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Informing View of Organization

Strategic Perspective



Bob Travica

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Informing View of Organization: Strategic Perspective

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Preface

The first publication of the Informing View of Organization (IVO) framework introduced aspects of the framework and their relationships (Travica, 2014). The key goal was to shift understanding organization (in business and other social areas) toward an information system (IS) perspective. That original IVO framework is shown in Figure 1a. The IS Life Cycle layer involved the phases not shown in the figure (system design/development, adoption, use, evaluation, and management). The shift suggested by IVO rested on combining IS theory with organization theory in major way. The main idea behind this synthesis was to propose a view of organization comparable to the familiar views, such as the structural, cultural, political, process, and economic view. While being rooted in these traditional views, the distinction of IVO has been in placing informing agents at the nexus of organization; the character of these agents is cognitive (data, knowledge, information-meaning, wisdom) and technological (technology prefixed by the terms “information,” “information and communication,” “digital,” “electronic,” “business,” or “computing,” and usually referred to by the acronym “IT”). So as the cultural view, for instance, suggests thinking of organization by focusing on deeply-rooted beliefs and practices shared among organization members, the IVO view suggests thinking of organization by focusing on IT and associated cognitive artifacts.

The 2014 IVO book reflected for the most part the period between the 1980s-early 2000s. That period was characterized by remarkable economic and political changes around the world, globalization of business operations and of supply and consumer markets, and an accelerated development of IT. Various types of IT and associated IS emerged, featuring those for communication, group work, decision making, enterprise-wide operations support and reporting, e-commerce, supply chain, social media, and mobile business. Wide area computer networks (public and private) grew up breeding a global cyberspace for business and other social needs. Overall, that historical period saw an unprecedented amplification of the capabilities of using and managing electronic data and organization members’ knowledge, which made or supported core business operations and strategies (Travica, 2014: 2). What has happened after the period that the first book on IVO had captured?

The previous trends of mobile and Cloud computing have escalated. The same applies to social media. The Internet has got complemented with the Internet of Things (IoT). Artificial intelligence (AI) finally leaked from its traditional habitat in mysterious laboratories to begin enhancing IT in business and at home. A data tsunami struck with the emergence of a Big Data trend. It has coupled with the advances in technologies for analytics (formerly, business intelligence) to improve professional and managerial decision making. In a way, Big Data represent a common denominator of these other trends. The mobility, Cloud, social media, IoT and AI altogether fuel Big Data; these also use Big Data. The Big Data trend represents a running theme through the book.

It is clear that IT/IS today are not just being everywhere like the air, but they generate another wave of gale winds. A distinct historical moment chimes again. It urges on taking a fresh look at the IVO framework. Most importantly, we need to look beyond everyday business operations, and to concentrate on strategic aspects in studying and managing IS in organizations. In the first edition of IVO (Travica, 2014), the discussion focused on the operational domain of business organizations, while strategic aspects were rather in the background. This advanced look at IVO amends the original IVO model with a strategic aspect as depicted in Figure 1b.

Within the IS discipline, the topic of IS strategy has only recently started attracting a deserving scholars' attention. Similarly, business and in part systems managers have treated IS function as a cost center and as an instrument for resolving business problems, such as a cost cutter or a productivity

Figure 1a. Original IVO framework (Travica, 2014)

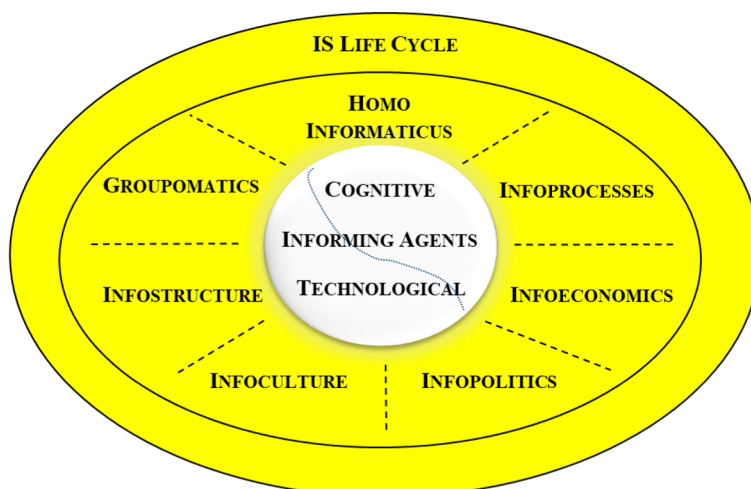
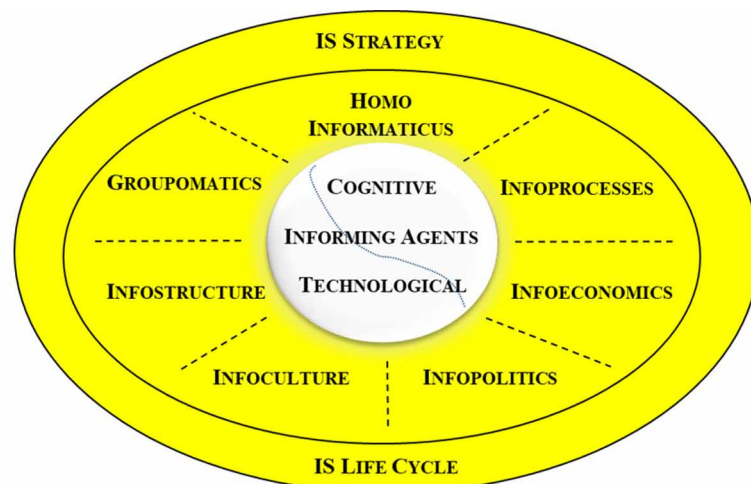


Figure 1b. Amended IVO framework



Preface

booster. Only recently has IS research begun focusing more decisively on IS strategy. In addition, there have been advances in business strategy research. Taken together, these two streams of literature constitute grounds for amending the IVO framework with a strategy aspect. IVO itself provides a hospitable frame. The IVO aspects (infoprocesses, infoculture, infopolitics, and others) lay at the intersection of organizational design dimensions (organizational processes, culture, politics and others), and informing agents (information technologies, data, knowledge, meaning, and wisdom). This intersection facilitates explaining and predicting of the relationships between IS strategy and organizational design. In turn, organizational design is supposed to support a business strategy. The discussion in following chapters will aim at proving these assumptions.

How does IS strategy relate to business strategy? The discussion will address this question in the context of a broader IVO framework that includes organizational dimensions in Chapter 1 and further on. At this point, it suffices to cite the fundamental assumption of the strategic perspective advocated in this book: IS strategy has a proactive role toward business strategy that can be explained in terms of enabling, inciting, and channeling. In other words, IS strategy is supposed to reach beyond mere service to business strategy, which has been advocated in the traditional strategy literature.

A remark on philosophical assumptions behind this book may be warranted at this time of expanding process automation, data analytics fueling decision making, and multi-purpose artificial intelligence. The pervasiveness and capabilities of technology may elude the observer to lose human agency from the eyesight. It is true that airplanes fly themselves with a limited intervention of the pilot. Cameras tacitly register our behavior in public places whether we know it or not and allow for automated profiling of individuals and groups. Our Internet searches are continuously catalogued and processed so our next search will be easier, while unsolicited online ads will be landing on each of our Internet technologies. Sensors and remote control devices making the Internet of Things work incessantly and drive automated environments while we sleep. Internet search systems deliver an ever changing content that influences our thinking, decisions, research, learning, and creativity.

All this is true, giving rise to assuming that humans are entangled in the world of technology which acts on its own. Reality created, or reality that matters, appears to be that which is prominently engendered by technology. Still, it is misleading to assume that causal powers of agency have spread from humans to technology. Capabilities of technology result ultimately from volition of social actors rather than agential powers of technology's some authors speculate about. Technology mediates power of social actors – designer, producer – in the domains in which it is deployed. Unless technology starts creating and reproducing itself autonomously, the character of agency remains with the human being.

INTENDED AUDIENCE

The primary audience of this book is expected to be academics – students and researchers in the fields of information systems and organization/management theory as well as other scholars interested in the relationship between IS and organization.

This book is also to assist practitioners, such as managers in various domains, IS experts, and other professionals in different organizational functions. In addition, consultants may read this book as a guide for helping organizations to build and effectively manage IT, IS, data, and knowledge.

ORGANIZATION OF THE BOOK

The book is organized into ten chapters. A brief description of each chapter follows.

Chapter 1 discusses fundamental concepts of IVO. It also brings up several updates to the 2014 book, and specifically a discussion on modeling customer with Big Data, the updated comprehensive model of IVO model, and an introduction to the IS strategy perspective.

Chapter 2 explores the concept of *homo informaticus* – human agency defined by its primary activity, as it has been done in other academic disciplines (*homo economicus* in economics, *homo politicus* in political science, etc.). Individual organizational members are viewed in their roles of users and creators of documents, communications, knowledge, and IS. New examples from company Google are provided.

In Chapter 3, the discussion will shift to work groups in organizations that go under the IVO topic of *group informatics* or *groupomatics*. The group context renders informing agents in a new light. Groups can obtain cognitive characteristics resembling those of individuals, such as perception, memorizing and thinking. Groups are also users of specialized IS whose purposes and uses are subject to group's shaping. The theme of mobile enterprise enabled by systems for communication and group support is reworked and illustrated by an example of company Uber.

Chapter 4 explores the IVO topic of *infostructure*. While acknowledging merit of the structural view, IVO proposes that structuring of data and IT is a necessary condition if not antecedent to social structure of organizations. The discussion will introduce several infostructural dimensions, and discuss informal organizational structure and social network concepts. Next, the discussion will turn to a new topic of social media as business, framing social media in contrast to old media for mass informing. The second part of the chapter explores theorizing of technology and IT in organization theory, in the IS field, and in IVO. A new model for extending the emergent process ontology will be introduced. A recently aroused IS scholars' interest in philosophy of IT/IS will be addressed by examining critically the philosophies of critical realism and of sociomateriality.

The theme of Chapter 5 is the concept of culture of informing or *infoculture*—the segment of organizational culture that evolves around informing agents. Infoculture is one of IVO topics that attracted more attention among scholars. New examples will be brought in the chapter, including a case of infocultures' clash pertaining to a Boeing's highly automated aircraft.

Chapter 6 elaborates on politics of informing or *infopolitics*. It is argued that a particular domain of organizational politics refers to access to IT and data, possession of valuable knowledge, and the capability of manipulating meaning. In addition, self-interests, struggles and coalition building revolve around various types of IS. The concept of infopolitics explains dialectics of dependency and autonomy in power relationships. An update in the chapter concerns changes in infopower with advent of Big Data.

The topical area of informing processes or *infoprocesses* is the subject of Chapter 7. This topic is directly related to the IS field, drawing on the philosophical background of general systems theory and a more applied process approach to management and organization. Infoprocess is a subset of or an entire organizational process. The discussion addresses the issues of organizational design in general and new organizational forms in particular, coordination, business process reengineering, business process management, enterprise systems, process-centered organization, virtual forms, and cloud computing. As an indispensable part of process thinking, different concepts of time are discussed. The chapter updates include the topics of Big Data-based decision making, data transformation, and the Internet of Things.

Chapter 8 is about economics of informing or *infoeconomics*. This theme synthesizes much of the previous discussion. It explores the issues of informing agents' costing, valuing, and of organizational

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performance associated with informing agents and other IVO aspects. Updates concern the IT commodification argument, costs of Cloud-based analytics, costs of Big Data-based decision making, and developments in Cloud computing. The management audience might find this chapter particularly interesting.

Chapter 9 explores issues of *IS life cycle management*. This is another take on synthesizing the previous discussion on IVO aspects and their relationships. The focus is on the phases of systems design/development, adoption, and use in the production phase, and operational and strategic management of IS. These topics have traditionally been studied in the field of management information systems. The IS audience of students and practitioners may draw a particular value from the discussion. The discussion will explore relationships between the IS life cycle management and IVO aspects. Case evidence will be supplied.

Chapter 10 concludes the discussion presented throughout the book, pointing to its limitations and the directions of prospective research. A Big Data-IVO alignment model is introduced.

Throughout the book, the discussion uses a voluminous literature from the IS field, organization theory and other disciplines as well as empirical studies this author has conducted over years. An effort is made to balance academic concerns with practical implications. Although there is some linearity in the discussion that follows, the reader may also choose to go directly to topics of interest.

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Travica, B. (2014). *Examining the Informing View of Organization: Applying theoretical and managerial approaches*. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-5986-5

Chapter 1

Introducing Fundamental Concepts and Strategic Perspective

ABSTRACT

This chapter introduces the fundamental assumption and argument of the informing view of organization (IVO) that informing agents are central to understanding organizations. Informing agents are information technologies (IT), data, knowledge, wisdom, and information conceptualized as the meaning resulting from processing data by knowledge. This informing process assists in resolving uncertainty but only partially since it is bound to a spiral of uncertainty. The discussion furthermore addresses the topic of big data in relation to understanding today's customer in a more comprehensive way. Next, the strategic perspective is introduced, and several important theories of strategy are explained and compared. Moreover, a full model of IVO is introduced, and each of its aspects are explained. The chapter closes by elaborating on the interdisciplinary background of IVO and its theoretical and practical goals.

INTRODUCTION

This book introduces a conceptual framework called *Informing View of Organization* (IVO). IVO brings together the disciplines focused on information systems, information, information technology, organization/management, and cognition.

Bridging Theoretical Gulfs

The foundational assumption of IVO is that cognitive informing agents (data, meaning/information, knowledge, and wisdom) and technological informing agents (information and communication technologies—IT) are at the nexus of organization. From the perspective of organization theory, this assumption is new. Phenomena of individual and group behavior, organizations' relationship with environment, work organization, economics, politics, emblematic beliefs and practices categorized as organizational

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culture or climate and other aspects have traditionally consumed energy of organization scholars, while rendering marginal attention to relatively new phenomena of informing. Exceptionally, some areas of organizational research areas (e.g., decision making and knowledge management) have come close to the core phenomena of IVO. However, they interest in IT at best is tangent. This has been so despite the fact that organizational members and groups spend most of their time in processing and interpreting data with help of IT.

Although technology in a general sense has played a role in organization inquiry for a considerable period, it has been treated in a highly abstract way. Organizational technology has typically been conceived as a technical component that blends together cognitive and material artifacts and transforms organizational inputs into outputs. Therefore, IT as a particular kind of technology has usually been treated as just one of technologies, if acknowledged at all. This is so despite the pervasiveness of IT in every industry today and the huge investments IT has drawn in the past fifty years.

In contrast to organization/management theory, the disciplines focused on information systems (IS) taken together have made informing agents the central phenomena of research. However, this field of study is unbalanced if not literally fractured. As mentioned in Introduction, some disciplines focus on the cognitive phenomena (“information”), such as library and information science, nowadays usually called study of information. Select kinds of IT are part of inquiry (e.g., those for data retrieval). Few MIS scholars share the focus on the cognitive aside (“information”). However, a majority is preoccupied with the technological side, and many authors do not differentiate it from the cognitive side (IT “contains” “information”). This in spite of the fact that cognition cannot be understood fully without understanding IT that interacts with it, while IT cannot be understood fully without understanding its informing effects.

The consequences of the orientation split are that the cognitive camp often fails to see differences that different types of IT imprint on data, meaning, and knowledge. As for the technological camp, it fails to see cognitive aspects that intervene between IT and organizational tasks and processes, such as the fact that the same data are interpreted in different ways depending on knowledge intervening in understanding the data. Bringing together the cognitive and technical approaches provides a more complete, theoretically sound approach, benefitting from contributions of cognate disciplines. But it can also help in positioning toward organization theory. The MIS discipline has usually borrowed from organization theory without clear selection criteria. Without a firm grounding in both cognitive and technological concepts, which are defined in an academically scrutinized manner, MIS cannot but remain driven by random technological fad and fashion.

IVO intends to rectify this situation by bridging the orientation gulfs and providing lenses for viewing organization theory. These theoretical goals have a practical counterpart: the IVO framework should help practicing managers, professionals and other organization members to understand the workplace in a new way and to act consequently. The importance of these goals is amplified by challenges of our time.

Intelligence in the Time of Unreason

The world we live in compels organizations to be intelligent in order to survive and prosper in a rapidly changing environment. Ours is a world of uncertainty and paradoxes, driven by intertwined economic, political, demographic, and technological factors. Enormous political changes in Europe and Asia have been paralleled by the development of market economies and globalization of business operations and markets. In the depth of new, emanating horizons lingers a vacuum of the unexpected and unknown. Old empires crumble and young, enigmatic ones emerge over night. Historical orders cease to exist, and the

void is filled by new orders that do not have clear directions. The previous bipolar global equilibrium is replaced by a one-polar system that is continually shaken by economic and political stresses. The state of stress spares no part of the world but those marginalized ones, which are left to struggle alone with their own daunting problems. And in nearly all corners of the world, organizational values and practices of stability, certainty, predictability, security, familiarity and control have been shaken.

Contemplating about this big picture led some students of organizations to conclude that we live in a time of change and even “chaos.” Calls for responding creatively to the challenge and for taking advantage of it have been voiced (Clegg & Hardy, 1996; Davidow & Malone, 1992; Hatch, 1997; Heckscher & Donnellon, 1994; Morton, 1991). Other authors warn about the unpredictable and uncontrollable character of the changes. To borrow Handy’s (1989) remarkable characterization, ours is a “time of unreason,” in spite of the fact that economic and political transformations seemed to be as expected and looked desirable at the outset (see also Clegg, 1990). Instead of clarity that was expected, ambiguity has set in. Contemporary organizations are both the subject and object of these dynamics. Business organizations as well as those from other walks of life are affected by these developments, while simultaneously being the engines behind the developments. International and global corporations, smaller profit and non-profit enterprises, government, non-government and grass-roots organizations, organizations of education, entertainment, ecological care, mass media, political parties and movements, and others—all of them play on the global scene, creating it and experiencing influences of the resulting dynamics. Organizations are articulations of the economic, political, and demographic trends of change described above.

Another force acting on the global scene is technology in general and IT in particular. IT and associated informing practices that it serves and enables participate in deconstructing and reconstructing organizations. The accelerated development of IT in the last two decades of the 20th century has increased the capabilities of using and managing the electronic data that constitutes or participates in core business operations. Transferring these data around the globe became possible owing to the development of global computer networks and their linking medium—the Internet along with its Web segment. These global flows of electronic data carry out business transactions between firms and between the firms and consumers. Today, one can grow business operations through electronic networking rather than by adding people and material resources. The workplace in itself has been transformed, because electronic data and IT allow for breaking up spatial and temporal limitations, while the routinized work is moved to computers, leaving more space for people to do creative work. Accounting and financial control have improved in precision since a single piece of data can be tracked throughout an enterprise from the start to the end. Moreover, a cyberspace created via computer networks, data flows, and related ISes envelops and gives new dimensions to social gatherings, and this trend reaches beyond business to incorporate social services, civil society, and non-civil society. Conditions for organizational growth, development, innovation, emancipating knowledge and wisdom abound, as data flows annihilate various traditional boundaries, making the world *a global workshop*. All this indicates opportunities that appear to be incommensurable with any preceding period in history.

But again, the *Janus* that signifies this time of unreason boasts its face of the unexpected and unknown. Owing to the electronically networked character of today’s global economy, the social forces that influence our lives now evade our comprehension and control more than ever (Castells, 1996). Money can be pushed rapidly via electronic channels into national and regional economies, and it can be quickly withdrawn as well. This nanosecond market is everywhere the Internet reaches, with the power of revitalizing some economies and marginalizing others. The timeless 24/7/365 mode of operation imposes a strain on organizational people. They also have to sustain effort of adopting yet new ISes, and managers

have to deal with unpredictable consequences of adoption and with spiraling costs of systems maintenance. Countering the phenomenal power that modern IT brings to the control of data, there stands the fact that accounting and financial systems can be tweaked to consistently distort balance sheets, while the data within the systems remain perfectly integrated. Furthermore, the opportunity of global sourcing, based on the possibility of scanning electronically global markets, undermines the accustomed safety of supply chains. Opportunistic interorganizational arrangements utilizing electronic networking, such as some virtual organization forms, come and go at the spur of a moment. Stable relationships between buyers and suppliers thus are washed away, and neat models of competition are dramatically fogged. The global workshop the Internet engenders is not used just for creation and development, but also for teaching destruction and subjugation. Therefore, challenges abound as much as opportunities in this time of unreason.

To exist, survive and succeed today, organizations have to be able to mobilize optimally all resources in their command. They need to act as a form of intelligence in a rapidly changing environment. The idea of intelligent enterprise is not new, indeed (e.g., Argyris & Schön, 1978; Cronin & Davenport, 1991; Quinn 1992; Gupta & Sharma, 2004; Thannhuber, 2005; Wassermann, 2001; Wilensky, 1967). Even going farther back in the past than this discussion does, one could argue that organizations had to be somehow smart in order to succeed. The new moment the IVO framework emphasizes is that individual ingenuity is not enough. Organizational intelligence is a result of synergizing individual competences as well as of managing informing agents in various contexts, such as teams, enterprise-wide processes, inter-organizational arrangements, and so on. In addition, both cognitive and technological agents shoulder organizational intelligence rather than just one of these agents, as it has been assumed in the previous images of intelligent enterprise. A metaphor of nervous system adds to this new image.

Morgan's (1986) analogy between team-based organization and the human brain serves as the point of departure in developing the metaphor of organizational intelligence. Although the differentiation of brain cells is small, they can develop intricate patterns of connections that are assumed to be the physical basis of the process of learning. Morgan argues that work teams carry a similar self-organizing capability. Moreover, the brain can be compared to the drops of water created by a splash in a pond. As each drop contains the entire picture of the surroundings so do the brain cells carry the capacity to create larger mental capabilities that they do not possess themselves. Morgan argues that teams resemble brain cells since teams can carry organizational knowledge and perform in different roles. This propensity of brain-like flexible organizing is extended owing to electronic IT, because it enables "organizing without having an organization in physical terms" (Morgan, 1986: 84). Using these ideas, and assuming that other organizational designs can also grow intelligence, let us see what are the additional similarities between the nervous system and organization intelligence based on informing agents.

As the brain, spinal cord and nerves enable a human organism to think and act intelligently, so do informing agents for social organizations. The intelligent organization mobilizes optimally its informing agents. Similarly to the creativity pertinent to the human brain, organizations have to invent new ways of manipulating new types of IT and electronic data, while still coping with the persistent paper trail and older types of electronic IT. The intelligent organization persistently endeavors to put in sync these different types of IT and information. Furthermore, the brain that is resilient to aging is the one that never ceases to learn. Similarly, the intelligent organization is involved in continual learning in order to advance its vital aspects, such as the organization of work, shared visions and values, communication, decision making, planning, and relations with the environment. The brain exhibits the capability of memorizing, and so does the intelligent organization. Knowledge, wisdom, meaning, and data are part of

organizational memory that is located in organization members. Data also reside in information systems and repositories, while knowledge can be also embedded in the organization of work, physical structure of the intelligent organization, and its technologies and culture. It follows that organizational intelligence is distributed rather than localized. This is similar to the structure of the humans' autonomous nervous system. Finally, the nervous system penetrates the entire human body. The idea of distributed intelligence implies that the same is true for informing agents in the intelligent organization. One purpose of IVO is to provide an analytical framework for understanding that informing agents sit at the nexus of every organizational aspect studied in different areas of organization theory.

The distributed character of organizational intelligence allows for understanding nuances of what is happening inside/outside of an organization, and for controlling and preventing surprises. This is the essence of a "mindful" behavior (Weick & Sutcliffe, 2001). The authors posit that a mindful organization is one that is capable of managing the unexpected—the key challenge of our time, as argued above. This organization refines expectations based on new experiences and unprecedented events, and it can understand the context in ways that improve foresight and current functioning (ibid., p. 42). The mindful organization is attentive to knowledge that moderates and reduces surprises and is open to checking its operating assumptions against reality. Information needed for work flows smoothly around this organization, and sharing of information (knowledge, data) is intensified when something unexpected happens. Near-misses and errors are used as an opportunity to learn. Challengers of the status quo, skeptics, divergent thinkers, careful listeners, innovators and trustful persons alike have the space in the mindful organization. In order to get mindful decisions, decision making activities move to most highly qualified members regardless the hierarchical rank (same, pp. 85-115). All these traits of mindful organizations complete our image of organization that draws its intelligence from its informing agents.

In summary, we live in a time of the unexpected and uncertainty that constitute global trends. Organizations are both subjects and objects of these trends. In order to survive and prosper, they have to be intelligent. To accomplish this, organizations need to treat their informing agents in the way the nervous system works in the human body.

ORGANIZATIONAL INFORMING AGENTS

Organizational informing agents refer to knowledge, data, meaning and wisdom and to information technologies (IT). The word "agent" is supposed to signify the active role of informing agents in the organizational context. The phrase "organizational informing agents" is an opportunistic rather than perfect choice. In addition to signifying the subject of interest, its role is to differentiate between this subject and similar ones. Cognate but distinctive terms include "information systems" (as already mentioned, IS is a broader term and it includes IT while obscuring the information agent), "information resources" (the term is sometimes biased toward the information and sometimes toward the technology side), "intellectual capital" (captures knowledge, which resides in the human mind and can be materialized in organizational procedures, structure, and technologies), "IT infrastructure" (the focus is on computer software and hardware and large scale technical systems, such as enterprise-wide computer networks), and "computing resources" (the focus is only on computer hardware and software). In addition, the term "organizational" in the core phrase signifies the primary social context of interest. The term is broad and it embraces different levels of analysis –individual, group, macro-organizational, and

inter-organizational analysis. This is in accord with the contemporary character of informing agents, as these are situated in these different contexts.

The Informing Process

A concept of informing is central to understanding cognitive informing agents. It puts the traditional trilogy of data-information-knowledge in a particular perspective: informing is a process that brings these three entities together. IVO also supplements the trilogy with concepts of meaning and wisdom. Data are conceived as external stimuli that are interpreted in human cognition by knowledge or wisdom, the result of which is information or meaning. Therefore, informing is a process that involves the steps of data taking, applying knowledge and/or wisdom to interpret data, and inferring information that is synonymous with meaning (see Figure 1).

This conceptualization draws on ideas from the areas of semiotics, semantics and human communication. Briefly, data, such as symbols created for communication purposes, constitute the signifier, while information and knowledge are the signified. This fundamental informing process is an aspect of communication, that is, informing happens within a broader communication process that has other aspects as well (e.g., relationship maintenance, and culture reinforcement). These concepts are discussed in more depth below.

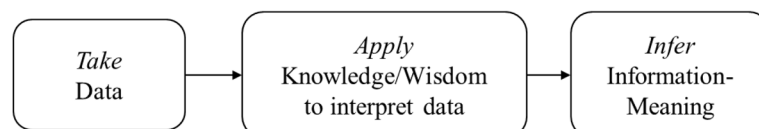
Data

Data refer to sensual stimuli (e.g., visual and audio stimuli) and symbols created for human communication (e.g., letters, numbers, sounds, graphics, and film). Depending on the data kind, data taking in the informing process could be performed by different senses. Data have no meaning in themselves—rather, the meaning is attributed through the informing process, as stated above. Data reside in storage spaces (e.g., file cabinets, database records, and locations on the Internet) or are in motion (e.g., data conveyed via speech, books, or some electronic channel). Data can also reside in the memory of an individual. Think of details or statements that “make no sense.” Sometimes a sense emerges (i.e., information is created); at other times, memorized data perish in oblivion.

Data can be in different states of organization. Voices have to be ordered in a certain way to form spoken words. Letters are ordered to form written words, words into sentences and so on. Numerical data can be organized in tables, graphical data into drawings and figures; combinations of textual and graphical data can be organized into genre categories, such as business and scientific reports; scientific reports contain complex organizations of data that can be called knowledge representation; and so on.

No matter how much organized data are, organization is not a sufficient condition for information to emerge. Organized data are associated with informing only through processing in the human brain. These assumptions reflect on the role and capabilities of various IT (electronic and pre-electronic). IT are

Figure 1. Fundamental informing process



clearly confined to the domain of data. Consequently, IT (and IS incorporating IT) do not store, process or provide information. Rather, IT can facilitate information creation in human cognition.

The concept of data was brought up prominently by computer science. There was a time of data processing centers in early days of the business use of computers. But the rest of the world was already tuned to the term “information”⁴. Many players in the specialist and public discourse have never adopted the term data. Examples are organization and economic theory, where the term information has reigned unchallenged, referring roughly to any of the cognitive informing agents addressed in IVO.

Information

In IVO, information results in human brain through interpreting data (usually external data, or memorized ones). “Information” is synonymous with “meaning,” “understanding” and other terms that signify a difference in cognition. The cognitive realms of interest are perception, thinking, knowledge, memory, as well complex cognitive activities like problem solving/decision making. For example, a manager reads financial figures (data) and applies a domain knowledge or professional wisdom to understand the figures in the context of a given business. The resulting information refers to the achieved understanding, increment in knowledge, memory – any of these singularly or combined. Cognition is in-formed, put in a form different from the initial one. Information is the measure of this difference.

The reasons behind this non-conventional concept of information are both theoretical and practical. Theoretically, information is differentiated from data in more objective terms: (a) it is internal to cognition as opposed to data that are usually external; and (b) it can be assessed qualitatively/qualitatively on the side of the informed person. From the practical perspective, this concept of information-meaning discriminates against models treating information as a thing that is transferred (“provided”) by a mere presentation of some potentially informing content, that is, data. Such reified modeling of information usually assumes that data are transformed into information owing to properties of organization and “meaningfulness.” However, these properties are usually stated in an axiomatic manner rather than formally defined (Travica, 2011). Data organization is subjectively determined (e.g., a report is “organized data” while the data entered in the report are not), while meaningfulness appears a proxy to a notion of meaning.

The reified notions of information, which pervade everyday day talk and penetrate the academic vocabulary, privilege the sender (“information provider,” informer) while largely neglecting the receiver (client). The informer—not the client—determines what is “organized and meaningful” data. However, it stands reason that without testing information (or a success of the informing process) on the client side no claim on conveying the meaning from the informer to the client can be made. If a meaning lacks in the client’s mind, all that has transpired is data transfer. The typical example is when the informer uses a language or a lingo opaque to the client. This implication has a lasting practical importance in the world of IS and organizations, addressing the relationship between different informers and clients (e.g., IS experts and users, managers and sub-ordinates, one professional group versus another, clerks and other organization members, etc.).

Refocusing attention on the client’s side is consistent with espousing a broader communication perspective that reaches beyond the accustomed, dyadic, conduit model of sender and receiver of information, which could be tracked back to Shannon and Weaver’s (1949) mathematical theory of communication. Another aspect of IVO’s broad-based approach is the inclusion of intrapersonal communication or self-informing, where the boundary between the roles of informers and client disappear. This approach

differs from both classical and recent approaches to informing (e.g., Machlup, 1983; Cohen, 1999). In IVO, the interpretation of any data regardless the source's location is considered an act of informing.

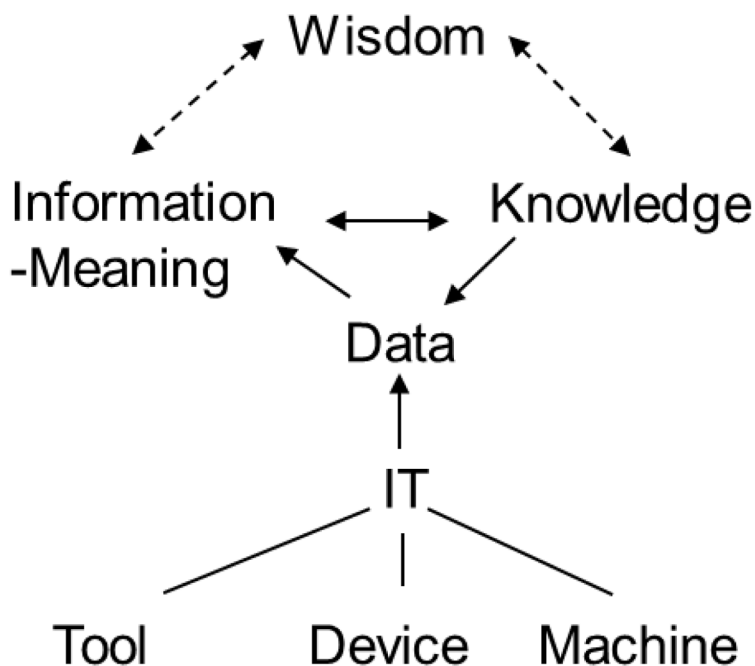
Bateson (1979) suggested that that information is a difference that makes a difference. This concept is still interesting for pointing out to the process aspects and dynamic character of cognitive informing agents. For instance, journalistic news is the content (data) that represents a difference to what is known and it can make a difference in the audience's cognition (information-meaning). Similarly, a business analyst collects indicators of the state of a market (data), and upon analyzing these adjusts his understanding of the market (experiences a cognitive difference, i.e., gets informed). The analyst's report makes a difference in the organization's view of the market and in organizational documentation. In turn, the client consuming the report can experience a cognitive difference. And so on. Therefore, the process of informing, along with its data and information creations, is associated with causal ordering of differences/changes.

Knowledge

Knowledge is the decisive agency in the informing process. It “processes” data to transform it into information. In turn, information feeds knowledge, or knowledge progresses by inferring information and incorporating it into existing knowledge—both taking place in the human brain. These relationships are depicted in Figure 2.

There is no information without knowledge. At the elementary level, one needs to be familiar with the data form involved in informing. In human languages, this starts with the knowledge of written symbols (letters, numbers) and voices (elementary signifiers). The next level is the knowledge of vocabulary,

Figure 2. Relationships between organizational informing agents



Introducing Fundamental Concepts and Strategic Perspective

which associates words (higher signifiers) with concepts (the signified). Understanding this sentence requires knowledge of Welsh language and Arabic numbers: Felly, rhif 18 cwsmeriaid ei wario bron i 234 ddoleri mewn un pryniant. Roedd y gwerthiant mwyaf y mis diwethaf! (So, no 18 customer spent nearly 234 dollars in one purchase. The biggest sale last month!)

While trivial when exemplified this way, this key role of knowledge is neglected in the reified concepts of information cited above. Worse yet, it is neglected in lingo that exist in organizations. IS experts, finance staff, clerks and any other occupational group tends to develop their own lingo. When communicating with outsider-clients, a lingo user may believe that “information is passed” while the client has just “received” unfamiliar words (data that cannot be interpreted).

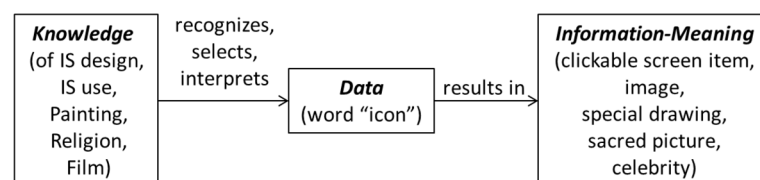
Due to differences in personal knowledge, different clients within informing process can infer different information from the same data. Indeed, the client’s knowledge can intervene in the entire informing process, starting with the data intake (recognition, selection), and ending with data interpretation (vocabulary recognition, analysis, conclusions). Figure 3 depicts variation in information determined by knowledge.

Knowledge can be represented (codified) and its representations can be stored in IS and other locations. For example, the Google Translate system, which helped in writing the sentence in Welsh above, associates words across languages and have some grammatical rules encoded. Any piece of computer software is a representation of knowledge. A so called knowledge base in a knowledge work system may contain networks of associated terms, questions and answers, problem solving procedures. No matter how complex these may be they still are data in special forms of organization. As information, knowledge cannot be stored in technologies. Its exclusive storage is the natural biological habitat residing in the human brain and nervous system. Technologies can only simulate capabilities of human knowledge.

In spite of advances of investigating knowledge in cognitive psychology and other disciplines, our knowledge of knowledge is limited and incoherent. Most generally, knowledge refers to complex cognitive structures resulting from both experiential and theoretical learning, which enables human understanding (informing) and purposeful action. Knowledge can be thought of in terms of:

- The content or what aspect (concepts, conceptual maps, mental imagery, mental models, and concept relationships);
- The explanatory or why aspect (a special type of conceptual relationships conceived as cause-effect models, which have a particular prominence in modern science, even though the explanatory aspect precedes science);
- The procedural or how-to-do aspect (memorized scripts and procedures of performing physical or intellectual activities, including those that result in new knowledge).

Figure 3. Knowledge, data, information



Aspects A and B are related to understanding, while B and C engender the actionable character of knowledge.

One could search in vain for a coherent conceptualization of knowledge. These usually come in dichotomies, accounting for some salient aspects and dimming down others. As aspects A and C above indicate, a distinction is made between procedural knowledge (knowing how to do something, like using computer) and semantic knowledge (concepts and their relationships; for example, knowing names and functions of hardware pieces that comprise a computer). A different category implying the experiential source of knowledge is called episodic knowledge (e.g., a piece of history, a war story, or a best practice description). Experiential knowledge is also called “theories-in-use” and it is contrasted with theoretical knowledge (Argyris & Schon, 1977). However, sometimes semantic and episodic knowledge taken together are called declarative knowledge (cf. Eysenck & Keane, 1995: 170-171). Semantic knowledge can be in the form of organizing concepts based on similarities and differences (categorizing or classifying them), or on relating concepts in cause-effect relationships (aspect B above).

A distinction has been made between inductive and deductive knowledge. The former is based on experience. Inductive knowledge is known as *a posteriori* knowledge, since cognizing comes after doing, or synthetic knowledge, because pieces of knowledge are put together in a larger whole. Deductive knowledge is derived by reasoning from previous knowledge and current data. It is also called *a priori* knowledge as cognizing comes before doing. Deductive knowledge is akin to analytic knowledge, as it results from moving from general to more specific knowledge.

Followers of the knowledge management movement incepted in the 1990s a focus on tacit knowledge. This knowledge is internal to the knower, non-explicated and indeed difficult to externalize in any form (Polanyi, 1966; Nonaka & Takeuchi, 1995). The counterpart is explicit knowledge – the knowledge externalized and communicated in some form. In a somewhat slanted perspective, cognitive psychologists talk about implicit knowledge.

Knowledge is never perfect but rather changes over time. It is rather “messy” (Davenport and Prusak, 1997). For instance, experiential and theoretical knowledge may contradict each other, and each of these may contain internal contradictions. It is precisely through theories that contradict each other that any science advances, and therefore the body of certain scientific knowledge always contains internal inconsistencies and contradictions.

Wisdom

Wisdom refers to a capability of making a right judgment in a right moment. Popular terms referring to similar notions include “thinking out of box,” “being smart,” “doing the right thing,” “intuitive decision making,” and “improvisation.” We should separate wisdom from knowledge because wisdom does not necessitate knowledge, although it may spring from accumulated experiential knowledge. This assumption is depicted by the dotted line in Figure 2. Also, knowledge can be acquired via a self-learning process and can be taught, while the possibilities of learning and teaching wisdom are questionable, to say the least. The relationship between wisdom and knowledge is anything but linear. For example, while reading about work procedures can increase declarative knowledge, the increase in this knowledge does not necessarily advance wisdom. A knowledgeable bureaucrat knows operating procedures and their relationships well, while a wise bureaucrat knows how to deal with problems that do not fit procedures, so that a worthy solution can be invented.

Much knowledge may not engender wisdom while flexibility in thinking and inventiveness may do so. A continuously successful improviser appears to be wise although he may not know more than his colleagues (see Ciborra, 1999; Weick & Westley, 1996). Outrageous moves that result in small changes with significant consequences may result from wise thinking. Such is the decision of an executive of Greyhound Canada to hold black tie dinners for managers in toilets at Greyhound bus stations. The intention was to improve the cleanliness of the toilets and thereby improve service to passengers. At that time, the company was experiencing a drop in customer numbers. This unusual move triggered a wave of thinking in which small changes contributed to improving overall performance (Weick & Westley, *ibid.*). These cases have a similarity with the way wisdom is understood in Eastern thought. According to Dr. Suzuki, a teacher of Zen-Buddhism, wisdom refers to “knowing the true condition of existence,” and this is achieved by “giving free play to all the creative and benevolent impulses inherently lying in our hearts” (Barrett, 1956: 13, 3). Therefore, thinking in a non-conventional manner is akin to wisdom, and to get there one does not need conventional knowledge.

Wisdom can also result from much of accumulated experiential knowledge. High caliber experts can find solutions to problems inaccessible to others because they operate at the level of intuition based on accumulated experience. This is a form of tacit knowledge. In this case, accumulated tacit knowledge enables experts to make a right judgment when facing new problems. An analogy with the accumulation of life experience may be appropriate: elders have wisdom because “they’ve been there, seen that.” In the model in Figure 2, this *a priori* indeterminate relationship between knowledge and wisdom is represented with a dashed line.

Sometimes a trigger outside the realm of knowledge is needed to produce a spark of wisdom. Consider people who are facing some sort of existential drama; an employee facing layoff, a manager struggling with a decline in the firm’s performance, a person grieving a loss in private life. Pressed by necessity, any of these actors could make a wise move to survive. As Kobayashi (1985) suggested, “wisdom is squeezed out of someone who is standing on the edge of the cliff and is struggling to survive” (cited in Nonaka and Takeuchi, 1995: 80). The wise move can result from various sources – serendipity, improvisation, or seeing old things in a new way, or seeing new things previously neglected.

In summary, wisdom as the capability of making a right judgment, accounts for flexibility and novelty in thinking, tacit knowledge, and existential struggle. In organizations today, wisdom is as important as knowledge. That is why wisdom deserves more attention than it has been given so far.

Information Technologies

Information technologies (IT) are the informing agent complementing the cognitive informing agents (data, knowledge, meaning, and wisdom). IT refers to the tools, devices, and machines designed for the manipulation of data. IVO is interested in electronic and pre-electronic technologies. IT refers to tools (e.g., those bound to paper), electronic devices (e.g., calculator and various devices used in computer networks), and machines (computer and its various implementations as in the smart telephone). Including “paper trail” technologies is motivated by practical reasons: paper is resilient in organizations. Rather than being eradicated, the paper trail keeps co-existing with electronic technologies. Apparently, IVO does not endorse the premise that “computers started it all,” which insinuates that before computers people lived in some sort of world deprived of informing.¹

Data management existed before computers and there was IT before computers as there will be new kinds of IT after computers. The tabulating machine, which used electro-mechanical principles and

paper forms (“IBM cards”), was a kind of IT. And so was the simple abacus that still is used for calculations in some parts of the world. Paper files and file cabinets resist the electronic push in contemporary offices, painting a mixed picture of organizational cultures (infocultures, indeed) stretched between a vision of “paperless office” and reality. Although historically older kinds of IT loose importance over time, the development trajectory is not linear. Electronic and paper technologies still coexist even in the most developed countries.

Since the time immemorial, the *homo informaticus* has manipulated data in this or that way and built technologies for that purpose. The contemporary focus on computer technology is justified given its pervasiveness and capabilities. But IT change over time, and IVO should be able to account for them in any historical time. Rather than changing research focus with every new piece of IT that rolls out of leading software and hardware shops, IVO favors combining the focus on a certain type of IT over time, while also following new technological trends. The organizational context at the task, process or another level is a constant in the IVO approach. While the former approach leads to an in-depth understanding of a certain type of IT, the latter ascertains that technological trends are studied beyond the over-exploited descriptive level.²

Even though the citation frequency of the term “IT” in journal articles and grant proposals matches citations of a ruling party’s name in public discourse of former communist countries, well-grounded conceptualizations of IT are indeed missing in IS research. Writers bow to IT as to a deity whose might is beyond questioning. Still, it is a crying paradox that in spite of all this attention IT is poorly conceptualized in many social disciplines claiming IT allegiance. If not defined plainly as “computer software and hardware,” IT is usually specified by its producer-designated purpose. For example, IT is “email” or “ERP,” or “Email system” and “ERP system.” Apparently, these “definitions” are not very revealing. In addition, they do not differentiate between notions of technology and information system. Orlikowski and Iacono (2001) identified other opaque notions of IT used in a prestigious IS journal. IT had been often addressed via surrogate measures, such as investment amount, frequency of usage or users’ attitudes regarding IT adoption. Apparently, study of this sort cannot tap to any appreciable extent into functional or any other difference between an email and ERP software (or any other kind of IT for that matter). In other studies, IT is simply named in a generic sense (e.g., “IT” or “computers”) and its characteristics remained unexplained. This is yet another example of a black box approach that appears to be a hallmark in a part of IS research.

IT is a complex subject. Some scholars may be avoiding more elaborate conceptualizations because these would additionally burden already heavily loaded research frameworks and models common to contemporary empirical IS research. Nevertheless, abandoning black box models of IT in order to account for its specific aspects and theorize IT more deeply are the necessity that IVO advocates. The reason for that should be obvious: Single functions of software and details of computer screens (user interface) may be essential for adoption, use and organizational effects of IT.

If the abstract approaches to IT hide deeper disagreements about the character of IT, an agreement in part of the IT-focused IS field seems to be certain. For a number of scholars, IT means some sort of computer technology. As already mentioned, this view of IT is much narrower than the one used in IVO, and it neglects the factual diversity of kinds of IT that still exists anywhere in the world. IVO does not deny an increasing significance of computer-based IT. However, IVO encourages a broader, systemic and more realistic approach. In contrast, when the computer dogma is coupled with the opaqueness in conceptualizing computer technology, this position irresistibly resembles a special ideology – “ITology.”

Whereas providing esprit de corps that may be useful in some situations, ITologists trade believing for thinking and have difficulties in communicating outside the circle of believers.

Organization theory carries part of the responsibility for the opaque character of IT. From its perspective, IT is just a part of organizational technologies, which are typically thought of as a transformational function. The function consists of knowledge, organizational structure, processes, management methods and other elements work toward transforming organizational inputs into outputs. In spite of the proliferation of new kinds of machines, means of transportation, information and communication devices and machinery, and sources of energy, many organizational theorists to this abstract conceptualization of technology. It is not surprising that IT is buried in it as a needle in a haystack. On the bright side, there are notable exceptions among organizational scholars who have contributed to conceptualizing IT in the organizational context. (The discussion of these is in the chapter on infostructure.) These conceptualizations as well as valuable ideas from IS theory provide a backdrop to the IVO definition of IT presented in the beginning of this section.

Cognitive and Technological Informing Agents: Bridging Gaps

Cognitive and technological informing agents create a nervous system of an organization, which is part of the presented metaphor of organization as a form of intelligence. Technological agents are more dynamic than the soft part. Generations of database technology have been developed and deployed for managing customer data, but the data content has changed little in structure (metadata). True, designers have added new pieces of data in order to enrich the understanding of customers (e.g., purchasing history in retail). And yes, some of these data never existed in the past (e.g., clickstream tracking of a customer's move around a Web storefront). Still, the customer's name, address, access, purchasing transactions, and the like have always been the metadata identifying customers. Customer records can be ported over to new database technology without changing design of database records.

Different technologies have imposed different ways of organizing data for storage, retrieval and transformation. That was one change, and it interested primarily database experts. For end users, a really important change was that the capabilities of manipulating data have changed with different generations of database technology. Over time, the speed of database engine has increased, database retrieval has become easier (as in the current semantic approaches), the aggregation of data and other transformation capabilities have improved (as in the current data warehousing and big data approaches), and data transfer over different systems and space has become near-seamless, and so on. Recently, new sources of data potentially useful for customer profiling have emerged, owing to social media, communication systems involving various portable devices, and Internet repositories.

A line of division within the IS field, as already discussed, is defined by allegiances with either the technological or the cognitive ("information") side. For example, much of the literature addressing decision support systems or the adoption of enterprise systems indicates a preoccupation with IT, while research on knowledge management indicates more of a cognitive focus. If adamant, this split can be counterproductive. It muddles the larger picture, in which organizations should use IT according to their informing needs that spring from specific tasks and processes. In turn, task and process-related data should support organizational and management goals. Data management is an interface between IT and organization, and bypassing it limits understanding of the complexity of organizational reality. Such an approach also portrays IT as a magic wand that impacts on organization directly. The result is paradoxical: although IT is glorified, its specific characteristics that determine data management remain

opaque. For example, adoption of enterprise systems is not only about adopting a “thing” but also about accepting new data formats, content, and flows that make business processes. Changes in data may affect the ways in which the meaning of data is interpreted. Knowledge of both business and technology needs to be advanced. In sum, technological and cognitive aspects complement each other.

To take another example, one can study if an animated car presentation on a car dealer’s web site relates to consumers’ purchasing propensity in two ways. One way would be to compare the number of purchasing decisions made by a baseline consumer group with the number of purchasing decisions made by the consumer group exposed to the animated presentation. Another way would be to include in the model the meanings and knowledge about the car aspects presented, which are triggered by the animation. Provided that users of the animated presentation buy more, these two models lead to dramatically different conclusions on why this happens. In the first model, IT makes all the difference, while in the second model IT facilitates a cognitive difference without which consumer behavior would not have changed. The second model is less linear and more complex, since the creation of new meaning and knowledge is dependent on previous knowledge and situational dimensions. Therefore, the scope of variation increases. Also, more creative research instruments that draw on individual and cognitive psychology are needed. By understanding these intervening dimensions, one can categorize better the consumers, develop an insight into the cognitive effects of IT characteristics, and, consequently, understand how to fine-tune the animation system for better results.

While jumping from technology to behavioral outcomes is one sort of reductionism, its opposite is the exclusive focus on “information” with neglect of IT. However, IT is not just a neutral means of creating and manipulating data. Different kinds of IT can make a difference in meaning and knowledge elicited in users’ mind, as exemplified in the case of portraying the same event by different technologies of mass communication. TV, radio, press, or the Internet operate with different formats of data, and each of these media can interact differently with specific individual cognitions on the client side. Different information-meaning and learning are likely to result, as it is remarkably captured in McLuhan’s (1964) gloss “medium is the message.” The increasing “compression of time and space” (Castells, 1996) represents another manner in which IT affects our cognition and assists in reshaping contemporary organizations. A sense of common, global space is created through interconnected computer networks and their services, and the communication velocity reduces time dimensions to the present one. Even more dramatic impacts of IT have emerged with high automation, which may critically shape the information and knowledge in the user’s mind (Weick, 1990). All this argumentation suggests that technological and cognitive informing agents are equally important. Consequently, IVO opts for a balanced approach to both of these.³

How do organizational informing agents relate to the contemporary interest in knowledge management? Answering this question requires putting things into an historical perspective. In fact, knowledge has always been important in and for organizations. In the Western world, one can trace the knowledge thrust back to the 15th century’s renaissance and the later period of enlightenment in Western Europe. This concentration of powerful social forces of knowledge development and use ultimately culminated in the era of science in the 19th century. New technologies for the generation of energy, production, transportation, trade, housing and health care resulted from implementing, productively, knowledge from advancing sciences and respective areas of engineering. This development extended from West Europe into the New World, notably in the United States, where favorable economic and cultural conditions facilitated the rapid development of technical inventions. In the East, a similar focus on knowledge was unleashed in Japan when the Meiji Restoration period was launched by the end of the 19th century.

Ever since knowledge obtained such a prominent social role, there must have been some sort of knowledge management in organizations. Inventors, engineers and trained professionals have been part of the labor force with a privileged status. Paper was the technology for data storage and organization, and various writing tools and then mechanical and electro-mechanical devices were the dominant kinds of IT. Indeed, knowledge was not left to chance before the knowledge management interest surged in the 1990s. Expert systems, which represented knowledge in the form of if-then rules, originated in the 1960s. Other kinds of knowledge support systems available in the early 21st century were also invented before the 1990s (case-based reasoning systems, CAD/CAM, virtual reality). These systems were certainly associated with interest in capturing, codifying, and managing knowledge in other ways. In this way, they are precursors to the focus on knowledge management in organization and management theory. Contemporary organizations, however, experience a need of generating more knowledge (implicitly, information as well) from the growing mass of data inside and outside organizations. Advancing knowledge that creates economic value has been the driving force in the times of shifting markets and globalization. One can argue that knowledge today is expected to be *a difference that creates economic value*.

Staking knowledge management on the premise that information is “organized and meaningful data” may not lead toward knowledge goals. Instead of focusing on the client side and interaction of client’s knowledge with data, the informer-driven approach is prolonged. It can easily lead to more data (on the background, context of a given business entity), more indexing, slicing, dicing and organizing in other ways, rather than to more and better knowledge. The IVO approach to information overcomes this shortcoming. In addition, it promotes wisdom as an informing agent that still has not been given deserved attention. As discussed above, valuable new learning can emerge as a consequence of improvisation (Ciborra, 1999), serendipity leading to inventions, processes leading to “small wins” (Weick, 1996), and accumulated experience. In conclusion, the new knowledge starts with both new data and the existing knowledge and wisdom, and develops through their interaction.

Deficiencies in the mainstream approach to information, unfortunately, have a complement on the IT side. IT and ISes it is built into are still better suited to data manipulation than to supporting knowledge processes. Advances in data mining technology represent the only more recent technological development that has some relations with knowledge creation. What software vendors promote as knowledge support systems are usually just more advanced document management systems that serve a limited role of documenting knowledge. A lack of innovation is apparent and one may wonder to what extent is it influenced by non-technological factors as opposed to the ultimate limitations of the computational machine as we know it.

Information Technologies and Information System

IVO differentiates between the concepts of IT and information systems (IS). IS is not technology *per se*, but it *contains* many technologies. Therefore, the term IS is broader and it includes IT, along with procedures and data. At times, even the user can be included within a system boundary. This distinction is often obscured in more general IS research even though it is made quite clear in the realm of systems analysis and design, which belongs to IS theory. The distinction is important because it can make the approach to IT more analytical than it is in some other disciplines.

The IS (system) is usually treated as a whole separated from the user who touches the system (sometimes called primary user). Users operate the system, entering inputs into it and observing the outputs created in the process of user-system interaction. Even though systems typically cannot function without

this interaction with users, users are considered to be outside the system boundary. This assumption is sensible as long as the user performs simple tasks that do not influence the system's final output. In other words, the system output is invariant to the user input. Users are replaceable and indeed support the system, although the conventional language suggests the opposite. This scenario applies to Transaction Processing Systems, Management Information Systems and many other types. However, if user procedures involve manual steps that can influence the final output of a system, the identity of user becomes important. This is the case with Decisions Support Systems that require user expertise in order to complete programmed decision procedures. For example, a user may face programmed multivalued decision points demanding expert judgments. Similarly, a multidimensional view of data a user creates in a data warehouse can be done in different ways by different users, and with different end-results. Group Decision Systems also involve the user within a system boundary. The procedure of facilitation in GDSS system varies with the skill and performance of human facilitators, effecting different flows in group deliberation and the final outcome. (The chapter on groupomatics discussed this extensively).

IVO encourages looking at the relationship between the user and the system with concern for the level of automation and varying possibilities of including/excluding the user from the IS domain.

Organization

Organization is a collection of individuals and groups that is based on division of labor, rules, norms and the purpose of delivering a good or service. IVO is using this commonly accepted behavioral definition. It also draws on various philosophies of organization that place the relationship between organization and organizational informing agents in different perspectives. As shown in Table 1, the philosophies include postmodernist, constructivist, socio-technical, structurational, and functionalist (Hatch, 1997; Westwood & Clegg, 2003). This apparent eclecticism means that none of the approaches is discriminated against as long as it delivers a solid study methodology, theoretical rooting and interesting results for theory and practice. Understanding an organization in terms of a machine as in the functionalist (structural-functionalist) approach, or as multiple intertwined processes of organizing materialized through interactions of organization members, or via the structurational approach seeking to reconcile structure and agency approach—all these are examples of acceptable paradigms. Each of them provides some insight into the complexity of organizations and their informing agents. Of course, it is equally important to recognize limitations of each paradigm. No discrimination regarding the metaphors of organization is applied either, although more fruitful may be those akin to cognition, as discussed above.

Knowledge, wisdom and information-meaning are manifestations of organizational intelligence embedded in individual organization members and groups. Organization as a form of intelligence can work toward rational, predetermined goals, where the rationality is being judged either from an internal or external stance. An organization that is perfectly rational in preserving the status quo could appear irrational from the perspective of change. It is also possible that the work toward rational ends can be fractured, uneven, and contradictory. A zigzag trajectory may equally characterize the irrational behavior of organizations. Again, the judgment of rationality is always relative to a certain frame of reference and not an absolute. Intelligence of organization can also work toward surviving in and nurturing of chaos (dynamic unpredictable social systems), which subsequently leads to a higher level of order.

Organizational Purposes of Informing Agents

Since the time of classical information theory and Shannon & Weaver's (1949) mathematical theory of communication, it has been assumed that the role of information is to reduce entropy. Information theory conceived entropy in terms of energy loss, and information was negative entropy—the difference between the initial and current energy level. Similarly, Shannon and Weaver conceived noise in the communication channel as the loss of signal transmitted and information as energy needed to recover the loss. Although the authors later regretted that they used the term “information,” the idea of information being an agent for uncertainty reduction took on its own life in various realms of inquiry. It was also imported into social sciences and has survived up to date.

Part of this long-lasting appeal may be in the intuitive connections between technical and social concepts: chaos and noise in technology resemble aspects that may be undesirable in the social context, such as uncertainty and ambiguity. Contrast these with the lexical meaning of the word information (that which gives a form), and “information” (in various conceptualizations, and possibly including knowledge) becomes a vehicle for managing the unknown in organization (Galbraith, 1973, 1974, 1977; Stinchcombe, 1990). The idea of uncertainty reduction has been elevated from the metaphorical and initiative level to a lasting axiom. Is information just a reducer of uncertainty—the more informed an entity is, the less uncertain it is?

Quantum physics has for long been familiar with the idea that uncertainty and information can be positively correlated. According to Heizenberg's principle of uncertainty introduced in 1927, we can only know one characteristic of a subatomic particle at the expense of not knowing others. If we measure with precision a particle's location, the measurement process will affect the particle's mass and speed thereby introducing uncertainty. Thus, information that resolves some uncertainty creates another uncertainty. One of the messages of the *Hawthorne Effect* is quite similar: observing employees at work can influence their behavior—we learn about some behavioral aspect and simultaneously induce uncer-

Table 1. Philosophical perspectives in informing view of organization

Perspective	Organization	Informing agents
Functionalist	Machine metaphor of organization; Organization is objective reality - structure or set of processes (workflows); Rationality of efficiency and effectiveness; Deterministic;	Means to the end; IT and data focus; Agents of reducing uncertainty; Deterministic
Constructivist	Interactionist metaphor; Organization is continuous processes of organizing, negotiations and sense-making; Indeterministic;	Meaning dependent on interaction characteristics, continuous sense-making; IT/IS is socially shaped; Indeterministic
Structurational	Organization emerges in interaction between action and structure;	Informing agents are resources that mediate interaction between action and structure; IT/IS both part of structure and enablers/ results of action
Postmodernist	Plurality of metaphors including all here listed; Symbolic reality and esthetics have ontological substance;	Cognition is primary reality; IT/IS shaped via cognitive and social processes in unpredictable ways
Socio-Technical	Interrelated, mutually adjust-ing social and technical systems make organization	IS with material properties to be tuned to social context and reversibly

tainty about other behavioral aspects. Something similar happens in human learning. New information that a student learns may disturb the student's confidence in their own knowledge: new questions arise and uncertainty creeps in. The process of invention unfolds in a similar way. By resolving engineering puzzles through successful experimentation, an inventor opens up new puzzles to be solved along the way to a finished product.

Numerous examples related to IT and IS indicate the same. For example, as one learns of a security breach in a company's computer network, the next question becomes, what systems are affected? That question answered, triggers yet another question: what data are affected? This being determined leads one to question the extent of the data damage, possible propagation of errors, and so on. A similar spiral characterizes adoption of group decision supports systems (GDSS) or enterprise resource planning (ERP) systems. Once the adoption process creates some unexpected results, attempts are made to understand why. The realization of a misfit between the technology, users' expectations and behavior, old data and work practices may be a likely answer. But introducing changes in some of these aspects can trigger unexpected outcomes in related aspects, that is, new uncertainty for adopters to respond to.

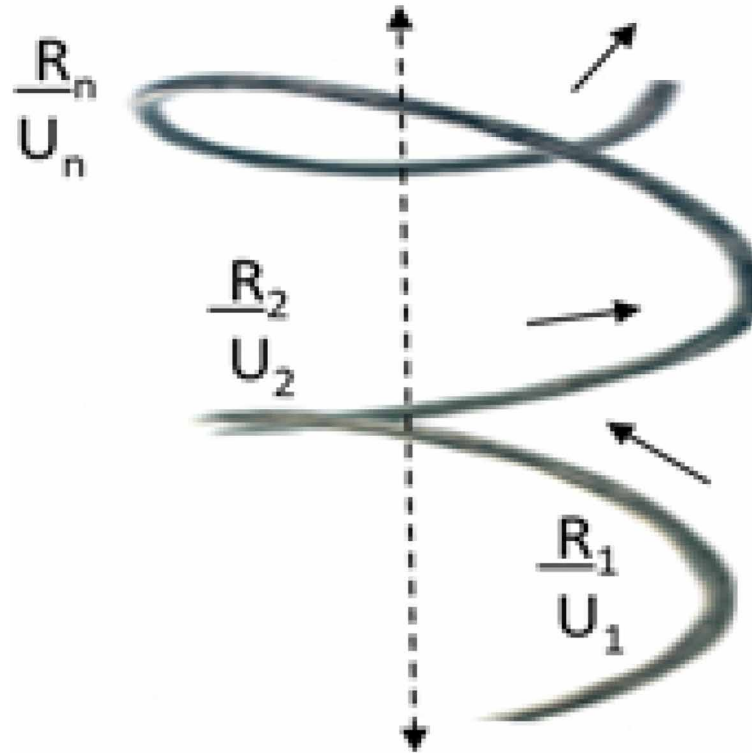
It follows from this evidence that the relationship between information and uncertainty is complex. A reduction of uncertainty on one side creates new uncertainty on the other. Or, while new information resolves uncertainty regarding the present/past, it creates uncertainty regarding the future. There is a chain or a spiral process of questions, answers, questions... uncertainty, information resolving it and creating new uncertainty, more information, and so on in an infinite process. As Figure 4 shows, resolving current uncertainty U_1 by the resolution R_1 allows for a cognitive movement forward, signified by the upward arrowhead of the development time continuum; but the resolving also creates to a new uncertainty U_2 . Its resolution leads to new uncertainty, and spiraling of the uncertainty-resolution continues in conventional, calendar time.

The usual movement is upward, which is represented with the dashed line's upward pointing arrowhead. However, newly learned information can sometimes shed a new light on previous resolutions of uncertainty. This happens, say, when a more precise measurement with a new instrument (whether this be a distance measuring device or a more reliable research questionnaire) provides a different result than the past measurements; or when a new piece of evidence unravels a previously built chain of evidence. A new information brings in doubt the past information. Therefore, uncertainty spirals down the time line, as depicted by the downward pointing arrowhead of the dashed line.

An illustration of the spiral of uncertainty is a case of ERP system discussed later in the book. The system exhibited a usability problem. Uncertainty regarding the cause of it was diffused for the employees who obtained some technical explanation, usually through the grapevine. However, the explanation typically triggered the response: "OK, but for how long do I have to live with this?" Ambiguous answers referencing a "release of new, better technology" had only a palliative effect in resolving the new uncertainty. Interestingly, organization members, who over time were exposed to unambiguous but differing technical explanations of the problem's cause, admitted: "Eventually, I really don't know what's going on." Therefore, the past explanations became ambiguous in the historical perspective and erased retroactively nearly all certainty. This is a case that opposes the normal cognitive movement upward and is signified by the downward arrowhead of the development time continuum in Figure 4. Therefore, the time of the spiral of uncertainty moves both ways.

The spiral of uncertainty applies also to scenarios that some authors characterize as ambiguity. In their discussion on knowledge management, Nonaka and Takeuchi (1995) suggested that organizations needed to generate "creative chaos" in order to be inventive and innovative (pp. 78-80). Management

Figure 4. Spiral of uncertainty
(Legend: U =uncertainty, R =resolution)



could invoke a sense of crisis in order to move organizational members into action. Instead of solving clearly defined problems, attention had been focused on identifying problems in organizational procedures and values. Management had been issuing open-ended, ambivalent directives in order to trigger a creative reexamination of procedures and values. Employees' would try to create answers, thus reducing somewhat the "chaos." But the answers would open up new, more specific questions, and the process would continue until new values, procedures, values and products are determined.

Weick (1990) analyzed complex systems and established that they may create opaqueness and conflicting signals akin to ambiguity. He called such systems "equivocal" because even the expert user could not always understand their inner workings and outcomes (desirable or not). To compensate, the user would create mental models of the system's workings. While operating the system based on these mental models could be successful in some domains, a possible mismatch between the mental models and actual system workings could engender unexpected system's responses. Therefore, a resolution of some ambiguity would create another ambiguity/uncertainty. (A detailed discussion of Weick's interesting propositions is in the chapter on infostructure).

In conclusion, the organizational teleology of informing agents is much more complex than the classical uncertainty reduction principle reveals. IVO is supposed to be an instrument for exploring this complexity.

Big Data Turn

The phenomenon of Big Data brings together some of the topics discussed so far. This concept refers to data that come in big volumes, variety of types, and at a high velocity (speed) (Davenport, 2014; Laney, 2001). Note that these three “V” characteristics are cumulative to have a case of Big Data, so merely a big volume (which is not a new thing) is not enough. Indeed, it could be argued that the increasing variety of data types is actually a new and the most remarkable development.

The Big Data relevant for business are generated by trends marking the first decades of the 21st century—Internet-based communication, global e-commerce, the Internet of Things, social media, and a cyberspace in general in which a user acts by performing searches, getting entertained, and possibly otherwise. The early literature suggests that organizations across different industries can improve their performance with Big Data. Examples include retail, banking, manufacturing, health care, securities trading, transportation, and power grid (Barlow, 2013; Bharal & Halfon, 2013; Columbus, 2016; Davenport, 2014; Hickins, 2013; Neumann, 2015; Travica, 2017; Viégas, 2015). Broader and deeper explaining of business entities and improving prediction capabilities are common benefits that are likely to result from analyzing Big Data.

The customer entity is central to all business disciplines (and not only marketers). The field of information systems is no exception. How can we conceive the customer in this early era of Big Data? A brief answer is, more comprehensively than in the past. The pre-Big Data or “small data” was staked on alphanumeric data reflecting purchasing transactions combined with customers’ demographics data. The products purchased, quantities, dates, and spend totals were squared with customers represented by their age, gender, residence locale, and income level. These data enabled managers to analyze sales totals, variances from plans, trends, cross comparisons (on products, time periods, salespersons, sale locations), best-selling products, and market segments. Operational and mid-level management was served by reporting systems—Transaction Processing Systems and Management Information Systems—across business functions (sales, inventory management, purchasing, accounting, payroll). Marketing function used aggregated data with help of analytical software built into Decision Support Systems (DSS) in order to understand and manage markets. Executive management benefited from getting key performance indicators (KPI) reported via their DSS. Drawing the KPI trends, combined with analysis of business environment, shaped strategic planning.

The key technology behind management processes supported by “small data” was relational databases that were tuned to numerical and textual data. Management informing process relied on highly structured data, formalized reports, and management familiarity with a customer-related vocabulary. Systems professionals took a back seat, being focused on smooth functioning of technology and a correct execution of data management processes. What has changed with Big Data?

Most apparently, new data sources emerged and expanded the picture of customer, as depicted in Figure 5. *Online communications* refer to Internet-based discussion forums, public chats, various postings (e.g., responses to blogs and messages on sharing websites), and the like. These are not to be confused with the communication transpiring via social media. Communications can provide indications of customers’ product-related sentiments. Consequences reach beyond advertising, for example, to product development. Textual data prevail in this domain and technologies for text mining are the typical enabler of this dimension of customer modeling.

The *Internet search* is an important source of new customer data, allowing for informing inaccessible to some traditional methods (Stephens-Davidowitz, 2017). As people usually access the Internet through

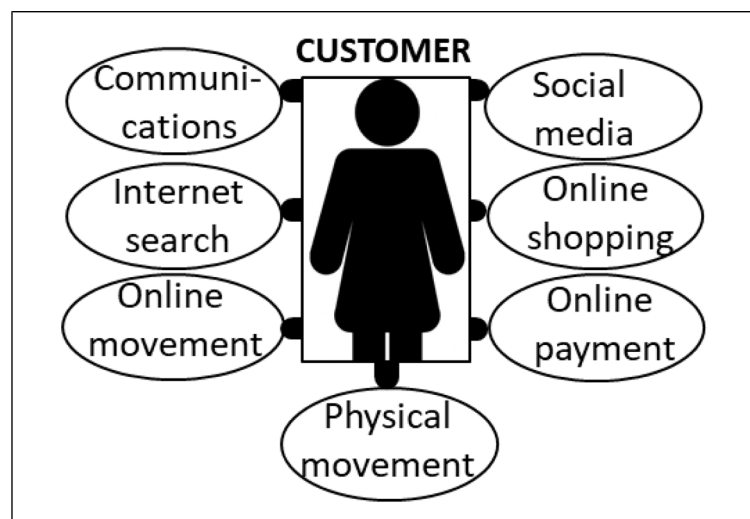
some search engine portal (Google, Yahoo, Baidu, etc.), their behavior is recorded by the portals. These users can seek any of many utilities and diversions the Internet provides – shopping, informing/learning, socializing, communicating, entertaining, publishing, political organizing, and so on. Any of these can be interesting for marketers and sellers of goods and services. Customers experience consequences of leaving search traces when they get targeted by advertisements on products lexically associated with previous searches. The big example of this is Google's AdWords system (Travica, 2015). The Internet search traces are still in the form of alphanumeric data but the storage is different from classical relational database systems since it has to accommodate new data properties (e.g., a variable number of attributes across customers).

Whether an Internet user performs the search first or jumps immediately to a point of interest (Website, social medium, online store), the user creates a digital path of the *online movement*. This path may be analyzed in order to understand users' interest in products. Relevant data allow for creating semantic networks and maps of online moves. A popular operating system and a standard browser generate and maintain a unique identification for every user of electronic technology connectable to the Internet. This identifier can then be used for tracking the user wherever he/she moves around the Internet.

Even early online retailers had the capability of seeing where their customer was before visiting them. This capability has scaled up. Recent insights into Facebook's practices revealed that the company has been monitoring keenly the online movement of its members (John, 2018); an example is technology called pixel. The corollary is that social media and other Internet businesses and cyber places relying on the advertising income can learn yet ever more about existing and prospective customers.

Social media behavior refers to chats, discussions, postings, and digital photos, videos and audio files that are continuously being stored on innumerate social media by some 2.5 billion of people globally (Statista, 2018). The key difference between social media and the classical mass media (TV, radio, press) is indeed in the user-generated content as opposed to the content created by professionals. The social media businesses quickly learned to monetize the user-generated content and in so doing invented a new business model. The trailblazing Facebook has led the way. Every bit of online behavior has been

Figure 5. Big Data view of customer



used for creating user profiles that are, in turn, utilized for advertising. Various data types are utilized as well as a new breed of databases (Google and Facebook are among the lead developers of these new technologies).

Online shopping emerged as a customer data source with e-commerce. It started in the mid-1990s and spread globally, involving new, rapidly developing markets, such as China and India (Pandolph, 2017). Indeed, today China is the largest e-market place in absolute numbers. Amazon.com has been the trailblazer from the start to date, currently holding a lion's share of the global electronic retail. While an online merchant can never see the customer, the merchant has a plenty of methods available for learning about the customer, such as product searches and purchases, webpage visits and movement within each page, clicks made, and other moves. Online shopping records are a welcome component to Big Data-based modeling of the customer. While the data can be a simple tabulation of steps taken, their sheer volume and variability across customers require new types of databases.

Online payment practices accompany online shopping. Tracking online payment methods is possible via specialized software, such as Facebook's pixel. The amount is not captured, but just a method of payment associated with the unique identifier of a payer mentioned above. These facts are interesting for providers of online payment solutions as well as credit card businesses. An Internet user searching for the Web address of a bank experiences the tracking when he/she gets targeted with ads of credit card companies. Using a cryptocurrency that commenced in 2008 (Coindesk, 2018) allows for tracking payers within the community of cryptocurrency owners through a shared electronic ledger. As credit card companies, retailers and other businesses can be part of that community, they can monitor the behavior of cryptocurrency users and take advantage of so learned information.

Physical movements do not occur in the cyberspace but are possible to track electronically. This technological capability has been around for some time: While a little Joe skateboards down the street, while peaking at his smart phone, a commercial on jeans sales in the nearby store hits his phone (Travica, 2007). The smart phone-GPS connection serves well the advertisers. Data suiting geographical information systems are of interest for this aspect of the contemporary customer.

Big Data allow for a more comprehensive insight into customers' behavior. They extend organizational intelligence. The effect resembles widening eyes to see a bigger picture of an environment. Thus, uncertainty is reduced. On the other hand, the scope of customer profiling is unknown as yet new sources and analyses get possible. Thus, the uncertainty resolved triggers new uncertainty forth and back in time.

THE SCOPE OF IVO

Relevant topics in IVO are presented in Table 2. Also, Figure 6 depicts these along with the corresponding aspects of organization. Individuals make a logical start in thinking about information, IT and organization. Some of the classical relevant works that operated on the bridge between IS theory and organization theory indeed built on the individual perspective (e.g., March & Simon, 1958). From one perspective, individuals are actors that create meaning, and command knowledge and wisdom. They differ in cognitive gestalts (e.g., Eysenck & Keane, 1995) or information personalities (e.g., Jung, 1921) that can be understood in terms of perception, learning, memory, and thinking, or as sets of particular traits. Human agency can make impact on crucial IS issues, such as adoption, use, design, and evaluation. In IS theory, there are different approaches to agency, which is signified in the concepts of "IT user" (e.g.,

the mainstream MIS research) versus “information user” (e.g., Dervin, 1983; Dillon, 1994). Part of IVO’s mission is to integrate these approaches, while bringing to the fore creative aspects of “the user.”

From another angle, individual organization members are subject to conditions of the organizational context. In organization theory parlance, these include organizational culture, politics, processes, and structure. In the IVO framework, these facets intersect with informing agents to create new analytical concepts of infoculture, infopolitics, infoprocesses, and infostructure. So for example, organization members are indoctrinated into certain beliefs and behaviors of an infoculture and have to perform certain infoprocesses in prescribed ways. Such cultural and professional knowledge syncs deeply into their memory and influence their perception. This institutionalization of the organization member, then, impinges on evaluation, adoption, and use of new IS and associated infoprocesses. Effective management needs to account for these important phenomena that the individual organization member creates and is created through, and IVO offers analytical tools to this end.

Organization is also a collection of groups. Or put another way, work groups (teams, committees, etc.) can form an important building block in organizations. This has always been the case in the matrix organization in various industries, such as mining (Tavistock studies), airplane manufacturing (Galbraith, 1973), and public accounting (Travica, 1999). Since the early 1980s, workgroups have been a constant management concern in organizations of various sorts. Workgroups may have their particular perception, thinking, and memorizing dimensions, as speculated by early social psychologists. A pattern of connections and interaction among group members renders knowledge and meaning to a particular perspective. Group Support Systems that facilitate communication and collaboration in groups have been the subject of intensive study for years. Groups can also shape the relationship between IT and people by compensating for the narrow bandwidth of communication technology (as exemplified in the revision of media richness theory) and for limitations of a spatially dispersed work design (Majchrzak et al., 2000). All these issues are important for IVO, since they concern both IS and organizational researchers (see Shulman, 1996). These issues constitute the topic of group informatics or groupomatics, for short.

The ways of dividing labor in organizations reflected in the theory of organizational structure are all but untouched by informing agents. The IVO complement to organizational structure is informing structure or infostructure. Organizations based on intellectual work have grown in prominence during

Table 2. Scope of informing view of organization

<i>IVO Dimension</i>	<i>Focus / Definition</i>
Homo Informaticus (Individuals)	Individual cognitive aspects and informing behaviors; individuals as users and creators of organizational IT/IS.
Groupomatics (Workgroups)	Group cognition, decision making, work and group support IS.
Infostructure	Stable relationships between data segments and the arrangements of IT that complement social structure.
Infoprocesses	Processes of data manipulation and of cognition, external and internal to homo informaticus.
Infoculture	Stable beliefs, behaviors, and artifacts related to informing agents.
Infopolitics	Agendas, power, and fight/flight behaviors related to informing agents.
Infoeconomics	Costs, benefits, and other organizational performance aspects related to informing agents.
IS Strategy and Life Cycle	IS mission, goals, plans, and intents. IS design/development, adoption, management, use, and evaluation from the perspective of IVO dimensions.

the last two centuries. These had started in the sectors of education, publishing, government, banking, insurance, accounting, and news media. The location of data, their collection, processing and transfer as well as the capabilities and limitations of contemporary IT have always influenced the departmentation, job specialization, hierarchical and geographical differentiation, formal rules and regulations, and other structural aspects. These influences have become even stronger with the expansion of organizations that intensely collect and interpret data, and focus on the development and use of knowledge in the second half of the 20th century. Examples include the financial industry, hi-tech industry, libraries, entertainment industry, legal services, and Internet-based extensions of organizations or the new businesses creating the sector of electronic commerce (e-commerce).

Management of data and knowledge has increased in all industries. This process was fostered by IT development. IT progressed through several stages that make its trajectory long (electro-mechanical, electro-magnetic, electronic, micro electronic). In contrast, this trajectory was compressed in a relatively short period of time. In organizations, centralized data processing functions were succeeded by PC-based data management distributed across organizational functions, and this form is now being succeeded by ubiquitous computing and mobile solutions. All these developments were reflected in organizational structures. An apparent change was in the outlined division of computer-based data processing, which gave rise to job specialization. The increasing capabilities of IT in the domains of reporting, decision making and control paved the way for pushing power up and down in organizations and made them “thinner” at the mid-management level. Computer networks allowed for transacting beyond organizational boundaries and for creating inter-organizational networks. Structural changes in vertical layering have occurred owing to outsourcing and subcontracting, while maintaining electronic links with the external parties. Virtual organization and other new forms ensued, countering the bureaucratic form (Clegg & Hardy, 1996; Travica 1999). To be sure, organizational informing agents were not the sole forces enacting these changes. Rather, they worked in concert with organizational strategy, environment, and other forces.

IVO’s concept of infostructure acknowledges the close connections between social structure and informing agents. The term has been used in the literature but not in the same conceptualization as in IVO (e.g., Ciborra & Patriotta, 1996; Davenport & Prusak, 1997). Infostructure refers to stable patterns of relationships between information segments (data organization entities and knowledge representations) and the arrangements of IT that complement social structure. Specific infostructural dimensions also complement dimensions of social structure. For instance, the dimension of hierarchy that refers to the levels of graded authority (Weber, 1946) can also be understood in terms of the levels or vertical distribution of informing agents. Indeed, one can argue that hierarchy is based on the asymmetric possession/access to data, knowledge and IT. Possession and access to reports, even without actual use of them, are part and parcel of hierarchy levels (Feldman & March, 1987). IT can be conducive to hierarchy by serving as a report mill, even to the extent of engendering “information bloat” in government organizations (Strassman, 1985). In contrast, IT can be instrumental in reducing the middle management. In any case, the vertical distribution of informing agents complements social hierarchy. IVO applies similar shifts to centralization, departmentalization, and other structural dimensions. A separate chapter in this book is devoted to a detailed discussion.

IVO also takes interest in the process view approach to organization. A variant of the systems view of organization, the process view naturally fits with process technologies, such as IT. The process view has a longer history that can be tracked back to the work of Frederick Taylor, later quality control methodologies in manufacturing (e.g., kaizen, lean), and to more recent approaches to coordination (Malone et al., 1999), business process reengineering (Hammer & Champy, 1993), and business process management.

At the outset, organization can be conceived as a network of workflows or processes. Each process is a set of tasks that has a common start and end point, usually stretches across organizational departments, and has a defined recipient of its end deliverable (the customer). Processes can run over organizational boundaries as well.

Organizational processes can be rested in various degrees on IS. Process optimization largely depends on technological solutions. Typical example is ER systems that can enable enterprise-wide integration of business processes in electronic form. The business process reengineering approach has particularly been occupied re-organizing that would take advantage of these systems. Modernist rationality can easily be recognized in the background, along with the classical metaphor of organization-machine and the limitations its historical predecessors have borne (see Hatch, 1997). Indeed, the reengineering Big Bang approach has received substantial criticism (Galliers & Swan, 1999). But if the prophetic transformational aspect of the process view is set aside, the understanding of organization in terms of processes, in conjunction with advances in IT and integrated data management, does remain a useful ontological core.

IVO adopts the process view while advancing the informing aspects. Every organizational process has data components, and some processes are nothing other than a set of data processes complemented with higher level cognitive processes. For instance, planning entails gathering of relevant data, data analysis, thinking involved in conceptualizing goals, option definition and selection, negotiations, and so on. IVO uses the term informing process, infoprocess for short, to refer to data-related and higher cognitive processes. Examples of the former are data collecting, organizing, and transformation. The other kind of infoprocess was already mentioned in discussing the central infoprocess that takes data and transforms it into information (meaning). This infoprocess includes others within its category—perception, retrieval of memorized knowledge, and thinking. The central infoprocess feeds learning and memorizing, higher infoprocesses on their own. The infoprocess perspective is important for understanding homo informaticus and the role IS play in informing.

Informing agents are influenced by organizational culture and, in turn, can influence organizational culture. Culture of informing, or infoculture, refers to this interaction and to its results. Beliefs attached to data and knowledge assets, communication practices, and expectations attached to IT are just some examples of the cultural impacts of cognitive informing agents in today's organizations. Every organization values its proprietary knowledge embedded in copyrights and patents or in its core competences (a distinctive bundle of skills and technology). In some organizations, the knowledge creating capability is elevated to the pedestal of core values; for example, Microsoft has viewed itself as a company with a high IQ and the company has created a culture of a knowledge-generating campus in its main software production unit. Similarly, the 3M corporation has praised the creation of new knowledge through stories about inventors of its brand products (Morgan, 1986).

The belief that one is supposed to share ideas, insights and knowledge with teammates and others concerned and the corresponding practices drive cultures in the American public accounting industry (Travica, 1999). The Internet features in key cultural narratives at Amazon.com and other companies rooted in this socio-technical environment. All these new phenomena can be explained by the concept of *infoculture* that refers to stable beliefs, behaviors and artifacts (e.g., lingo, and material objects) concerning informing agents, which are shared by organization members. The term “infoculture” has been used in the literature in reference to concepts that have some similarities with the IVO concept (Bressand & Distler, 1995; Davenport & Prusak, 1997). Organization theory has also provided some inspiration; for example Ouchi (1980, 1981) compared how certain artifacts akin to informing agents were valued in clans, markets and bureaucracies.

Much of organizational politics is about informing agents. These constitute large stakes that attract much of decision making, negotiations and conflict management. Organization theory has operated with the concepts of expert power for decades (French & Raven, 1959; Mintzberg, 1983). While the technical knowledge of machinery constituted the power basis in the industrial age, the knowledge of using IT and electronic information is crucial today (Pfeffer, 1981). The ongoing hot debates between employers and employees concerning the privacy of electronic communication are political phenomena since each side fights for territorial gains. The distribution of power can be disturbed by the use of group support systems, health care systems (Barley, 1986, 1990), and other kinds of IT/IS (Davenport & Prusak, 1997; Strassman, 1995; Travica, 1999). IT and ISes can be sources of energetic territorial battles, whether a database system or outsourcing/insourcing policies are concerned. IT in itself may be a force of control from above as well as of appropriating autonomy (Beniger, 1986; Peters, 1992; Quinn, 1992; Zuboff, 1988). IVO introduces the concept of *infopolitics* in order to account for this theorizing. This important aspect refers to power, agendas and fight/flight behaviors related to organizational informing agents.

Earning, spending, economic effects, and overall organizational performance related to organizational informing agents constitute the next IVO segment—*infoeconomics*. Since the *raison d'être* of informing agents is to support organizational goals and needs, the domain of infoeconomics represents a manager's test bed for the value of organizational informing agents. How do the deployed IS square with performance of business processes and overall operational efficiency? What are the expenses of data management? What direct and recurring costs are associated with IS? Does a new IS generate expected financial returns and intangible benefits? Is it conducive to accomplishing strategic goals? These questions have been traditionally associated with the economy of IS. IVO views these from the perspective of economics of informing agents, aiming to expand the depth and breadth of this line of inquiry. Newer methodologies, such as balanced scorecard, are given more attention and the impact of other IVO aspects on infoeconomics is brought into analysis. perspective, infostructure can affect infoeconomics. For example, infostructure can impact negatively on infoeconomics when the applied data organization induces high costs of using the data. In contrast, organizing and maintaining properly knowledge on production processes is an example of the infostructure contribution to a company's efficiency and effectiveness.

The last topical area in IVO refers to IS Strategy and IS life cycle management. IS Strategy refers to the mission, goals, plans and opportunistic intents related to IS. The IS life cycle has been a traditional topic in the IS field. Table 3 shows the IVO slant on these traditional topics. IVO looks at the issues of IS design/development (planning implied), adoption, use, and management—both operational and strategic. IVO adds system evaluation to this list of IS management issues, presuming that users, managers and other stakeholders are the evaluators.

Both IS management and IS evaluation flow throughout the system life cycle. The evaluation aspect is related to infoeconomics. Other IVO-based slants shown in Table 2 are based on IVO assumptions discussed in Introduction (e.g., differentiating between technological and cognitive informing agents, differentiating between IT and IS, overcoming abstract approaches to these, a user focus, and engaging different ontologies of organization). From the practical perspective, IVO is supposed to provide a guide for managers and professionals to deal with IS life cycle issues. The topic is discussed in a designated chapter as well as throughout the book.

Introducing Fundamental Concepts and Strategic Perspective

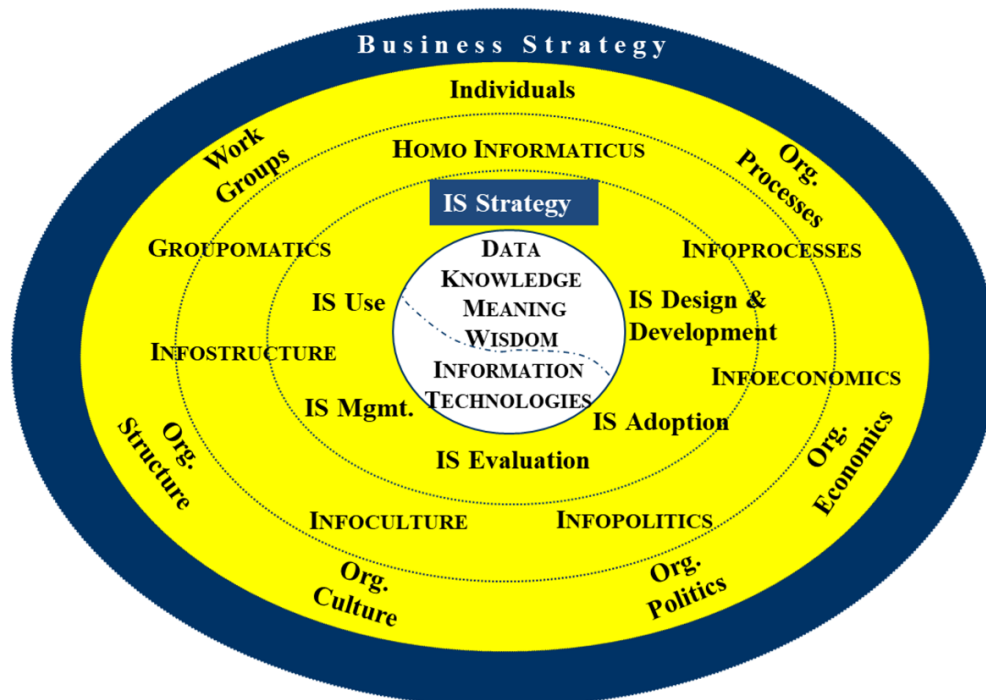
Table 3. Information system life cycle management in IVO

Traditional Approach	IVO Approach
IS Design/ Development	- Alternatives to expert-driven design involving IS users in proactive roles; - Attention to design of data content
IS Adoption	- IS with specific characteristics—not a black box; - IS not only as a given entity but also shaped by users and organizational context; - Adoption of new informing practices
IS Use	- Importance of organizational learning and knowledge processes; - User focus
IS Evaluation	- Differentiating between adopting new system's IT and outputs - Combining evaluation perspectives (organization ontologies, cultural stance, intangibles and tangibles); - Impact of cognitive factors - Relationships with infoeconomics
IS Management	- Operational and strategic management of people, finances, work and timeline within each phase of IS life cycle; - Both IT and data addressed; - Relations with IVO aspects (infoculture, infopolitics, infoprocess, etc.)

STRATEGIC ASPECT IN IVO

This section discusses the newly added strategic aspect in IVO. Both the topics of IS strategy and business strategy will be addressed. It is appropriate to end the Introduction this way because the strategy perspective will pervade upcoming chapters.

Figure 6. Informing view organization with organizational aspects



Strategic Perspective in IVO

Within the information systems (IS) discipline, the topic of IS strategy has attracted less attention than, for example, system adoption or economic effects. In parallel, the position of IS in companies have been evolving at a slower pace. Typically, IS function has been managed as a cost center and support to operations. Strategic goals are set before such IS function, such as increasing the business process efficiency in support of a business strategy of cost leadership. Less frequently, IS function partners with business management in creating business strategies.

The mainstream approach to IS strategizing has been focused on understanding how firms can compete on cost leadership, product differentiation, or in a focus market (Porter, 1980, 1985). While still being important, this approach fails to account for a strategic impact potential of modern IS. Initial movements in this direction have recently been made (Bharadwaj et al., 2013; Chen et al., 2010). The business strategy literature offers an additional opening. Promising strategic approaches have been introduced and tested, such as Blue Ocean Strategy (Kim and Mauborgne, 2004) and Dynamic Capabilities (Teece et al., 1997). This chapter will discuss research contributions that are relevant for setting a blueprint for an IS strategy aspect in the IVO framework. To this end, strategy concepts will be explored, followed by an analysis of strengths and weaknesses of the mainstream approach to IS strategy and of the alternatives.

Strategy Concepts and Theories

Business strategy (strategy) refers to the organizational mission, significant goals, plans for accomplishing goals, and opportunistic intents, all of which engage significant resources and determine business for a longer term (see Figure 7). This definition complies with some key ideas in the strategy literature (Chen et al., 2010; Mintzberg, 1978; Porter, 1980). While a mission frames a general direction of a company with regard to products and/or markets, strategic goals specify the targets to be reached. For example, the mission statement of Amazon.com reads: “We seek to be Earth’s most customer-centric company for three primary customer sets: consumer customers, seller customers and developer customers.” This statement implies markets of Amazon’s online retail, third-party sellers that sell in Amazon’s online stores, and system developers using Amazon Web Services (AWS). Specific strategic goals led the creation of particular products, such as 1-click service, Amazon Go physical stores, order fulfillment services for third-party sellers, several non-relational database software products, and the Kindle electronic reader.

Further to defining business strategy, it includes plans (or policies, road maps) that define a path to accomplishing goals. Resources’ allocation and timing make a key part of these plans. The last concept in the strategy definition, opportunistic intents, is proposed here in order to capture today’s highly dynamic business and the idea of emergent strategy (Mintzberg, 1978). In contrast to a deliberate strategy that emphasizes the clarity of goals and plans, an emergent strategy endorses the possibility of changing goals and plans with opportunities arising. For example, it could be argued that AWS resulted from an unexpected opportunity to commercialize Amazon-made systems as a Cloud computing service. Intents in that direction could have initially been part of guesswork rather than deliberate goals. Still, such intents paved the way to an AWS strategy.

IS strategy mirrors the definition of business strategy, and so it refers to the mission, goals, plans and opportunistic intents of IS function in a company, which engage significant resources and determine the direction of IS function for a longer term (Figure 7). The IS mission and goals can be more or less determined by the business strategy. For example, a product innovation strategy in a pharmaceutical

company calls for systems that support imaging and exploration of new chemical compounds. However, in a high-tech company, such as Amazon, the boundary between strategic business and technology goals may be blurred. An example again is AWS; another example is the Kindle reader that, in addition to being a product for sale, has stimulated Amazon's publishing business. Google provides an example of how an opportunistic intent in the systems area shapes the opportunistic intent in the business area. The company's core business model of monetized Internet search emerged with the availability of a software product developed by another company. By buying the product (and the company), Google was able to link its powerful Internet search with lexically related advertisements and to engage in selling the screen space to advertisers.

The proposed definition of IS strategy integrates several ideas. The IS mission, goals and plans can serve or be aligned with those of business strategy, as the proponents of the traditional approach advocate (e.g., Atkins, 1994). As well, IS can incite business strategy, be a play-maker and partner to business (e.g., Earl, 1989). The latter approach has recently been re-endorsed. Bharadwaj and associates (2013) suggest that "IT strategy" and business strategy should be fused in a digital business strategy. In a rationale, they cite technological advances, a need for novel multisided and multilayered business models, and a new mandate for IT and the Chief Information Officer. The authors argue that effects are being manifested, among other things, in new sources of value creation and faster decision making. Accordingly, Pagani (2013) built on the new value creation thesis. The author's study of broadcasting industries showed how companies at control points in digitized ecosystems create and capture value thereby cashing on their digital business strategies. In addition, Chen and colleagues (2010), based their concept of IS strategy on Mintzberg's (1987) view of strategic goals shared among organization members. They argued that IS strategy could be operationalized as the degree to which the organization has a shared perspective to seek innovation through IS. This approach, therefore, makes IT a major innovation lever.

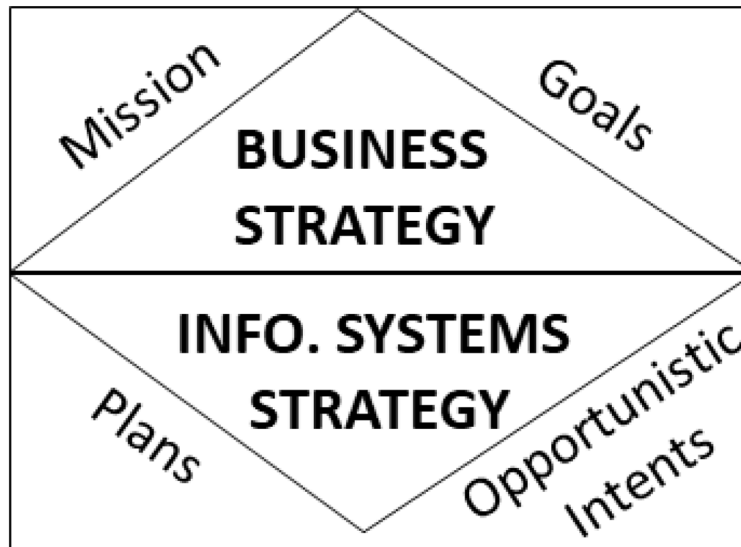
Sometimes, it is useful to view IS strategy as one of specific strategies in a firm pertaining to the IS function in the manner in which marketing strategy applies to marketing function, human resource strategy to HR function, and so on. In this approach, IS strategy concerns the life cycle of relevant IS, systems architecture (overall design) and infrastructure (actual hardware, software, databases, networks, etc.). Assumptions about the relationship between such IS strategy and business strategy apply here as well. Therefore, IS strategy gets aligned or possibly incites business strategy by adjusting the organization toward accomplishing a strategic business goal. For example, the goal of reaching a certain efficiency level may require a process organization, and a supportive IS strategy could be an ERP system strategy. Consequently, a number of business processes would be automated via the ERP system. When being more proactive, IS strategy stimulates business strategy by influencing business goals.

Strengths and Weaknesses of Traditional Strategic Approach

The area of business strategy (or strategic management) has been dominated for long by theory of competition developed by Michael Porter (1980, 1985). The IS discipline has followed the suit. Porter's theory contains three parts. One focuses on business strategy positing that companies compete on either price leadership or product differentiation across a market. Optionally, a company can focus just on a market segment and there again compete on either price or differentiation; this is called focus or niche market strategy.

The second part of Porter's theorizing centers on competitive forces. It views a competing company within an environment consisting of a customer, supplier, and three kinds of competitor—the direct,

Figure 7. Business and systems strategies



indirect (competing with a substitute product), and potential (a new market entrant that can be either a direct or substitute product competitor). Finally, the third part is value chain theory. It views a competing company in terms of its internal activities that are primary (creating economic value, such as product assembly work) and secondary (supporting primary activities, such as information systems). The value chain extends across a company's boundaries, as is the case with partners in a supply chain.

Porter's theory of competition provides a well-rounded foundation for explaining common competitive strategies. It has considerable predictive power (the concept is used in this discussion in qualitative rather than statistical sense). For example, the theory predicts that in order to compete against direct competitors on price, a company's value chain activities need to be coordinated toward the goals of efficiency and cost savings. Therefore, the theory posits that cost competition strategic goals precede shaping of a value chain that, in turn, shapes competitive outcomes.

Within the IS field, Porter's theory has enjoyed a broad acceptance, and particularly so among textbook writers. Still, it has certain limitations. First, IT does not play a prominent role in the theory but is bundled with other organizational technologies into support activities. Hence, this theory is *IT-obscuring*. Such an approach cannot provide sufficient explanatory and predictive power nor management guidance in the cases of high-tech sector or the companies leading in digital revolution (e.g., Google and Tencent). Digital technology can transform the value chain and stimulate business strategy.

The second issue is that Porter focuses on existing markets rather than on the creation of new ones. Thus, it is *reactive*. In contrast, just a brief glance on the markets in the ongoing Internet era, however, reveals how digitized businesses keep creating new markets (e.g., e-commerce, Cloud-based services, and wearable digital products). Market builders follow what can be called *proactive* strategy.

The third issue is that Porter's theory does not emphasize enough innovation, thus appearing *innovation shy*. A product differentiation strategy assumes innovation (e.g., iPhone vs. BlackBerry), and even a cost leadership strategy may need periodic innovation (e.g., budget airlines' cost cutting methods). But innovations are rather in the background. This approach does not suffice in today's highly competitive

global markets. Companies must innovate or are pushed aside the competition tracks. Therefore, successful companies are on a continuous innovation curve (e.g., Apple and Huawei).

Finally, Porter's theory of competition assumes setting up clear goals and plans of achieving these. Cost and differentiation strategies belong to a deliberate type of strategy because they rest on planning. While a deliberate strategy allows for orderly management and reducing uncertainty in organizational life, it is less effective in dealing with dynamics of modern markets and business. Examples of successful companies in present time indicate that they make quick, opportunistic moves in product development and market entry/exit. Such moves can be explained better by the concept of *emergent strategy* (Mintzberg, 1978). An emergent strategy combines elements of a deliberate strategy with new goals emerging as an opportunity presents itself or a blockage appears. This idea is reinforced in the concept of opportunistic intent in the here proposed definition of IS strategy. For example, Facebook, Alibaba, and Google keep adding yet new hi-tech services to their portfolios by realizing opportunities surfacing in technology and market developments.

Theorizing on business strategy has been advanced in recent years. New theories, frameworks and models have surfaced responding to limitations of *reactiveness*, *innovation shyness* and *deliberation exclusiveness* in the mainstream theory. Although still being falling short of overcoming the *IT-obscuring* aspect, some new theories can aid theorizing of IS strategy.

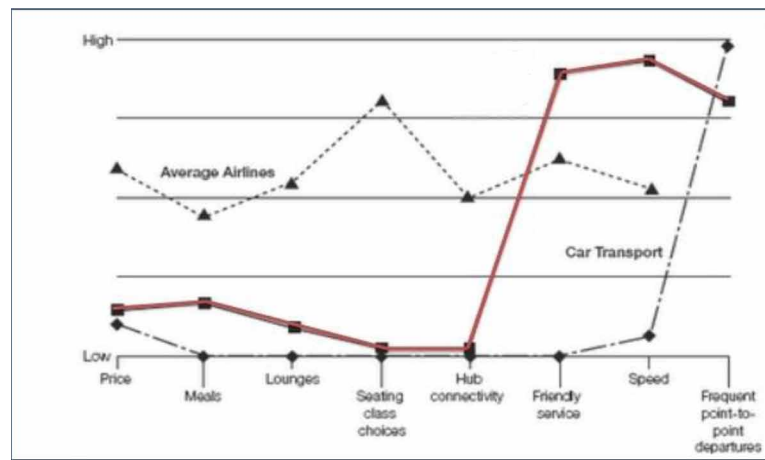
Alternative Approaches to IS Strategy

The discussion on alternatives to the traditional strategic approach starts with Blue Ocean Strategy (BOS) (Kim and Mauborgne, 2004). This is a recent contribution to studying strategy. Since its introduction, the original book sold in millions of copies and in dozens of languages, attracting many awards internationally. The market success is somewhat contrasted by academic criticism that the theory has been an attractive integration of existing concepts rather than a radical novelty.

BOS developed partially in reaction to the mainstream competition strategies. Instead of fighting bloody battles against competitors by reducing price or making a product more attractive, a company may (metaphorically speaking) sail into a vacant, blue part of the business ocean. In other words, a company may create a new market and attract new customers. The theory's creators assume that a BOS can accomplish both the cost and differentiation goals when compared with direct competitors or substitute product makers. For example, Southwest Airlines created the budget (cheap) air transportation service in the U.S.A., and in that way beat the established airlines on price. While covering regional routes rather than hub airports and flowing more frequently, it also differentiated itself from competitors' services. In a larger regional transportation industry, Southwest Airlines also differentiated itself from the land transportation based on the speed (see Figure 8). This is analyzed and demonstrated via strategic canvass depicted.

It is based on competition factors (cost, route design, timetable and speed in the example above), which are used for comparing the competitors. A successful company improves its customer value proposition by enlarging and creating competition factors on the benefit side (route design, timetable, speed). In addition, the company reduces and eliminates competition factors on the cost side (in our example, the air ticket price was reduced by focusing on a single model of aircraft and thus eliminating costs of retraining the flight and maintenance staff over time, parts' expenses, and some others). BOS also includes value propositions for other parties, such as employees and shareholders. The competition factors are the causes of competition outcomes.

Figure 8. Strategy canvass for Southwest Airlines (Source: Free Slide Share)



BOS offers convincing theoretical explanations to scholars and some predictive power to managers engaged in innovation and proactive strategizing. It can suit emerging strategy making as well as the deliberate path. However, BOS is still lacking a focus on the contributions of digital business technology to competition factors and ultimately outcomes. For example, interesting questions are: What is the role of technology in planning the budget airliner's routes and timetable and in executing operations? Is this business at all possible without support of such technology, while controlling for the headcount (a big cost factor)?

Disruptive Innovation Strategy

The Theory of Disruptive Innovation (TDI) (Christensen, 1997; Christensen and Raynor, 2003) has gained many followers among scholars and practitioners since its inception. The term "disruptive technology/innovation" entered the professional and academic lingo and has been used profusely even when the users are ignorant of the term's theoretical background.

The author of TDI first focused on technologies (many of them digital), which is of interest here. Later on, Christensen expanded the study to any innovation (a business model, type of business, etc.). TDI aims at explaining why some companies, which once delivered successful, innovative technological products, later failed to embrace further technological innovations surfacing in their market. Another problem TDI addresses is the success of technological innovations that succeeded although they played against market rules. Christensen labelled these surprising technological products with the term "disruptive innovations". TDI shares some ideas with the philosophy of creative destruction (Schumpeter) that is in the background of a market economy. A disruption is akin to the phenomenon of destruction, an instance of which is when a company cannibalizes (abandons) its own well-performing product in order to remain competitive.

In order to explain disruptive technologies/innovations, Christensen proposed a model based on four assumptions, which is depicted in Figure 9:

Introducing Fundamental Concepts and Strategic Perspective

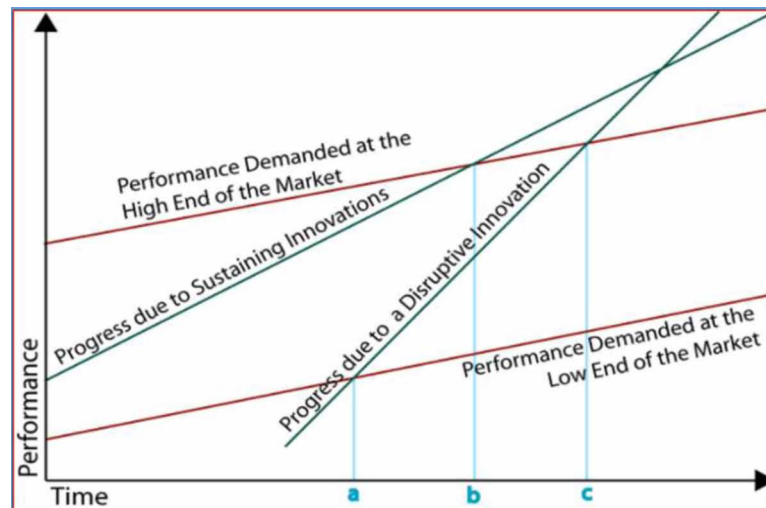
- (1) A new entrant into an established market launches a competitive or substitute product that is simpler, cheaper, and modest in performance (the lower progress curve in Figure 9).
- (2) The target is a low (cheaper) market neglected by market incumbents (time point A in Figure 9).
- (3) Market incumbents overshoot the demanded innovation, and make a pricier product that customers may not fully utilize (point B in Figure 9).
- (4) Market incumbents ignore the disruptive innovation although they can fight back, while it keeps improving to reach the high market standard (point C), and eventually displaces incumbents.

From the strategic perspective, TDI may help to explain failure/success in competitive hi-tech markets. Christensen argued that the personal computer disrupted typewriter, email did it to mail, cell (mobile) phone to landline phone, smart phone to cell phone, mobile digital technology to stationary technology, and digital camera to film camera (to cite just few examples). However, the cumulative nature of the TDI assumptions has been questioned as well as its explanatory power (Danneels's, 2004; King and Baatartogtokh, 2015; Lepore, 2014; Weeks, 2015). Also, predictive power of TDI is doubtful, examples including the iPhone and the company Uber.

The key problem of TDI is a lack of clarity regarding the causes behind disruptive technology/innovation, which could be in technology characteristics, in the market, in the incumbent's organization, and on the customer's side. The methodology of TDI also needs further development. These problems stand in contrast to high attention that TDI and its language of "disruption" aroused among scholars and practitioners.

Keeping in mind the limitations, one can still use TDI for explanations by trying to match cases of successful technology products with the full TDI model. The organizational/social context must be taken into account. So for example, the personal computer disrupted typewriter because it made particular typewriting tasks simpler and faster to perform, thus saving on labor cost. Being more expensive than the typewriter, the PC could not attract customers by price, as it would follow from a rough application of the first TDI assumption. This approach, can also help in focusing attention on digital technology in strategizing, which is a missing aspect in TDI. However, note that this changes the theoretical unit of analysis from technology to task and organization.

Figure 9. Model of disruptive innovation (Murray, 2011)



Dynamic Capabilities

The Theory of Dynamic Capabilities (TDC) was introduced about 10 years ago (Teece et al., 1997, Teece, 2007). Its basic idea is that organizational resources (such as expertise, technology, capital, the way a company is organized and managed) can be continually reconfigured in response to environmental opportunities in order to maintain a sustainable strategy of innovation. A company with dynamic capabilities keep evolving business models, lines of business, and products. Its market outputs correlate with intra-organizational changes.

An example of TDC at work is Google (Travica, 2015). The company started from an Internet search system (portal), and within two decades expanded toward products cutting across many industries (e.g., advertising, communication, publishing, security, maps, analytics, operating systems, application software, computer hardware, system development, automotive, wearable digital products, and home electronics). Google has been continually riding innovation curves and changing its internal organization. Results are inventions and significant earnings.

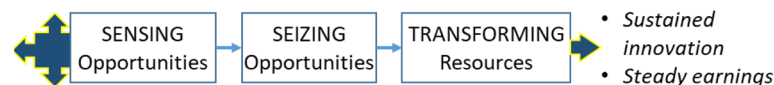
TDC builds on three processes: sensing opportunities, seizing opportunities, and transforming resources (Teece, 2007); see Figure 10. Opportunities lie, for example, in science and technology developments and markets. For example, Google has been adjusting its webpage ranking algorithm embedded in its Internet search system to generate advertising income in yet new product markets. A company seizes opportunities by changing business models and its organization as well as decision models and controls. For example, Google leveraged the advertising income to commence a number of software and hardware products targeting different customer groups. The third process is about a continuous alignment of resources (e.g., organizational expertise) toward a new business model. In the Google example, the company pooled together its capabilities in Internet search, mobile computing, and voice recognition products to create a personal digital assistant that is embedded in other Google's products. The whole TDC model draws on logic of a causal chain.

TDC can help explain innovation strategies that reach beyond product differentiation. It may have predictive power regarding the downstream dynamic capabilities, once opportunities are sensed. In particular, TDC incites defining the organizational adjustments needed to seize opportunities as well as identifying the resources to be transformed. TDC provides a more complete methodology than TDI but not as detailed as BOS. Like with the other two theories discussed, TDC is lacking an explicit focus on IT/IS.

Comparisons of Three Strategic Approaches

Results of comparative analysis of three theories applicable in study of IS strategy are summarized in Table 4. BOS is suitable for new companies and markets; DIT applies to both new and established companies/markets; and DCT fits just the established ones. DIT and DCT can help in identifying emerging

Figure 10. Dynamic capabilities model



strategies centered around a disruptive technology or environmental opportunity, respectively. In contrast, BOS explains deliberate strategizing. All theories are proactive and focus on product innovation and new business models. This forward looking, strategic focus makes them suitable for strategizing with modern IT.

All the three theories, however, are lacking a decisive focus on technology. BOS is the weakest in this respect, while the other two fair somewhat better. DCT has the highest potential since IS could play an active role part in each dynamic capability. Note that DIT, despite all its loud talk about IT, focuses on IT as a product in the market rather than an entity within the company. Still, such a focus is possible with a calibration of the causal formula (mentioned above and elaborated below). The lacking IT focus in these promising approaches imposes a challenge and a pressing task for a scholar who intends to use any of these for studying IS strategy.

The alternative theories differ in the completeness of their methodology. A user of DIT is left to cope with the disruption assumptions discussed above, with no help on how to estimate the dimensions to be plotted in the disruption graph. The uncertain unit of analysis can confuse a researcher. Confusion amplifies with the unclarified causal aspect of DIT. These methodological shortcomings weaken explanatory power of DIT and deprive it from predictive power. A possible way out of methodological problems is in using consistently a particular unit of analysis (say, the core task supported by technology). Consistency and clarity can also help with disruption causes. A researcher may decide to focus, for example, on a combination of causes that capture a disruptive technology's customer, producer (the disruptor), and competitor (the disrupted).

DCT fares better on methodology than DIT and thus yields more of explanatory power. One should keep in mind, however, that the causes are defined only on a general level. Therefore, a researcher has to investigate specific causes within each dynamic capability area. The DCT literature provides leads in this respect. Considering the clear general causal formula and the open-ended formula of specific causes, it could be said that DCT has some predictive power.

BOS offers the most complete methodology. The focus on competition factors, their grouping, and the ensuing strategy canvass showing strategic advantages of a company under analysis relative to competitors altogether provide a solid guide for research with credible explanatory power. Weaker points concern the uncertainty in identifying competition factors and the subjectivity in performing relative comparisons of companies on competition factors. Both could be alleviated by relying on an inter-subjective agreement familiar in coding qualitative data. The solid BOS methodology yields certain explanatory power. However, predictive power does not exist in the theoretical domain because competition factors are partly newly created and so they cannot be known beforehand. Still, managers engaged in BOS, who create new competition factors, may find the strategy canvass useful for tentative predictions.

In conclusion, the three strategies have merits for studying IS strategy. They are compliant with the previously discussed view of a close cooperation/partnering between IS business and IS strategy (Bharadwaj et al., 2013; Chen et al., 2010). When using any of these, a researcher of IS strategy should be aware of the particular methodological limitations and endeavor to put a creative effort in advancing the methodology. Combining two or all the three of theories in the same study could yield a more comprehensive explanation. Finally, increasing predictive power of theoretical and practical modeling of IS strategy based on these theories is a standing task.

Table 4. Comparing theories of blue ocean, disruptive innovation, and dynamic capabilities

Approach Characteristic	Strategic Approach		
	<i>Blue Ocean Strategy (BOS)</i>	<i>Disruptive Innovation (DIT)</i>	<i>Dynamic Capabilities (DCT)</i>
Company, Market	New	New and old	New and old
Reactive/Proactive	Proactive	Proactive	Proactive
Product innovation	Yes	Yes	Yes
Cannibalizing product	No	Yes	Yes
New business model	Yes	Yes	Yes
Technology focus	Low	Moderate, Implied	Moderate
Deliberate/Emerging	Deliberate	Deliberate & Emerging	Emerging
Method completeness	High	Low	Moderate
Unit of analysis	Company	Technology, Variable	Company
Causal aspect	Yes	Unclear	Yes, general level
Explanatory	Yes	Somewhat	Yes
Predictive	Possibly in practice	No	Some

INFORMATION SYSTEMS THEORY AND ORGANIZATION THEORY

At the theoretical level, IVO intends to integrate literatures that are relevant for understanding organizations from the perspective of organizational informing agents. The relationship between the IS field and organization theory has existed for decades. As Figure 11 depicts it, both fields share interest in the systems approach. For the IS field this is the main paradigm, since (a) data are supposed to be manipulated in a systemic (procedural) fashion with help of IT, (b) the main role of IT is to transform data inputs into outputs, and (c) IS is one kind of systems studied in general systems theory and its subsequent extensions. In organization theory, the systems approach is one of the important paradigms. The father of general systems theory, Ludwig von Bertalanffy (1968), included organization theory in his selection of relevant disciplines.

Organization scholars showed a similar recognition of systems theory (e.g., Scott, 1963). In his representative selection of contemporary organization theory, James March (1965) included an extensive chapter on the systems view of organizations. The chapter's author argued that the power of systems theory for organization and management was beginning to be appreciated and that "informational systems" are one of the more important properties of an organization (Haberstroth, 1965: 1172, 1192).

Organization theory continued to build on the systems approach (e.g., Galbraith, 1973; Lawrence & Lorsch, 1967; Scott, 1981; Thompson, 1967). For years, attention has been directed toward the relationship between organization and environment and to so-called contingency approaches, which conceived organizations as open systems (Katz & Kahn, 1966). This research has had direct relevance and influence on the IS field. For example, Thompson (1967) introduced the concept of task interdependence that later became important for understanding IT-enabled coordination (Malone, et al., 1999). Some of the key organizational scholars, such as Herbert Simon and James March, used an "information processing" paradigm in explaining organizations (Starbuck, 2013). For instance, Galbraith (1973) based

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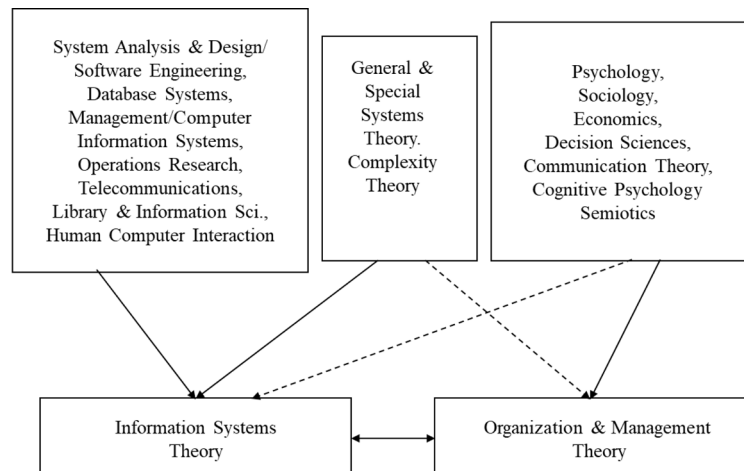
organizational designs upon variation in needs of reducing uncertainty via “information processing.” Simon (1957, 1957a) exemplified a group of researchers who have contributed both to organization and IS research. Approaching our time, organizational scholars have expressed even more interest in issues that are relevant for IS research. For instance, Karl Weick’s (1990) concept of technology as equivoque has modern IT framed in terms of stochastic and continuous processes and abstract events. This concept is still ontologically inspiring as modern IS keep increasing in technological complexity. More recent reviews of organization theory have demonstrated vivid interest in both technological and cognitive informing agents (Clegg et al., 1996).

IS scholars have been building their research directly on organization theory. In addition to the already mentioned examples, one should cite the decades-long sociotechnical research that blends the social and technical perspective with the inclusion of IT (Young, 2004). Another venue is characterized by focusing on specific organizational processes or aspects in conjunction with relevant IT and IS. Examples include decision making and systems for supporting decision making, computer mediated communication (Hiltz & Turoff, 1978; Rice et al., 1984; Sproul & Kiesler, 1991), group work and group support systems (e.g., Ciborra et al., 1996; Gallagher et al., 1990; Nunamaker et al., 1996/7), and organizational processes and structures in relation to enterprise resource planning (ERP) systems. Specific organizational views have been invoked as well, such as the structural and cultural. Particular organizational theories have also attracted attention of IS researchers, including transactions cost theory, resource dependence theory, and institutional theory.

The IS field has even demonstrated a competitive capability. For example, the structuration theory of sociologist Anthony Giddens was promptly adopted into the IS field (cf. Jones; 1999; Hatch, 1997). In addition, the IS field took a special interest in particular organizational topics. One is new organizational designs (forms). With the origin in organization theory (e.g., Burns & Stalker, 1961; Handy, 1989; Mintzberg, 1979), new organizational designs have been part of mainstream IS research since the 1980s. The compelling reason for this is that there is an umbilical cord between the new forms and the capabilities of modern IT in terms of task variety, geographical reach and speed (e.g., Heckscher & Donnellon, 1994;

Figure 11. Relationships between disciplinary fields

Note: The solid line represents a stronger relationship, and the dashed line a weaker relationship.



Morton, 1991; Sproul & Kiesler, 1991; Travica, 1999). A remarkable example in this regard is virtual organization design (Davidow & Malone, 1992; Mowshowitz, 1994, 2002; Travica, 1995).

Although the fields of organization theory and of IS are apparently related, the cross-pollination between them is still meager. For various reasons, an intra-disciplinary focus is the rule rather than the exception. The number of researchers that are well-grounded in both fields is still small, and evidence of the lack of exchanges between the two fields is abundant. Informing agents still play a smaller role in organizational research, in spite of the fact that the paradigmatic contemporary enterprise is data and knowledge intensive. The topic of e-commerce, which occupies so many IS researchers, is almost unknown among organizational scholars, as evidenced in their leading publishing outlets. IT itself is typically conceived as merely one of the “high technologies” rather than a pervasive technology. The line of studying organizational technology that connects Joan Woodward, James Thompson, Jay Galbraith, Charles Perrow and Karl Weick (see Hatch, 1997) may just partially be relevant to the digital IT of the present time. For example, it could be argued that different kinds of IT could fit into any of the familiar typologies of technology. If this is true, the typologies do not account for different kinds of IT. Given this abstract approach to technology, it is not surprising that organization theory, with rarer exceptions, does not differentiate between different kinds of IT. An implication is that the study of organization misses the aspects of informing agents.

The IS field in North America bears its part of the responsibility for a narrow bridge connecting it with organization theory. With the exception of a focus on the group context (in conjunction with group support systems) and the more recent interest in cultural and political aspects, the IS field has not been well-anchored in organization theory. Many authors have been preoccupied with describing capabilities of a trendy IT, inferring management implications of such IT, and correlating IT/IS aspects with liberally selected organizational dimensions. Similarly, cognition-focused research (e.g., study of information seeking) is usually focused on the individual who is either isolated or just loosely connected with some environment. Purely technical research influenced by applied computer science suffers even more from this problem of the de-contextualization of technology. As a result, IS research sometimes discovers just the ephemeral or the obvious. Moreover, most of the IS field keeps to traditionalistic philosophies of organization (functionalism, structural functionalism), while missing the opportunity to approach the social context of informing agents from other perspectives, including the interpretive and postmodern (Clegg, 1990; Clegg & Hardy, 1996; Hatch, 1997). Communicating over the narrow bridge appears to be unsatisfactory for both IS and organization theory. IVO intends to broaden the bridge.

GOALS OF IVO

In connection with the discussion in the previous section, one goal of IVO is to contribute to broadening the bridge between IS theory and organization theory. IVO is supposed to help organization theory to obtain insights into different types of IT and informing phenomena in organizations. From the perspective of the IS field, organizations are a natural habitat for IT and business data. Therefore, a broader opening toward organization theory may assist in obtaining a potentially broader theoretical horizon and academic relevance. Academic relevance should be balanced with the practical relevance, which may have been over emphasized in some segments of the IS field (see Hirschheim & Klein, 2003; Markus, 1999).

Another goal of IVO is to serve as a conceptual framework for explaining organizations. The concepts of groupomatics, infostructure, infoprocess and others provide a distinctive, holistic view of orga-

nization. IVO intends to equip students of IS with a systematic vocabulary on organizations as well as with special lenses. This theoretical goal is coupled with the next that is practical in character. Armed by ideas from IVO, managers and professionals in organizations are in a position to understand more deeply and broadly organizational issues, challenges, and problems. They should be able to understand what role informing agents play in organizational issues, challenges, and problems. This should enable managers and professionals to envision deploying informing agents toward materializing desired changes in organizations. In the arena of real-world IS, the IVO perspective renders every IS issue in a new light. Whether design, use or some other IS life cycle issue is concerned, one needs to pay close attention to infoprocesses, infopolitics, infoculture, and other IVO aspects that interface informing agents with a particular organization. The reasons are compelling. For example, by designing IS, one designs organization; by using IS, one creates and manipulates data, interacts with IT, and creates/recreate and sometimes modifies organization.

SUMMARY

The chapter began by introducing the fundamental assumption of IVO that cognitive and technological agents (that is, data, knowledge, meaning and wisdom, and IT) are central to understanding organizations. Theoretically, IVO brings together the IS field and organization theory, along with elements from cognitive psychology and other disciplines. The foundational assumption of IVO is new in organization theory, which typically takes an abstract approach to technology. Although the foundational assumption of IVO is a familiar one within the IS field, segments of the field take partial approaches, emphasizing either the IT or the “information” perspective. In this time of global uncertainty, both informing agents should be equally investigated as constituents of the nervous system characterizing intelligent organization.

The core concepts of IVO—informing agents and organization, were defined and their relationships discussed. While these concepts and relationships build on rich theoretical foundations, IVO introduces certain unorthodox slants. Philosophically broad-based, IVO encourages critical reexamination of entrenched concepts and models. One is the role of information in reducing uncertainty. The spiral of uncertainty introduced in the chapter implies that new data and knowledge play more complex roles in organization, including the diametrically opposite role of creating uncertainty. The scope of IVO and each of IVO aspects were introduced in turn—homo informaticus, groupomatics, infostructure, infoprocesses, infoculture, infopolitics and infoeconomics. Separate chapters will be dedicated to each of these.

The discussion continued by exploring the topic of Big Data, and in particular the possibilities of framing the customer in a more comprehensive way. A new, core topic of IS strategy was explored in continuation. Three approaches that have attracted scholars’ or practitioners’ attention were discussed and compared across – Blue Ocean Strategy, Theory of Disruptive Innovation, and Dynamic Capabilities Theory. Finally, the discussion looped back to the point made in the beginning of the chapter—the relationship between IS theory and organization theory. Elaboration of the general goals of IVO concluded the chapter.

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ENDNOTES

¹ Information technologies (IT) have not started with computer but with simple tools used for recording thoughts, facts, creative ideas, which is as old as humans. The need to manipulate and process data is constant, while relevant technologies come and go. Word processing software mounted on the personal computer is a popular technology for creating and recording textual data. But text has been created since the advent of letters. Ancient cultures did create their pictorial texts, using the technology available then—stone carving tools and surfaces of cave walls. Egyptians told stories by carving walls of Pharos’ tombs and made accounting records on papyrus. Later in history, text was handwritten with feathers and pigments; then primitive presses and the Guttenberg press, pencils, stylus, fountain ink pen, etc. The architects of old Greece and engineers of Leonardo da Vinci’s time drew by hand; ancient notaries maintained numerical data; and so on. People have organized and transformed data for thousands of years in various organizational contexts, before Alan Turing and John von Neumann developed their ideas that led to today’s computers. Data creation, storing, collection, organization, transfer and the like operations have been around as long as humans. IT progressed through many generations. In the future, IT will be different than the Turing-Neumann computing machine, computer.

² One cannot help but notice the recurring hype that most of the IS field attaches to each new kind of IT. As soon as software vendors release something new, professional conferences start ringing with new buzzwords, descriptions of new technologies and research plans. Not that these descriptions and research plans shine with depth. Still, showing up and expressing zeal for the “next big thing” or the “silver bullet” has become almost a professional norm in North America. While fuller consequences of current IT have not been grasped yet, a mass exodus to new terrains thus is unleashed. This IT hype is a form of academic vanity. However, in spite of the rush to embrace new kinds of IT, theorizing of IT remains rather scanty, even when the scantiness is recognized and critically evaluated (see Orlikowski & Iacono, 2001). Another undesirable consequence is that the rush to the new reduces time for research, obstructs the historical perspective, and blocks

deeper understanding of IT *and* information issues in organizations. The end consequence is that the quality of theory suffers.

Alternatives to the rush after the “next big thing” are possible: (1) focusing, on the longer run, on a certain type of IT/IS and the related information practices (e.g., communication IT/IS from the classical telephone, to email, text messaging, smart phone, social media); (2) following select technological trends corresponding to one’s focal organizational context (e.g., work groups, or a new organizational design); (3) following new technological trends from a certain research perspective (e.g., a certain theory or framework), and (4) following select technological trends from the perspective of certain information practice (e.g., planning, decision making, or knowledge codification).

³ Whether the IS field is about information or IT (indeed, electronic IT) is the controversy that has been reverberating in the IS field since its inception. Some authors phrase this question a bit differently, drawing the line of division between the allegiances to either the “I” or the “T” side in the acronym “IT.” But perhaps they tacitly admit that the field is, again, about IT, where one side focuses more on social aspects and the other on technical aspects of IT? Lynne Markus (1999) cited an episode with Peter Drucker, guru of management theory, who suggested that the problem of the IS field was in failing to realize that it have been about information. Markus commented that the word “information” was inadequate since it connoted neither “communication” nor technical issues that affect the quality of business information (*ibid.*, pp. 200-201). The IVO-based answer to the controversy is: the IS field is about both informing agents.

⁴ The term “information” has penetrated the everyday talk and professional lingo to the extent that many people cannot even express themselves without invoking it. The pervasive info-speak resembles an infomantra (Travica, 2011). “Information” is “requested, provided, stored, searched, sent,” and so on. The users of IS and the Internet are regularly prompted to “get more information.” “Information” is stamped all over the IS menus and the Web. All this is done typically with no apparent reason, except for taking linguistic shortcuts by the informers. The term “data” also appears in conjunction with “information.” But when it does, it is usually opaque how the informer differentiates the two terms. Consider this example: a secretary sends an email to employees with the subject line entitled “Examination Data Information Required.”

This infomantra has historical roots. In particular areas of human conduct, the term “information” was an indispensable label for a special content. Examples are espionage and police investigation. But note that this was a genre-based use of “information” rather than today’s blanket use. Journalistic content was still called “news,” the tracking of sales operations “sales figures,” people asked “questions” and would get “answers.” Today, “information” replaces all these specific genre labels. There are methods for avoiding the common confusion between data and meaning. First, one can label the given content by precise descriptors, such as description, instruction, explanation, report, news, guide, manual, files, database record. This method also eliminates uncertainty regarding the referenced content. Second, in the case of complex content, one can use the term “details”; the mentioned secretary could have asked simply for “examination details.” And third, the term “information” can be left out of the most phrases circulated in the public discourse (e.g., the ubiquitous phrase “for more information” can be replaced by “for more” or “to learn more”). This method also simplifies the language: there is no need for the phrase “information about” since the referencing becomes direct (e.g., a menu item “Information about customers” becomes “Customers”). If nothing else, refraining from the infomantra would save the space on cramped digital displays.

Chapter 2

Homo Informaticus

ABSTRACT

This chapter discusses the concept of homo informaticus—the individual organization member that performs complex cognitive processes, engages in decision making and satisfying of informing needs, and designs and evaluates information systems. Discussed are cognitive processes of thinking, feeling, perceiving, memorizing/memory recalling, and learning. These cognitive processes are involved in the fundamental informing process that starts with perception of external data, continues with applying knowledge to data, and ends with inferring information (meaning). Homo informaticus is typified based on Karl Jung’s psychology and Kolb’s learning styles. The discussion also addresses cognitive limitations. Memory is limited in volume and content, perception is prone to illusions, and thinking is susceptible to biases. These limitations influence the outcomes of informing, learning, and decision making.

INTRODUCTION

Organizations start with individuals. In the context of IS, individuals are usually called “users.” The entity which is used may imply IS as a whole, its modules, IT, or system outputs. There is a connotation of passiveness to the term “user,” as if people are merely given things to use without a possibility of active involvement. IVO takes a broader approach to individuals, putting an emphasis on their active and creative sides. They are assumed to have capabilities of cognitive agency, actively perform various cognitive processes, creating information and knowledge, making decisions, and influencing shape and destiny of IS. These capabilities are implied in the notion of homo informaticus. This concept builds on cognitive theory, IS adoption research, decision making theory, socio-technical approach and some more recent streams of research, such as social informatics, informing science, and structurational theory¹.

Homo informaticus represents a cognitive microcosm that consists of several cognitive processes and corresponding cognitive states. These are: perceiving (percept), memorizing (memory), thinking (thought), feeling (emotion), and learning (meaning, knowledge). Studied in cognitive psychology, in IVO these are conceived as cognitive infoprocesses. Hence, this discussion on homo informaticus is complementary to the discussion on infoprocesses at the organizational level, which has its own chapter.

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This chapter will start with a discussion on cognitive processes and artifacts, combining the perspective of cognitive informing agents with insights from cognitive psychology. Limitations of homo informaticus will also be addressed. Homo informaticus as decision maker and subject of informing needs and related seeking processes will be explored in turn. This will be followed by examining the capabilities of system evaluation and design, which extend the portrayal of homo informaticus.

HOMO INFORMATICUS AND COGNITIVE INFOPROCESSES

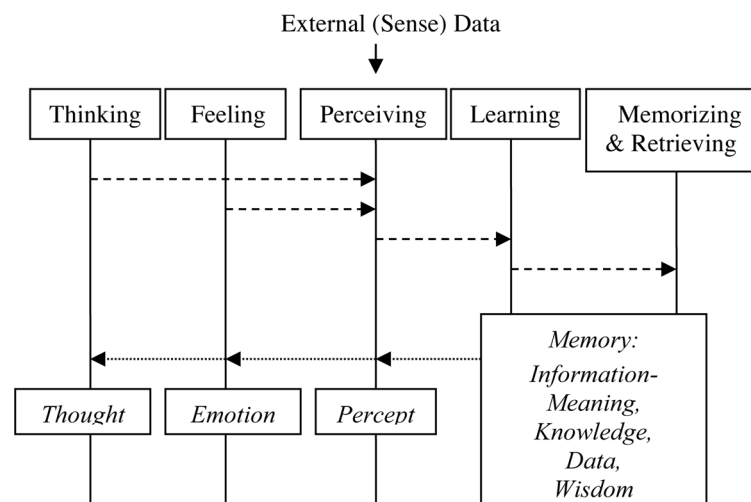
Homo informaticus is the subject that performs high level cognitive processes. These are represented in Figure 1. The model depicts main cognitive processes of thinking, feeling, perception, learning, and memorizing as well as their corresponding states or structures signified in italics (thought, emotion, percept, and memory).

The central idea in the model is the relationships between cognitive processes and between them and cognitive structures. One should not infer that the relationships are linear. For example, the process of perceiving that is initiated by external data can be assisted by feeling and then by thinking, or thinking and then feeling. It may also happen that the process of feeling dominates the perception process, pre-empting room for thinking; e.g., an existentially grave situation can trigger an overwhelming emotion of fear, which further influences the perception process. Learning compounds some combination of other cognitive processes and structures, such as perceiving, retrieving of memory for previous knowledge, and thinking.

Thinking

The thinking process (reasoning) refers to various intellectual activities, such as analyzing, synthesizing, inducing, and deducing. It uses perception and memory, and complements learning (Figure 1). The

Figure 1. Cognitive processes and states



thinking process is based on memorized (known, learned) formal methods and can use emotions (feelings) as well (see on Jung's concept of perception below). The coupling of thinking and learning leads finally to knowledge. When thinking results in making an optimal judgment in a given situation bearing an unstructured problem, we talk about wisdom.

The thinking process underlies a broad domain of purposive cognitive processes, such as formal and everyday reasoning, decision making/problem solving, planning, knowledge production, and so on. Apparently, there are overlaps between these process categories (e.g., decision making and formal reasoning). Thinking can reproduce existing knowledge (e.g., thinking based on using learned logic and logical or some other formal methods of thinking, or production rules) or it can produce new knowledge (via analysis, synthesis, inferring, and other thinking processes). The latter instance here is referred to as "learning." For our purposes, the discussion will be limited to decision making.

Figure 1 indicates that the results of cognitive processes can be conceived as states through which cognition is moved by the work of these processes. For instance, meaning changes, and so do percepts, emotions and thoughts. The results of cognitive processes can also be conceived in terms of structures of memory, perception, etc. The represented structure of memory reflects assumptions behind the IVO framework. The model of cognitive processes and states in Figure 1 implies that knowledge drives perception inasmuch as it does external stimuli (data). Knowing that a running train popularized in early films will not jump out of the screen keeps a child calm. But again, these relationships need not be linear and sequential. Memorized knowledge can drive thinking of a problem that has also been stored in memory, so that percepts and emotions are not involved. The following discussion will expand the examination of the cognitive makeup of homo informaticus.

Limitations in Thinking

Cognitive and decision making research identified limitations that apply to thinking processes. Part of this research is known under the rubric of cognitive heuristics and biases. These particularly limit the economic rationality of homo informaticus and seem to be persistent (Bazerman, 1994). Significant contributions to conceptualizing heuristics came from Daniel Kahneman and Amos Tversky. The discussion will concentrate on the heuristics shown in Table 1.

Heuristics can be understood as cognitive shortcuts that people commonly make, where cognitive processes unfold in an almost automatic fashion, without much thinking. Heuristics lead to biases—systematic variation from the objective state of matter that translates into inaccurate conclusions. That is why terms "heuristic" and "bias" are used interchangeably. One important heuristic is *representativeness*. According to Kahneman and Tversky (1973), *representativeness* refers to the tendency to make judgments (conclusions, decisions) on the basis of the extent to which the salient features of an object or person are similar to the features thought to be characteristic of some category. Part of the process of this categorizing bias is that other relevant and available data (the base rate) which could lead to a more accurate judgment is neglected. Kahneman and Tversky (1972) call this *insensitivity to base rates*, a bias tied into the representativeness bias. For example, one or two instances of negative experience with an IS that a novice user gathers from experienced users may lead the user to undervalue the quality of the system even when knowing that the official statistic puts user satisfaction high.

In making the negative assessment, instances of negative experiences with an extremely small frequency are taken to be representative of the system users. The novice user, thus, focuses on the meaning that stands out, that is more salient by the virtue of coming from experienced colleagues, while neglecting

Table 1. Some cognitive heuristics

Heuristic	Description
Representativeness	The tendency to base conclusions on an object's perceived similarity to the features assumed to be characteristic of some category.
Insensitivity to Base Rate	The tendency to neglect relevant, available data; related to representativeness.
Availability	The tendency to make a judgment about frequency or causes to an event on the basis of already available memory on such event.
Confirmation Trap	The tendency to seek only data/knowledge that confirms what one already believes is true.
Anchoring and adjustment	The tendency to be mentally anchored in a historical precedent or some opinion and to adjust thinking to that anchor.
Easy Recall/Presumed Associations	Believing that the events or associations that can be easily recalled from memory do happen more frequently than those less easily recalled.
Overconfidence	Answering questions that are moderately to extremely difficult.
Framing	Packaging data content to elicit an expected response.
Hindsight Bias	Overestimating the probability of predicting a known outcome

objective statistics. Mass media (e.g., television) can exploit this heuristic in order to make a case for a particular agenda by plastically portraying certain events or features that in effect lead the audience to categorize the events/features in a certain way (e.g., by using the good vs. bad guys stereotype). The process of indoctrination into organizational culture may follow the same logic. For example, exposing new organizational members to opinion leaders that emphasize only advantages of sharing knowledge could make the members believe that this practice is the “way things are around here,” whereas this is just a goal to be accomplished and there exists evidence on failures and on disadvantages of sharing knowledge from the individual perspective. The opposite can be true as well: making disadvantages of knowledge sharing salient can blind people to the attested advantages of it.

Another frequent heuristics is *availability*, which refers to one's making a judgment about the frequency or causes of an event based on one's previous knowledge of that event. For example, once one experiences a failure of IT for presentation at an important presentation event, one may become mistrustful regarding the reliability of presentation technology. In other words, one becomes prejudiced, or develops knowledge (imagery, mental model) that renders the concerned technology in a negative light. The availability bias indicates the inhibiting power of previous knowledge, and it may be a sag-way to conservativeness in perception and thinking.

Cognition appears to be affected by yet another bias that could be emerging from the same source and also resulting in conservatism. Often, one seeks only the evidence or knowledge that confirms what one already believes is true. In effect, disturbing inputs are filtered out. This is called *confirmation trap* (Wason, 1960). Confirmation trap implies that the previous knowledge (e.g., initial schema or mental model) about the truth value of some knowledge has a much chance of being reinforced. Thus, in seeking data about customer trends, the companies in the examples above may have filtered out the data that would speak against continuing with what they were familiar with or the data favoring different, new products. Confirmation trap and availability heuristics in combination may blind decision makers in predicting the prospective demand for current products or the changes in customer needs.

Conservatism that prevents us from making more accurate conclusions feeds on yet another source that is called *anchoring and adjustment* (Tversky & Kahneman, 1974). This heuristic accounts for the fact

that people can be mentally anchored in a historical precedent on which basis they adjust their present decisions. For example, accounting systems can be anchored in a certain historical value that becomes the basis for later calculations; consequently, all the decisions based on such accounting anchor are adjusted to it. This bias may influence decisions about IT spending driving it either in the restrictive or aggrandizing direction. If stable over time, this bias becomes an aspect of infoculture at the department, occupational group, or organizational level. For example, a historical failure in system acceptance may become a precedent that future acceptance situations do anchor in.

The discussion above shows that the conservative or *preferred choice* decision making feeds on multiple shortcuts commonly used in thinking (anchoring and adjustment, confirmation trap, and availability). Examples abound. In the past, IBM failed to predict sales for revolutionary computer product the company invented—the mainframe, PC, and the midrange computer. Xerox failed to commercialize a number of innovations made by its researchers (the graphical user interface being a salient example). For decades a formidable competitor in the mid-range computer market, Digital Computer Corporation (DEC) turned unable to think beyond its established product philosophy and was acquired by Compaq in 1998.

Another common bias is *easy recall*. It happens when one believes that the events elicited easily from memory do happen more frequently than those less easily recalled, even though both kinds of events occur with the same frequency. Easily recallable events are those that are more vivid in memory. Easy recall has also to do with the bias of *presumed associations*: one tends to estimate if certain events will co-occur relying on the number of similar associations that are easily recalled (Chapman, 1967).

Decision makers can show *overconfidence* in answering questions that are moderately to extremely difficult (Alpert & Raiffa, 1969). Here belong less structured situations and predictions. This bias is counter-intuitive as common sense would be to be more confident in dealing with easier questions. Moreover, individuals can also be drawn to an erroneous path of reasoning owing to the way a question is formulated or framed. For example, the framing can emphasize less relevant details that obscure the relevant ones. This is *framing bias* (Kahneman & Tversky, 1979). Instances are “tricky questions” that are infamous among students, questioning strategies used by lawyers or investigation authorities, and shaping of messages in public relations, marketing, and management domains. For example, a course of action a manager wishes to promote may be framed in a language of benefits, while an unwanted alternative may be framed in cost emphases.

After the war, everyone is a general. It is common to pretend competence when an outcome is known and the risk of erring is gone. This is the *hindsight* bias (Fischhoff & Beyth, 1975). More formally stated, once one knows outcomes of some development, one tends to overestimate the probability with which one could have predicted the. This bias may explain in part intuitive or *guts-based* decision making, particularly in instances when decision outcomes are beneficial (it is reasonable to assume that in such situations decision makers are more likely to relate decisions to their guts). There is also a whole host of errors we make by being ignorant or negligent of statistical reasoning. For example, the sampling fallacy (jumping to a conclusion based on a small sample one is exposed to), or the gambler’s fallacy (if the black turns out repeatedly, a roulette gambler may conclude that the red gets a higher than 50% probability to occur).

Training can reduce heuristics and biases. IS could possibly help as well, although software developers have so far shown a lack of interest in this sort of challenge. However, heuristics are resilient. We almost inevitably jump to quick conclusions as that seems to be a more natural way of cognizing. Consider the question: if a PC (the central unit and monitor) costs \$1200, and the central unit is \$1000 more expen-

sive than the monitor, how much does the monitor cost? If your answer is \$200, you are wrong, as most people would be. The correct answer is \$100 and it follows from a simple equation $1200 = (x + 1000) + x$, where x is the monitor price. But most people would not bother to use the equation in thinking. Rather, they would resort to quick math of subtracting the two numbers. Taking a path of least resistance as part of cognitive economy would also prevent most people from testing mentally the quick answer (if the monitors cost \$200, then the central unit costs \$1200, and the total price is, incorrectly, \$1400).

In 2002, Kahneman received the Nobel Prize for the work on heuristics, after Tversky's death. Reflecting on the past research, Kahneman (2002) proposed heuristics could be explained by modeling human cognition as two related systems. System 1 refers to perception and intuition and it is characterized by automatic, associative and fast processes (among others). System 2 refers to reasoning (conscious thinking) and it is characterized by controlled, rule-governed and slow processes (intentional application of production rules). The efficacy of System 2 is impaired by time pressure, concurrent involvement in a different cognitive task, performing the task at an inappropriate time of day (which is the evening for "morning people," and the morning for "evening people"), and (surprisingly) by being in a good mood. Conversely, the facility of System 2 is positively correlated with intelligence, a "need for cognition," and with exposure to statistical thinking. An important impact of heuristics/biases is discussed in the section on decision making.

Perceiving and Percept

The discussion on perception can start with realizing that "What I see is not what you see." Thus, perception is a source of individual differences. Perception refers to the process by which the stimuli of external data are gathered, processed, and interpreted (see Levine & Shefner, 1981). Thus, perception starts with stimuli and engages internal cognitive processes as our model in Figure 1 indicates. These complementing parts are sometimes referred to as bottom-up and top-down processes (Eysenck and Keane, 1995, pp. 80-81). In other words, perception is a process of gathering and organizing sense data and attributing a meaning to it. For example, seeing a computer screen will stimulate retrieval of the relevant previous knowledge and result in recognizing a particular computer screen. Even if the screen is of a type the observer is not familiar with, a combination of details viewed (e.g., the screen content) and the previous knowledge (e.g., of the typical contents of computer screens and perhaps of screen shapes) can help complete the perception process.

Perception works with different forms of external data—visual, audio, tactile, and olfactory. Data are human artifacts created for the purpose of communication—letters, numbers, images, tones. They have a character of symbols since they stand for something else—voices, quantities, objects, and sounds. Whichever data trigger the perception process, it engages background knowledge. We can construct a meaningful sentence from partial data (a capability pragmatically turned into a testing method in some countries albeit with a dubious educational merit). We can also venture into unknown areas of knowledge and still make some sense (grasp an elementary meaning) of it. All these examples of generating information from unfamiliar sense or symbolic data are possible because perception goes beyond senses and relies on our previous knowledge (schema, mental imagery, etc.).

Visual perception is particularly important because it is instrumental to a natural, pervasive way of knowing about the individual's environment, including the one charted by IS. While we take the perceiving process for granted (e.g., recognizing objects in a complex physical environment), this process indeed involves a complex brainwork that we have just begun to understand. A useful way of studying perception

is by using the concept of affordances developed by Gibson (1979) and adjusted by Eysenck and Keane (1995). Upon studying vision of military pilots, Gibson noticed that pilots share certain visual percepts (e.g., the point toward which a pilot is moving appears immovable, while the rest of the environment is moving). His detailed investigations led him to conclude that the common percepts are invariant across all individuals or within groups in any context. He posited that it is the physical objects themselves that are decisive in “affording” these shared percepts or meanings or “affordances” in his vocabulary (e.g., an orange “affords” the meaning on an edible object, unless it interacts with an angry person who may consider it a projectile—still a typical meaning within the group of angry persons). Gibson’s research advanced understanding of visual perception of the subject interacting with the environment (object). He gave primacy to the object and to bottom-up processes in the creation of meaning, assuming that people in the certain context (e.g., a national culture) share same visual capabilities. Eysenck and Keane (1995) noted that the value of this research is in demonstrating that the object elicits more information than it had been previously assumed.

Previous knowledge (top-down processing) has a role in perceiving as well. While Gibson gave it a limited role by recognizing impacts of culture on the formation of meaning, other researchers advanced this assumption. For example, any lost fisherman can see the North Star on the clear night sky, but not every fisherman may know that it is the North Star (see Eysenck and Keane, *ibid.*). To realize this, one must have appropriate previous knowledge, and this knowledge can make a life-saving difference on the sea. Eysenck and Keane (*ibid.*) also posit that the roles of visual sense stimuli and of knowledge depend on environmental conditions: the better the visibility, the less needed is top-down processing, and vice versa. Eysenck and Keane’s (1995) argument represents an extension of Gibson’s (1979) concept of affordances, which is relevant for IVO.

In IS research, a stream of literature inspired by the affordance idea is getting a traction. For example, Leonardi (2013) described how shared affordances facilitate adoption of technology within a group of users.

The perception process is of a crucial importance for learning or knowledge development. Take observation of physical environment as an example. If assigned to a help desk, a careful listener and astute observer can learn much about user capabilities and limitations, which can help him to effectively assist the users. In sciences, methodologically conducted observation engenders scientific knowledge. Empirical traditions in social and physical science concur around this principle. Galileo’s experiments with balls rolled down inclined planes from a leaning tower in Pisa resulted in visually-based percepts that undermined centuries-old Aristotle’s theory of gravitation. Similarly, today we lay much creed in percepts of user behavior, which we develop in usability testing and other methods utilizing direct observation.

Limitations of Perception

Perception has limitations affecting the homo informaticus. Since perception interacts with previous knowledge, individual differences in the knowledge background can elicit different information out of the same external data. The standardization of knowledge that professional bodies are preoccupied with aims at reducing this source of perceptual variation. In addition, it is questionable if visual data are invariant across individuals, as there can be individual differences in the construction of the visual apparatus. While letters expressed put in font types are uniformly recognized by different individuals, this is less likely to happen with colors or sounds. Moreover, percepts that go into a rubric of “visual deceptions” seem to be shared by all people. Gestalt psychologists discovered that people may “see” beyond facts

and in violation of them. In Figure 2a, we may see a straight and a curved line crossed, even if these are intended to be two distinct shapes that touch in one point; Figure 2b looks like a square with rounded corners, although the top line is not closed”; the attachments to the lines in 2c and 2d inform of unequal line lengths, which is false and the same error is caused by positioning of the lines in 2e.

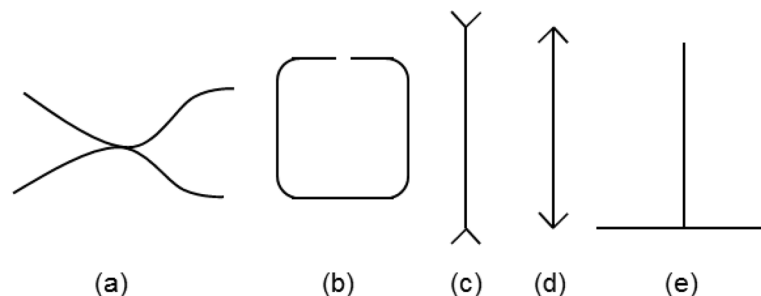
Gestalt psychologists explained these erroneous percepts by theorizing on principles that drive perception, such as simplicity, closure, similarity, symmetry, etc. If so and these principles are learned, then our knowledge counters sense data, which is an example of how we “filter” data according to pre-conceptions. It could also be that biological characteristics of our vision impose perceptual limitations. From the perspective of IS design, perceptual limitations call for attention. For example, graphical screen items that can invoke these illusions may need to be complemented with appropriate textual data, which would leave no space for variation in meaning.

Memorizing and Memory

In cognitive psychology, memory has been conceptualized in terms of processes and structure and studied in conjunction with learning and knowledge (Eysenck and Keane, 1995: 123). In the parlance of cognitive psychology, memory processes or memorizing mirror those implemented in computer: encoding, storing, and retrieving. As structure, memory has been conceptualized in terms of “stores,” usually differentiated on the basis of longevity as short and long-term memory. The computer analogy is again apparent. However, it is interesting that this conception of memory has early origins in James’ (1890) psychology, which predates both computers and cognitive psychology. To be put in use, a memorized content has to be retrieved. Memory retrieval can also be indicative of memory characteristics. Consequently, memory retrieval is a process studied in connection with memorizing.

Memory has been differentiated into short-term, long-term, and working memory. Further, some authors theorize that working memory incorporates a “central executive,” which is assumed to manage the workings of a store for auditory data (a phonological loop) and a store for visual data (a visio-spatial sketchpad, or even two different stores—one for visual patterns recognition, and another for specialized for movement). This differentiation has been made in an attempt to explain the phenomenon of interference. For example, we can hear as long as another sound source does not interfere and start competing for the same phonological loop. In contrast, we can hear a single source of sound and see something clearly at the same time. This is explained by the work of a central executive, which is assumed to handle communication between the stores and between the stores and long-term memory. Implications for user

Figure 2. Visual deceptions



design of interface in ISes are apparent: If a user is exposed, say, to both static text and animated text on the same Web page, this can be confusing. Exposed to such poor design, the user would have switch attention between the two modes of text.

Two kinds of memories have been hypothesized to exist in relation to the process of memory retrieval. One is *explicit memory*—a memory which a person is able to consciously remember and report, and the other is *implicit*—a memory that a person is not aware of. Implicit memory appears to be longer lasting and may depend on automatic processes, responding to the general level of activation of a memory trace and its basic perceptual features. Explicit memory lasts a shorter amount of time and seems to be dependent on controlled effortful processes, making use of associative or contextual inter-item connections. These types of memory could be in connection with retrieval processes of visual memory (knowledge). One is the process of *familiarity*, an example of which being our capability to easily recognize a certain face in a crowd. The other retrieval process is termed *recollection*. An example is the process of recalling identity of a familiar face we encounter in a context different from the one with which we regularly associate that face. Memory retrieval by recollection could be related to explicit memory, while retrieval by familiarity could be related to implicit memory. (See Groome et al., 1999: 125-127; cf. Eysenck & Keane, 1995: 167-169.)

The implicit-explicit dichotomy resembles the distinction between tacit and explicit knowledge, which is popular in both IS and organization research. Given the effectiveness of work performance that tacit knowledge and automatic retrieval can facilitate, it would be useful to know how these relate to IS use, upgrading of professional knowledge, and dynamics of infoculture. For example, it can be hypothesized that implicit/tacit knowledge could facilitate the use of IS and progress in knowledge (professional or cultural). Conversely, the same knowledge might block assimilation of new, significantly different knowledge.

Retrieval of verbal memory (knowledge) can take the form of recognition (simpler concept matching) or of recall (more complex knowledge). It is also interesting that the way memory is encoded (created) may influence the way it is retrieved. In general, the more the cognitive work is performed at the point of encoding, the better the recall is likely to be. This may imply that the learners should not rely on a single informing mode (e.g., students can learn more if they take notes rather than just listen; and programmers could track better their flow of work by recording salient details they come across). The section of learning will expand on this topic.

Knowledge

Knowledge is a part of the content of the long-term memory (Figure 1). Some authors do not differentiate clearly between knowledge and memory, and discussing knowledge in the context of memory can often makes sense, as it has been done in describing implicit and explicit memory above. Categorizations of knowledge are not lacking, as Figure 3 shows. One distinction has been made between declarative and procedural knowledge in order to capture differences between what-knowledge (definitions, facts, and more complex knowledge structures) and how-to knowledge (knowledge of procedures, tasks, and motor skills; special kinds of procedural knowledge can be the knowledge of acquiring knowledge /learning and the knowledge of conveying knowledge/teaching). Another distinction captures visual vs. verbal knowledge. Also, knowledge of episodes of personal experience is differentiated from general knowledge.

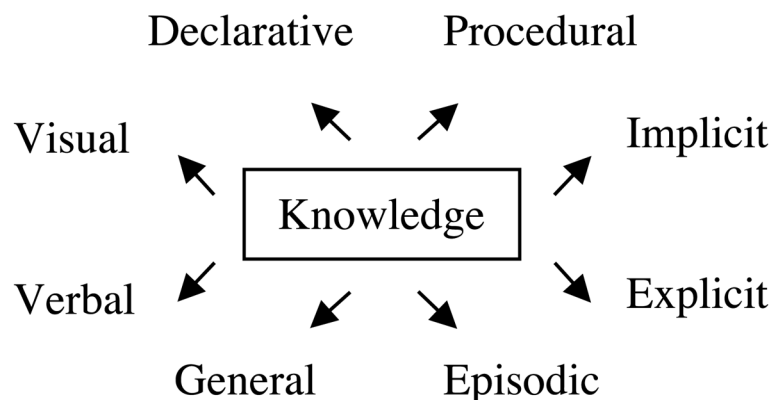
Another taxonomy differentiates between implicit and explicit knowledge. Researchers of education add to cognitive theory by asserting that it is not only important to know what and how-to, but also when-

and-why to-use declarative and procedural knowledge (Bruning et al., 2011). This category is called *conditional knowledge*, and it extends the declarative-procedural pair into a triad. Knowledge of when and with what goals to use other knowledge makes sense from the point of communicating knowledge, although it could be argued that it synthesizes other sorts of knowledge rather than being a separate category (e.g., production rules and tacit knowledge appear to be directly involved—see below). The categories of knowledge depicted in Figure 3 present various angles from which complex knowledge phenomena can be observed. Some are further broken down on specific kinds of knowledge, and some of these kinds can be placed in more than one category. We will look at some of the kinds of knowledge that are more relevant for this discussion.

Schema refers to a well-integrated chunk of knowledge about the world, events people, and actions (Schank and Abelson, 1997; see Eysenck & Keane, 1995: 320). Schemata are what colloquially are known as “previous knowledge.” Schemata comes in forms of scripts—knowledge about chained events and their consequences or procedures. Therefore, it is also a sort of procedural knowledge (e.g., user instructions for an IS). The other form of schemata is frames—knowledge about properties of objects and locations. Frames correspond to declarative knowledge (e.g., knowledge of a system’s architecture). A schema is important because it drives perception, thinking, and learning/memorizing—the cognitive informing processes. In other words, this knowledge works as an enabler of learning and as a filter for percepts and memory. Schema engenders a potent cognitive capability that enables an expert to quickly sort out irrelevant data in a problem solving situation.

Concepts and propositions are considered to be elemental building blocks of declarative knowledge (e.g., a concept of computer may include a mental image of a PC monitor and keyboard, and a proposition may be the statement “computer consists of software and hardware”). Scientific knowledge can be represented in the form of elaborate concept maps/networks. Concepts and propositions engender meaning of new data. Production rules are a particularly interesting kind of knowledge. They capture relationships between concepts that enable action, such as problem solving. Production rules take form of verbal if-then statements (e.g., if a computer displays incorrect time, then its internal battery may be failing). These statements are not to be confused with the if-then statements used in computer programming for controlling the flow of processing. Undoubtedly, sizeable parts of scientific knowledge can be stated in if-then rules, since the “if” clause can be a cause and the “then” clause is the effect. Experiential knowledge that has no validity of universal cause-effect relationships but still “works” under certain

Figure 3. Taxonomies of knowledge



circumstances is particularly susceptible to propositional statements. Production rules are the basis of expert systems. In reality, one can learn production rules and be optimally adaptive and effective in a certain environment by following the rules, although the rules could make no much sense. This applies to learning how to use an IS, perform some task, fit in an organization's culture, or do almost anything else based on this pragmatic, actionable knowledge. Therefore, production rules underpin much of procedural knowledge. Production rules can also be seen as an explication of implicit (tacit) knowledge of an expert.

Mental image is an analogical pictorial representation of external objects and their relationships (Shepard, 1980; Kosslyn, 1980). The image of computer mentioned above helps recognize different instances of physical computers and infer what things are not computer. Similarly to mental images, mental models are visual, analogical representations in memory. However, mental image can vary with interest and objectives of a person (Bara, 1995). For example, a user can conceive a computer as a compound of monitor and keyboard, while a programmer can visualize it as programming statements. The flow of experience can also make a difference. In the study of a human resources management system discussed later in this book, a user described a system as a "new animal" that is "running me around like a yo-yo." This conveyed a different image than this person's recall that an older comparable system "was the easiest system in the world to work with." Therefore, mental models abstract some characteristics of the known object and they change over time.

All mental imagery is subjective, based on incomplete knowledge/data and is unlikely to be objectively fully accurate. Still, it can affect various IS aspects. Apparently, "a new animal running the user around like a yo-yo" is not an image that facilitates system adoption. Visual knowledge and the thinking processes based on it may be in connection with the notion of "visual person" as opposed to text- or number-focused persons. Although more common sense than science, the notion of visual person may be useful in a pragmatic approach to computer instruction.

Information-Meaning

Information or meaning also resides in the memory. It is either implicit or not addressed in cognitive theory (perhaps because it cannot be computer simulated). In study of information, Dillon (2000) made a connection between concepts of meaning and knowledge in his concept of *information shape*. He also tested the concept in experimental psychological research. Information shape refers to spatial and semantic properties that convey coherence and which users can exploit both semantically and physically to gather meaning. For example, a user that navigates through electronic text displayed on the computer screen may be able to know where she is, based on both semantic clues (the meaning of the therein placed discussion) and location clues (e.g., the heading of a section and words found). In navigation based on meaning, experts are more effective than non-experts; the latter ones need more of location cues. Previous knowledge makes a difference in creating meaning that aids navigation. Combining both of these navigation clues albeit in different proportions seems to give optimal solutions. The concept of information space implies a notion of genre—a typified user interface, such as a display of scientific article or a Web home page.

Dillon (2000) has posited that the concept of information shape could improve design of user interface. Usual approaches to designing navigation have relied on a journey metaphor. Various features in user interface, such as landmarks, pop-up windows and maps are supposed to help the user to locate a desired content. Relying on these navigational clues represents an instance of bottom-up processing. Dillon argues that top-down processing may also play a navigational role. Information shape invokes this

by focusing on semantic aspects of the navigated environment. Indeed, the goal of users is not merely to arrive at a certain location but to assimilate information (meaning) into their own knowledge structures, which is an activity that extends beyond processing the layout of computer screens, contends the author. There is an implication to knowledge management in this modeling. The meaning grasped facilitates learning (knowledge creation), and, thus, systems metamorphose from being data access technology to knowledge technology.

The theory of semantics differentiates between the denotative and connotative meaning: the former refers directly to the object itself, while the latter refers to objects that can be associated with the primary object. For example, a denotative meaning of an accounting IS can refer to a set of data that reflect a company's assets and transactions, while the connotative meaning can refer to concepts of rationality, control, legality, fundamentals, and the like. No matter how hard organization people try to be "precise" in thought and speech, connotations creep in unconsciously since they are a natural part of making sense of the world. Denotative and connotative meanings are related, but rather in an indeterminate way. There may be no sequential or hierarchical relationships between the two; connotations can be richer and more colorful (imagery-based) than denotations; the subjective factor can paint differing connotative meanings of a single object and engender potentially an indefinite array of them. Learning connotative meanings that refer to an organization's self is what makes a big part of cultural indoctrination. Another term for connotative meaning is "symbol." An accounting IS *symbolizes* rationality, control, etc. In organization theory, Czarniawska-Joerges (1992) made the topic of organization symbolism a distinct line of research. The discussion will return to the topic of connotative meaning or symbols in the examination of infopower.

Limitations of Memory and Knowledge

Short-term working memory has a limited capacity and long-term memory is subject to forgetting. As for knowledge, while it is both a personal and organizational asset, knowledge can become a burden. In extreme, a dogmatic personality emerges, which holds to old opinions regardless of stimuli from the environment. Consequences of this conservative character of previous knowledge have been investigated in the management literature. Narrow vision, narrow framework, myopic vision and other terms are used to signify deleterious consequences of dominant schemas (Walsh, 1995). Generally, schemas become a burden when they make a person incapable of dealing with external reality. Walsh points out that Ashby's (1956) law of requisite variety is violated, as the internal diversity of a self-regulating system fails to match the diversity of its environment.

The level of internal diversity of knowledge has been studied from the perspective of differentiation (the scope of dimensions within a knowledge structure) and integration (the degree of interconnectedness among dimension in a knowledge structure). Some of the findings are that job aspiration, job involvement, hierarchical position, and experience correlate with differentiation and/or integration usually in ill-structured tasks. Messages for the management of IS are clear. Our frames can make us blind for changes in professional and technological knowledge, and our scripts of organizational processes can make us resist a process change introduced by a new IS. Consequently, strategies of IS adoption need to account for individual schemas that may have the ultimate source in organizational culture. Another message concerns data design of systems for supporting ill-structured decision making: these systems need to be capable to bring in more varied perspectives including conflicting ones rather than catering to the users' schemata.

Feeling and Emotions

The process of feeling and emotions resulting from it are the last part of the cognitive makeup of homo informaticus (Figure 1). Emotions constitute “the motor behind our life, the prime reason for our being, the compass directing group primary choices, the thermometer indicating the degree of our happiness with our surroundings and with how we are facing existence” (Bara, 1995: 251). This importance of emotions is contradicted with the insufficient attention that feeling and emotions have enjoyed in cognitive and particularly in IS research. A reason for the discouragement of researchers could be in the fact that emotions occupy a special place in the architecture of the mind, lying at intersection of cognitive, biological, and social domains (Bara, *ibid.*).

In the roots of understanding feeling and emotion lies a controversy that stretches to date: are these phenomena biological or cognitive? James (1884) argued that perception of an excitatory event triggers biological reactions that constitute emotions. Hence, something threatening in the environment causes particular organic reactions in the perceiver, which only in succession are perceived as fear. Cannon (1927) challenged this position and argued that emotion is a mental state and cannot be reduced to organic dimensions. A threatening stimulus is first perceived as fear, which can, then, trigger biological effects. Contrary to James’s argument that we first run and then realize fear, Cannon posited that the fleeing behavior is a consequence of fear. Schacter and Singer (1962) attempted to reconcile the two positions in their dual factor theory. The researchers found that both cognition and physiology explain feeling and emotion. They also acknowledged workings of a social factor that, in a group context and under certain circumstances, influences the perception of emotion.

There may be basic emotions (primitives) that are common to all people in all age groups, such as fear, anger, happiness, sadness, surprise, and disgust. Which stimulus causes a particular emotion depends on personalities, cultures, and other factors. The basic emotions are distinguishable in terms of their biological aspects. This re-validates a part of James’ (1884) argument (see Bara, *ibid.*: 254). Other emotions are based on the primitive ones and are also shaped by other psychological factors (e.g., one’s ego and previous experience) and social factors (e.g., culture and communication). Thus, love, hate, pride, shame, regret, loyalty, and egotism, are some of often discussed complex emotions. The counter-position denies innate basic emotions (Mandler, 1984). These are proponents of a componential theory, according to which each emotion is conceived to be a specific mix of cognitive and physiological components. Central analytical concepts are *appraisal process* (a cognitive process of constructing emotions) and *arousal* (a physiological component).

Feeling is one way of knowing the world (either the outer or inner), as it is confirmed in taxonomies of cognitive types discussed in this section. It complements knowing that is based on logical thinking. The process of feeling also complements human communication as in facial expressions of emotions. These are typical for babies but can appear in any situation when the vocabulary for articulating thoughts is insufficient, as may be the case with novice users of an IS.

Feeling and emotions are understudied in the IS field. Inspiring leads do exist. Weick (1990) has noted that emotions can bolster attention and a readiness of users for automatic, rapid response. Conversely, excessive emotions can also attenuate attention (more below). Latour (2005) noted that people could talk with computers and have a long lasting emotional relationship with technology. Deal and Kennedy (1999) have also touched on affective elements in computer users’ behavior (see the chapter on infoculture). One of the observations the authors made was that savvy users would engage in picking jokes on

the Internet and spread them around a company via email. Although the authors resent this new cultural ritual, the effect is the organization member that “is hooked” on the computer and happy.

Challenges of Feeling and Emotions

Drawing on the arousal-appraisal model, Weick (1990) has analyzed emotional challenges brought by modern IT. According to his analysis, the relationship between stress caused by disruptions in functioning of complex modern technology and the performance of users is curvilinear. When an unexpected disruption occurs, users feel arousal—a “discharge in autonomous nervous system,” which is “a necessary condition for emotion” (Weick, *ibid.*: 23; in the later analysis the author also uses the word “stress”). At first, arousal can coincide with increased performance, as users’ attention to the system increases. Arousal increases with the length of search for remedy. Over some point, arousal makes the users to begin ignoring cues that are central to task performance. They lose sight of performance indicators and everything becomes more complex and less comprehensible than it usually is. Further increase in arousal diminishes performance even more. Weick notes that arousals due to technological disruptions can be appraised differently, depending on the organizational consequences of disruptions and successfulness of repair efforts. These give rise to different emotions, such as irritation, anger, rage, relief, and pleasure. From the organizational perspective, an organization coping with technology disruptions can go through a process involving ad hoc changes, tighter coupling of parts, higher complexity, and—in case of extreme arousal—to eventual dissolution into loosely coupled parts.

Weick’s analysis points to an important challenge posed by a heightened emotional tonus that is associated with random disruptions in the workings of modern IS. Arousal and corresponding emotions can impede performance of users. In the case of control room of a nuclear power plant consequences can be disastrous. Organizations can get prepared to face this challenge by training people to work differently in emergency situations (e.g., a university that typically is a loosely coupled organization, may need to know how to function in a tighter coupling mode).

The discussion of feeling and emotion conveys another relevant message: Avoid building of undesirable “basic” emotions in users (fear, anger, sadness, surprise, and disgust) and concentrate on stirring up the desirable ones, such as happiness. Fearing a system may run against adopting it. Surprises with system modifications may lead to anger, and then to frustration and resistance. And poor usability of a system may trigger disgust and a sad lament for “good, old systems.”

Learning

Learning may be understood as a process of both acquiring new knowledge and increasing the efficiency in tackling new and old problems (Bara, 1995: 133). According to the IVO model of homo informaticus (Figure 1), knowledge progresses through the creation of information-meaning, while being enabled by it, and this process expands memory. Learning has received uneven attention in overviews of cognitive psychology, but generally less than other key cognitive concepts. Sometimes it is implied in the rubric of memorizing (memory encoding). Learning enjoys a more prominent role in the study of education that draws on cognitive theory as well as on autonomous sources (e.g., the study of learning types discussed below).

Learning synthesizes other cognitive processes, as it is enabled by them. So for example, cognitive theorists often discuss learning along with the phenomena of perception, memory, knowledge, and

productive thinking. With regard to perception, learning has been related to the creation of meaning, as in Gibson's (1979) concept of affordances. Some researchers assume that there is no firm dividing line between implicit memory and learning, although the latter typically involves memory for complex patterns rather than specific stimuli (Eysenck & Keane, 1995: 20). Also, the acquisition and transformation of production rules applied in thinking is considered to represent learning processes (ibid., pp. 385-7).

The extent of learning depends on the cognitive work invested in learning. This is known as *the level of processing*. In general, the deeper the level of cognitive processing, the more effective the learning is. The processing level can be deepened by the learner's active approach to the learning material. Methods include conscious endeavoring to understand text, using analytical guides, asking questions, focusing on a problem solving task, and venting emotions. For example, in the situation of system adoption, role playing and switching could enhance the learning of new processes. Similarly, learning of a new systems vocabulary could be more deeply punctuated by using acronyms, anagrams and other mnemonics. Another condition for effective learning refers to the schema activation. Engaging previous knowledge helps set the context for learning, create meaningful thoughts, and establish bridges between the old and new cognitive structures. Methods of activating schemata include brainstorming, open discussion, team work, and intentional organizing of the newly learned.

DECISION MAKING/PROBLEM SOLVING

Decision making, often coupled with the notion of problem solving, is an applied cognitive process drawing on thinking and other processes discussed in this section. Decision making indicates power of homo informaticus as well as its limits.

Simon (1949, 1957) developed a normative model of decision making/problem solving that is based on cognitive, economic and operational rationality. It calls for making decisions to solve problems in a rational, process fashion. The stages can be named: (a) formulation of decision problem, (b) intelligence gathering, (c) decision alternatives formulation, (d) evaluation of decision alternatives, (e) selection—these make the decision making sub-process, (f) implementation of the best alternative, and (g) evaluation—these extend decision making into problem solving. As rational decision makers, we should logically define a problem, study in depth and breadth possible ways of resolving it, make a rational choice that is not influenced by individual interest, emotions, or organizational politics, and then conduct post-implementation effects of the decision, which could prompt us to make some correction. This model gave rise to various scoring methods used in organizations, in which a number of criteria for evaluating decision alternatives are rated in terms of benefits and costs on the basis of objective data and intersubjective agreement.

Simon (1960) took a critical look at his own theory and argued that decision makers may use sub-optimal methods in decision making. Simon noted a number of limitations to decision making and captured them in his concept of *bounded rationality*. Bounded rationality results from (a) failures in evaluating the best solution option; (b) problems in choosing the best option rather than a good enough ("satisficing"); and (c) resorting to simplifications (heuristics) in order to ease the cognitive load. Pressed for time and resources, they may go for "satisficing" or "good enough" decisions rather than for normatively optimal ones. Satisficing decision making draws on incomplete data and knowledge and limited decision alternatives. Extending this argument, it is also plausible that decisions are created by "guts feeling" and

through selecting preferred choices used in the past. Different cognitive types and individual agendas may also play roles in these decision processes.

There have been other attempts at modeling non-normative decision making. The “garbage can model” of decision making is based on the idea that decisions are made in an opportunistic manner when the needed conditions coincide (Cohen et al., 1972; March and Olson, 1986). The conditions include opportunities, decision makers, resources, problems, and solutions. Solutions need not necessarily be new. As if one reaches out for the content of a garbage can, repackaged old solutions may be pulled out as well as old solutions that had been created with no apparent problem to match (e.g., a corporate computer network was put in place with some capabilities never actually needed). The garbage can model has been used to explain organizational change and resource allocation. For example, resolving a problem of sharing resources between two organizations may be tried out unsuccessfully through different allocation methods, including a merger. The problem may then be put aside until conditions become ripe for re-approaching it (say, one of the two organizations experiences a financial loss). This time, the problem can be framed as an opportunity for the weakened organization to improve its prospects. On the stronger organization’s side, benefits could be represented as enlarging its competence base, expanding its line of products, and finding a home for its under-employed experts; all these goals can exist as old unresolved problems in the memory of organizational members. In effect, old problems are matched with a “new” solution of merger, which can also be understood as an old solution to an old problem. It follows from the garbage can model that decision making can be impacted by cognitive framing of organizational situation rather than by rational definitions of problem. (This topic is also related to the concept of meaning management discussed in the chapter on infopower.)

Etzioni (1967, 1989) likened organizational decision making to the manner in which doctors makes decisions and called this “humble decision making” or “mixed scanning.” Because of the complexity of human organism, a health problem is broken down to different aspects, and then a particular piece is approached in terms of hypothesis formulation and testing. Diagnosing a certain cause to a health problem sets a hypothesis, which is used for prescribing a medication; the patient’s taking of medication is the process of hypothesis testing. If symptoms of the problem subside, the diagnosis is considered valid, and then another piece of the large problem can be dealt with. If testing shows no change in the patient’s condition, another diagnosis is set and another medication prescribed. A similar decision process can be identified in organizations. For example, top management assesses IS services as unsatisfactory and breaks the problem down to operations efficiency, management issues, and strategic position of the IS department. Testing the efficiency hypothesis, top management can order a revision of business processes. If the unsatisfactory level of performance persists, top management turns to management issues. Notwithstanding, top management may try to change the IS department’s strategic position (e.g., initiate some outsourcing and orient the department onto vendor management). The corollary of making decisions via mixed scanning is that rational choices made can be tentative rather than exact, probabilistic and even possibilistic. The limitations are primarily cognitive in character.

In contrast, Lindblom’s (1959, 1979) model of decision making focuses on organizational limitations, while leaving a space for further exploration on how these can be complemented by a cognitive perspective. His model is also on the other side of rational decision making, as its title “muddling through” reveals, and it concerns public organizations. The basic idea is that a decision maker is running away from a problem rather than facing it. The very definition of problem is not a straightforward act, and involves organizational politics. Negotiations, compromising, and maneuvering are salient characteristics of the decision process. A big picture problem is replaced with smaller, manageable problems, and the progress

in solving these is determined by the balance of shifting coalitions. Blockages can frequently appear in the decision implementation process, causing decision shifts that force decision making into a nonlinear trajectory. Decision makers can trade the forest for the trees, and decision making tends to become an unending process. If an end happens to be announced, there may be merely a remote link between the final decision and the initial problem. Complex systems development projects in public organizations may resemble the muddling through model. An example is the development of an automated system for passenger check-in and luggage routing at the Denver International Airport. The project was technically too complex, engaged many players, stakes and significant resources, and ended up with an unplanned system and well in the red. A muddling through decision making is complicated by organizational factors with a possible influence of cognitive characteristics of the numerous actors involved.

All these models of decision making demonstrate the role of cognitive and organizational factors pulling away from the rational (normative) path in decision making. The discrepancy between what-should-be and what-is has been acknowledged but still insufficiently addressed in design of DSS (see Marakas, 2003; Travica & Cronin, 1995). Cognitive factors deserve more research. Interesting questions include the role of knowledge in defining decision problems in mixed scanning; the role of perception and memory in defining/redefining problems in the muddling through and garbage can models; the role of heuristics in thinking used in any of the models; and characteristics of learning that transpires in longer decision processes (muddling through and perhaps garbage can). Better understanding of the cognitive background may be conducive to improving design of DSS and bringing decision making in real-world organizations closer to the normative standard.

INFORMING NEEDS AND SEEKING PROCESSES

The area of library and information science (LIS) has for long been occupied with informing issues. Popular topic has been *information needs* and *information seeking*. In general, information needs are a cognitive phenomenon and thus their location is internal to the cognizing subject. For this reason, the phrase compliant with IVO "informing needs" may fit as well. Assumptions behind information seeking models, however, are not always clear with regard to the location of information that is sought. Often it is external, referring to some external content (i.e., data in the IVO vocabulary). But understanding and evaluation of a found content can also be implied. Consequently, information seeking models may refer to the parts or to the entire key informing process in IVO (data intake – knowledge application – information creation).

In investigating information needs of engineers, legislators, physicians and other professionals, Robert Taylor (1968) likened information needs to biological phenomena. Information need is visceral in character, and thus its verbalization can never be entirely true to it. An expression of information need follows in a process manner from the visceral through subsequent states—conscious, formalized, and compromised need. In his *model of information use environment*, Taylor (1991) focused on the relationship between information needs and aspects of professional problem. Problem determines information needs, out of which emanate information behaviors. Problem can be well or ill-structured and it is embedded in particular work environment. Problem is dynamic, as users' understanding of it changes "in response to new information and in relation to the actor's position and perceptions" (ibid.). Taylor's model has been used for studying informing practices of managers. For example, Rosenbaum (2000) combined the model with structuration theory in order to get insight into subtle aspects of e-commerce.

Belkin (1980) and Oddy (1977) studied a learning process unfolding in the interaction between the user, data, and data retrieval system. The process starts with an *anomalous state of knowledge* (ASK) of information user. The user's knowledge is in some way inadequate with respect to the person's ability to resolve a problematic situation. The user then, interacts with the system's content, engages in a dialogue with the retrieval system, and progresses toward resolving ASK and the problematic situation. Belkin and colleagues (1982) designed an IS around these ideas that elicited textual problem statements from users, and applied a distance-sensitive co-occurrence analysis of these statements to graph the user's ASK.

Wilson (1981, 1999) conceived information seeking in terms of a complex process. His model accounts for the user's context, retrieval system (more or less sophisticated), intervening variables (e.g., human intermediary, and characteristics of the source), and modalities of information seeking behavior (e.g., active search vs. passive attention/search). Wilson (2005) suggested that satisfying information needs has to do with complex individual aspects that correspond to various phenomena studied in diverse disciplines, such as stress-coping theory, risk-reward theory, and self-efficacy theory.

Dervin (1984) posited that information is a means of "sense-making." (This is not to be mixed with Weick's (1995) sense making in organizations). Her sense-making is a process of "bridging gaps" in cognition. These gaps indicate information needs that are instantiated in questions, confusions, riddles, angst, and other situations of existential significance. Needs are satisfied by ideas, thoughts, beliefs, intuitions, and helps. These refer to information. Information needs can be investigated via interviewing protocols (see Dervin & Foreman-Wernet, 2003). By pointing to cognitive and process aspects of information, Dervin's theorizing is close to the IVO concepts of informing and information.

Erdelez (2005) has conceived a phenomenon of unintentional satisfying of information needs, and labeled it "information encountering." She assumes that an information seeker normally faces a foreground problem but also some problems or interests that reside in the background of mind. In browsing through some resource delivering irrelevant materials, the seeker's attention may switch from the foreground to the background problem. This would represent an instance of "information encountering," explaining how accidental discoveries occur.

Fidel and Pejtersen (2005) use *cognitive work analysis* in order to understand the behavior of information user/creator (the "actor") and to contribute to design of information systems. They assume that a number of interrelated dimensions play the role of constraints on information seeking. The dimensions span from individual resources and values to the work place environment. For example, work environment affects the way a work place is operating; this mode of operation shapes the task that an actor performs; the task affects the decisions that an actor makes; and these decisions influence information seeking behavior. The actor's characteristics and the social organization of the work place also influence information seeking.

Common characteristics of this literature are (a) a process approach, (b) visceral (cognitive) character of information needs, (c) a focus on subject actively seeking to satisfy informing needs, and (d) complex modeling that is primarily tuned to qualitative research. In accordance with a process approach, satisfying of information needs progresses in stages. Consequently, information need is not necessarily a fully shaped entity that reduces uncertainty. These assumptions are consistent with IVO. However, consequently with shifting attention to the domain of individual cognition and its interaction with the environment, IVO characterizes information as internal to cognition and favors an "informing" terminology (informing needs, and informing seeker).

HOMO INFORMATICUS CATEGORIES

Attempts of making sense of individuals from a cognitive perspective can be traced back to the early 20th century psychology, which today reads more like philosophy than science. In particular, the founder of analytical psychology Carl Jung wrote about psychological types in the early 1920s in Switzerland. Although Jung may have inclined to see his typology merely as a clinical instrument, efforts of the Myers-Briggs tandem (a daughter and a mother) revamped interest in Jung's work in the 1940s in the United States. In the following discussion we will present the well taxonomy by Myers-Briggs as well our interpretation of cognitive types inspired by Jung (see Figure 4). Deviations from the original categorization will be noted. The reader can find a description of Jung's original concepts in the notes at the end of the chapter.

Jungian Cognitive Types

Table 2 summarizes personality types that Myers-Briggs developed building on Jung's (1921) categorization depicted in Figure 4. These authors developed an initial questionnaire for assessing personality types, which was later expanded and commercialized by psychology consultants. The Myers-Briggs Type Indicator has been used widely for assessing job candidates, arranging work teams, and similar purposes in the area of human resource management (see CPP, 2004).

The categorization of cognitive types here proposed is similar to the Myers-Briggs interpretation of Jung, but it leaves out the introvert-extrovert types and introduces categorization criteria related to informing criteria. Also similarly to Myers-Briggs, the following taxonomy reduces the depth of Jung's categorization tree and tones down its dialectical logic by making the categories mutually exclusive. Figure 5 depicts the proposed taxonomy.

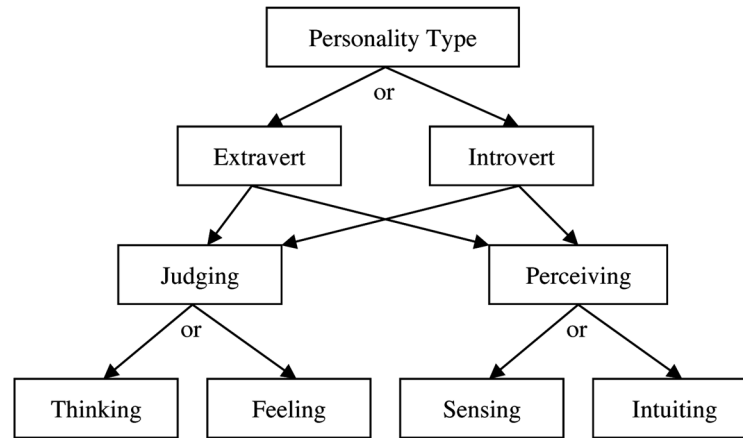
As Figure 5 shows, data scope is used as a criterion for differentiating between judgmental type (focused on necessary, narrow data intakes) and the perceiving type (a seeker of richer, broader contents). People of this type can quickly jump from data to conclusion, perhaps drawing on the "satisficing" model of decision making. (The word "judgmental" is preferred here over "judging" to avoid confusion of "judging" with "reasoning" or "cognizing"; this is consistent with Jung's original terminology—see note 3). In contrast, the perceiving type seeks more data, draws more inferences from a dataset, and applies different angles in interpreting the same data. More data and multiple meanings can lead to ambiguity due to mutual inconsistencies and to more uncertainty regarding the final choice. In other words, the perceiving type makes decisions and solves problems by actively engaging in the spiral of uncertainty

Table 2. Myers-Briggs psychological types based on Jung

Personality	Description
Sensing Intuiting	Trusting facts (objective focus); detail oriented. Trusting hunches (subjective focus); bigger picture oriented.
Thinking Feeling	Focused on logic in making conclusions/decisions. Focused on feelings in making conclusions/decisions.
Judging Perceiving	Action focused. Seeks necessary data; takes a specific task and tends to closure. Curious, adaptable, and spontaneous. Seeks rich data and takes on many tasks with uncertain closure.

Figure 4. Jung's types of personality

(Note: An arrow represents "is" relationship, which can be exclusive ("or") or additive.)



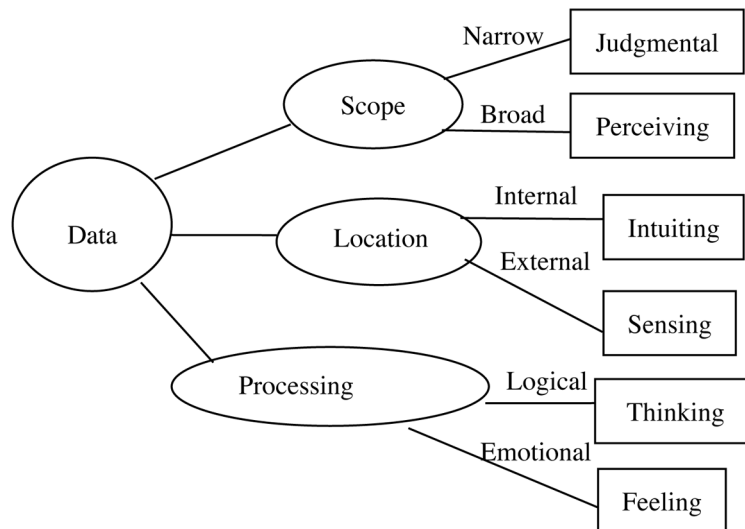
rather than seeking a shelter of uncertainty reduction. In contrast, this situation may appear chaotic to the judgmental type.

The perceiving-judgmental dichotomy has implications for user-centered systems design. A designer should provide filtered and summarized outputs for a judgmental user and less aggregated data and data transformation capabilities for the perceiving user. The level of data aggregation and filtering is implied in the traditional hierarchy of ISes: data is more filtered and aggregated at higher than at lower levels of management. While a useful shortcut in understanding managers and designing systems, fine-tuning of an IS to a cognitive type of a particular user remains an ongoing empirical challenge.

The location where one seeks data, stimuli for making sense and eliciting meaning, and sources of learning and knowledge do determine internally vs. externally focused types—intuiting vs. sensing people, respectively. These types incorporate characteristics of Myers-Briggs' introverts and extroverts, borrow some ideas from Jung, and also moderate hierarchical and dialectical characteristics of Jung's original concepts. *Extraverted Attitude* and *Introverted Attitude* make the root dichotomy in Jung's categorization: the former is characterized by a direction toward the "object" (external world) and the latter one characterizing a direction of the "subject" (an inner world of the individual) (Jung, 1921: 412).

A decision tree technique for determining Jungian cognitive categories (types) is presented in Figure 5. The root is defined as "data," and branches are data characteristics. These criteria approximate the Jungian approach while complying with the IVO approach. Assume an end-users' instructor realizes that the user in need of help is a logical person. The decision tree's processing mode branch identifies the user as the Thinking type. Then, the instructor may want to understand where the user would search for knowledge. If the user hesitates much before using the input devices, the location is internal—the previous experience rather than external one. A sensing user could engage in trial-and-error learning, hitting the keyboard with less deliberation. The next question is, whether the user gets satisfied once s/he reaches a procedure that resolves the problem at hand or the user continues to search for more procedures? The answer to this question would place the user in one of the categories along the Data Scope branch. Identifying the cognitive type of the user would enable the instructor to teach more effectively with concern for users' capabilities and limitations.

Figure 5. Decision tree of cognitive types and their criteria inspired by Jung



In summary, drawing on Meyers-Briggs' interpretation of Jung's categorization of psychological types and Jung's ideas, a six member-taxonomy based on informing aspects is introduced as a vehicle in IS research, management, and instruction.

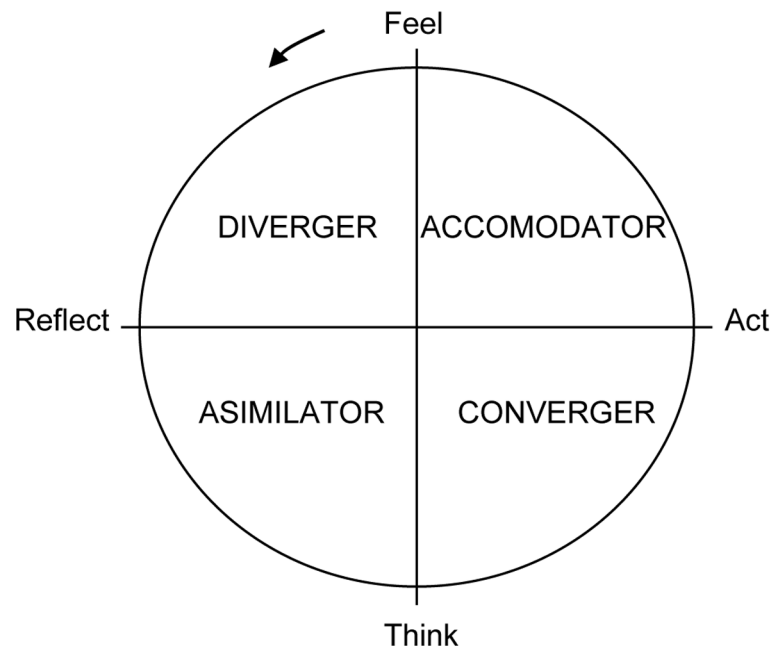
Kolb's Learning Styles

Learning is a cognitive process of acquiring knowledge, as already discusses above. The learning process interacts with the short term memory (where the meaning of newly acquired data is created), with the long term memory (where previous knowledge resides), and with processes of thinking and feeling (see Figure 6). Kolb (1984) studied learning from a more abstract perspective, aiming at understanding learning types. His *experiential learning theory* has gained popularity among educators and has been used by IS consultants in support to IS adoption efforts.

Kolb's theory starts with the assumption that experience is the root to all learning. This point in learning is characterized as a *concrete experience* and it engages feelings. A full learning process progresses through the next three stages—the *reflective observation*, *abstract conceptualization* (engages thinking), and *active experimentation*. Therefore, one learns through experiencing, reflecting on the experience, conceptualizing knowledge, and testing the knowledge through action. Kolb's learning cycle may not be realized in full with each person, and such a reduction results in certain learning insufficiencies. The stages in the learning process can be thought of as ends of two continua: a continuum of *modes of grasping experience* whose opposite ends are “feeling” and “thinking,” and a continuum of *modes of transforming experience* with “abstract conceptualization” and “active experimentation” as the ends (Kolb & Kolb, *ibid.*). These continua form a space of the learning cycle that is partitioned into four quadrants (Figure 6). Each quadrant belongs to one of four learning types: *Diverger*, *Assimilator*, *Converger*, and *Accommodator* (*ibid.*).

The *diverger* combines feeling and reflecting, and is best at viewing concrete situations from many different points of view, such as in brainstorming. Divergers have broad cultural interests and prefer

Figure 6. Kolb's learning styles



continuous learning. Interested in people, divergers are imaginative, emotional, and art-oriented. In formal learning situations, divergers prefer working in groups, listening with an open mind, and receiving personalized responses.

The *converger* is best at finding practical uses for ideas and theories. This type has the ability of solving problems. Technical tasks and problems, as in technology development and engineering, are preferable to social and interpersonal issues. In formal learning situations, convergers prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications.

An *assimilator* is best at broad-based understanding and putting it into concise, logical forms. The focal interest of assimilators is with ideas and abstract concepts rather than people. For this type, it is more important that a theory have logical soundness than practical value. The assimilator style of learning is important in knowledge-intensive careers. In formal learning situations, people with this style prefer readings, lectures, exploring analytical models, and having time for in depth thinking.

Finally, the *accommodator* learns primarily from “hands-on” experience. This type enjoys carrying out plans and being involved in new and challenging experiences. Acting on a guts feeling may be preferable to using logic. In solving problems, knowledge is gathered primarily from other people. The accommodator learning style is important in action-oriented careers, such as marketing or sales. In formal learning situations, accommodators prefer group work.

Kolb's taxonomy exhibits a Jungian background. Thinking and feeling are two moduses of understanding the world conceived as distinct cognitive types. Also, the concept of reflecting and acting share some similarities between intuiting and sensing, respectively. Consequently, Kolb's learning types seem to inherit Jungian sensing and intuiting characteristics. The main difference between Kolb and Jungian types is that the former assumes that different types are lined up as steps in a process that starts with a

feelings step. In addition, it is assumed that all the learning steps have to be covered in order to complete a learning process in each individual. While the ideas of linearity and sequence behind the first assumption do not seem to be particularly useful, the idea of holism in the second assumption is productive.

Kolb's framework could be useful in the process of adopting IS. Making sense of different learning styles may help in facilitating a process of learning a new IS. For example, a system adoption strategy may pair users who tend toward the action side and those that are more on the reflection side. The former can help experiment boldly with the system and learn quickly from doing while the latter can analyze what really is going on and define optimal use procedures. Another application of the framework may be in systems use. For example, diverging ideas and then converging them are two important informing activities associated with GDSS. They may call for bringing the diverger and converger type into the same session, and then facilitate their interaction. By balancing the two types, one may prevent both the diverger's slicing of the hair and the converger's rushing to conclusions.

Another application of Kolb's learning styles can be in training users. Since different people have different cognitive strengths (thinking or feeling, action or reflection), everybody misses some step in the learning process. Use instructions may start with understanding a particular user's learning style, and continue with walking the user through learning steps corresponding to learning styles the user is less familiar with. For example, an assimilator may be nudged to deliberate less and to complete learning by trying more to actually use the system, while an accommodator could be encouraged to drift from the guts feeling mode to reflect on optimal use procedures.

Other Cognitive Categories

The lists of cognitive categories/types interesting from the IS perspective can be extended. Three more pairs will be discussed. A technophile vs. technophobe dichotomy has been captured in various taxonomies based on speed of IS adoption. Usually, those with "love" for technology are zealous early adopters, while those who "hate" technology are late adopters (see Table 3). Some people can see clearly a small picture with vivid details, when they plan or try to understand something. These are "big picture" or holistic thinkers. Other may be less capable of capturing a whole but are rather good at discerning detail. These are part-focused or detail thinkers. Holistic thinkers can think a whole process through, focusing on landmarks rather than each step. The detail thinkers usually think from step A to step B, including forks and loops, but without caring of what comes after. In IS design, these different types can complement each other or cause a critical contention, depending on how they are managed.

There are also linear and network thinkers. For example, when navigating a Web site, a linear thinker may be able to memorize a sequence of buttons and associated screens than a network thinker that would memorize some affordances that may be remarkable to this person only. While the linear thinker may get lost if he misses a step in the memorized sequence, sequence is irrelevant for the network thinker, as she will get through as long as she encounters the memorized landmarks.

HOMO INFORMATICUS AS IS EVALUATOR

The theme of the discussion above was that individual organization member—homo informaticus—acts as agent in informing processes. The discussion also touched on some of the IS issues included in the

Table 3. Other cognitive categories

Technophile Technophobe	Having positive affection for IT; zealous early adopters and timely pragmatic adopters. Having negative affection for IT; apprehensive late adopters and Luddites.
Part-focused Whole-focused	Focusing on small picture; in process thinking, thinking just to the next or a few downstream steps. Focusing on big picture; in process thinking, think through an entire process with the end point in mind.
Linear Network Thinker	Thinking in terms of linear connections. Thinking in terms of network connections.

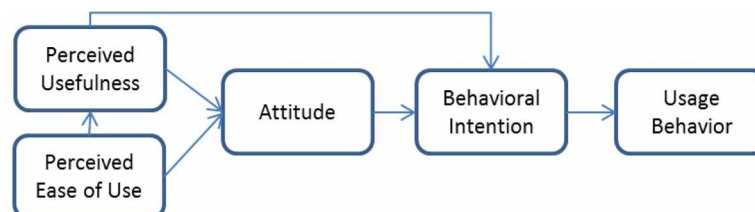
IVO framework, such as IS design, adoption, and use. This section focuses on evaluation capabilities of homo informaticus.

Homo informaticus is evaluator of IS throughout IS life. During adoption of IS this the evaluation has a paramount role, often deciding about a system's destiny. System adoption research is more discussed in the chapter on managing IS life cycle. The focus here is on two valuable premises this research has established: (1) users play an active role in system adoption, and (2) system evaluation is part of system adoption. This is apparent in popular methodologies for investigating system adoption, such as Davis's (1989) technology acceptance model (TAM) and Rogers's (1983/1995) theory of innovation diffusion.

Central to TAM is connecting users' evaluations with their attitudes toward the system and a subsequent intention of using it (Figure 7). The concept of attitude was borrowed from psychology to mean "an individual's negative or positive feelings about performing the target behavior" (Fishbein and Ajzen, 1975: 216). According to TAM, a user evaluates a system in terms of perceived benefits and costs. The former is conceptualized through the dimension of perceived usefulness, and the latter through the dimension of perceived ease of use (although the "ease" insinuates benefits, truly addressed is the level of effort needed to learn and use a system; cf. Davis, 1993). These are modeled as causes to the attitudes toward system use. How successful TAM has been in assessing users' evaluative capabilities is another question postponed for later discussion.

Rogers (1983/1995) also placed the individual in the evaluator's seat in the context of various innovations (e.g., innovation in technology, knowledge, and social practices). His sociological studies are directly relevant for the IS field and they have been deployed in IS research (more discussion is in the chapter on managing IS life cycle). Rogers also theorized about adoption factors (causes), and suggested that adopters could assess a relative advantage—what can be gained from a new system. Adopters also assess a system's complexity—a level of effort the system requires. (Note that relative advantage and complexity have similarities with TAM's perceived usefulness and perceived ease, respectively.) Homo informaticus as IS evaluator surfaces also with regard to Roger's dimension of compatibility—similarities between old and new work methods determined by the existing and a new system.

Figure 7. Technology acceptance model (Davis et al., 1989)



A particular contribution of Rogers is in invoking process modeling of innovation in the organizational context. Figure 8 depicts a process model that is based on his work. An employee becomes aware of an IS around the release time, then shows interest by engaging in active learning of the system, and in turn evaluates the experience and decides to proceed toward implementing the system in regular work or abandon it. If implemented at work, the system is still evaluated for a final adoption or rejection. The model emphasizes a continuous character of user's evaluation and how critical it is for adoption success.

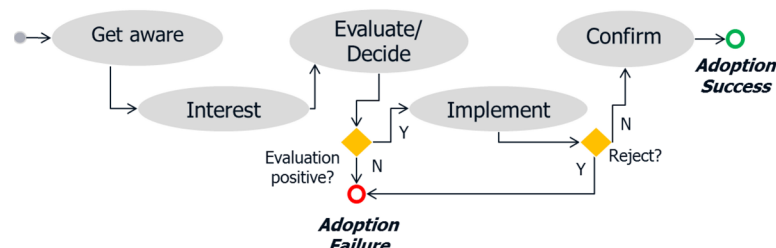
HOMO INFORMATICUS AS IS DESIGNER

This section is concerned with portraying action aspects that the homo informaticus exhibits in the area of systems design/development. An appropriate departure point is the methodology of user-centered system development. In this methodology, end-users are in some way included in the design stage. Historically looking, radical advances in user involvement were made in Scandinavia (Sweden, Norway, Denmark, and Finland). These countries nurture cultures that praise negotiations, tolerance and consensus building. Also, trade unionism has played a significant role in the respective economies. Participation of employees in IS development became guaranteed by law.

Iivari and Lyytinen (1999) argued that the genesis of Scandinavian methodologies can be traced back to the framework of Langefors (1966) and to certain software products (e.g., the object oriented programming language Simula). Langefors differentiated between “infological” and “datalogical” problems; the former concerned information aspects associated with an IS, and the latter technological issues of implementing information requirements in a data system. In Langefors’s terminology, “information” corresponds to meaning. Information is a function of interpreting data, based on the user’s knowledge, and the time available for the interpretation. Consistent with the IVO concept of homo informaticus, these assumptions place users’ cognition into the nexus of system design.

The involvement of users in systems development climaxed in Scandinavia with the socio-technical and trade unionist methodologies. The former originated in the Great Britain and was seeded in Scandinavian countries through certain projects (Mumford and Ward, 1968; Bjorn-Andersen and Hedberg, 1977). In conjunction with fundamental premises of the socio-technical approach that emerged outside of the IS domain, the socio-technical systems development sought to reach an appropriate fit between new organizational IT and organizational characteristics and potentials. The fact that some banks used new IS to merely routinize their procedures was deemed too limiting by socio-technical researchers. In seeking the ways of overcoming the limitations, the researchers concluded that the perspectives of both

Figure 8. Rogers’s process model of innovation adoption



workers and managers had to be combined in order to arrive at appropriate solutions. In other words, the systems had to be designed “participatively” (Iivari and Lyytinen, 1999: 69).

The trade unionist approach went even further in demanding a broad participation of employees/end users in systems development. A true Scandinavian invention, this approach (also called participatory design, democratic design, human activity-, skills- and tools approach) made the relationship between IS and principles of industrial democracy part of its program. The trade unionist approach abandoned the value-neutral, positivistic worldview of the socio-technical approach, which viewed organizations as harmonious assemblages of people (ibid., p. 70). Instead, a critical perspective on organizations was assumed, bringing the conflict between the labor and the capital to the foreground (Ehn and Kyng, 1987). This approach aimed at including workers maximally in design of new systems. For example, efforts were made that the switchover from the traditional typeset machinery to computer-based technology in the printing industry was accomplished through cooperation between workers and technical experts. This way, the workers could bring in their knowledge into system design, while learning about capabilities of new technology. And experts could become familiar with worker’s tacit skills, while bringing in system design a necessary technical competence.

The trade unionist approach was developed in practice through several projects of note. It brought to prominence a number of techniques for facilitating communication between user-developers and expert developers (e.g., mockups, wall chats, and photos). Greenbaum and Kyng (1991) provided a summary of central assumptions that elaborate on the relationship between the organizational context and ISes (“computer systems,” in the terminology of the authors):

- IS should be designed with a *full participation* from the users;
- IS are supposed to *enhance* workplace skills, including respect for tacit and shared knowledge;
- IS are *tools* that should be under the control of users;
- IS should be in service of *quality* and not only quantity (productivity);
- The process of designing IS is political and includes *conflicts* between different stakeholders that should be dealt with rather than pushed aside;
- The ways of using IS constitutes *use situations*, which should be a starting point for the design process (pp. 1-2; all italic original).

The trade unionist approach proved that systems development could be successfully driven by different goals, not only those of management (Iivari and Lyytinen, 1999). The same authors point out that this approach later shifted from the initial critical focus to mellower post-modernist syntheses of young Marx, Heidegger and late Wittgenstein.

Another Scandinavian contribution to promoting users into systems designers is the language action approach (Goldkuhl and Lyytinen, 1984). It drew primarily on Austin and Searle’s philosophy of language, Wittgenstein’s theory of language games, and Habermas’s theories of knowledge interests and of communicative action (Iivari and Lyytinen, 1999: 77). The language action approach has brought up conversational aspects of system development within an organizational context that is conceived in richer terms than in the infological approach. The very concept of IS shifted from an objective thing to an “intersubjective socially constructed institution.” Thus, IS have been conceived as “social systems, but only technically implemented” (ibid., p. 77).

One of the pillars of the language action approach is the theory of speech acts. According to this theory, communication can be categorized into semantic rubrics. Some of these are the statements on

facts, evaluations, predictions, promises, orders, and feelings. Being uttered, any of these embody and may enact certain behaviors on the part of communication actors, thus demonstrating that language is action and can move into action. Speech acts performed by various organizational players fill the process of systems development, forming intertwined flows of recurrent conversations through which the systems scope, requirements and other aspects are defined. For example, a question posed in a communication episode can be followed by an answer, a request for clarification, silence, or a counter-question. One needs to invoke a repertoire of speech acts in order to understand what development actors mean when they say or do not say something. As a whole, then, reality of systems development resembles a language game of Wittgenstein (1953)³. The language action approach, therefore, assumes that the users' voice is to be part of the conversations and of the language game of systems development, although this and other assumptions have not undergone sufficient testing in practice (ibid., p. 89). This approach has similarities with constructivist philosophy and with other linguistic approaches in the IS field (e.g., with the work of Winograd and Flores, 1986).

As the Scandinavian experience suggest, homo informaticus can exist as the IS designer in an appropriate institutional context, such as the one in which employees are organized for exerting a focused influence. This has rarely been the case in other parts of the world. The IS user is typically treated as a passive consumer of services delivered by the specialists sitting in the IS department in an organization. The challenges to emboldening design capabilities of homo informaticus have increased with the proliferation of system rental services, such as application service provision and cloud computing. The escalation of the rental and outsourcing services may push the homo informaticus down a path of cognitive sedation. Natural capabilities die out in a passive consumer of the informing services and content, when these are deployed without deliberation and moderation. In contrast, fostering the design capabilities of the homo informaticus delivers benefits in the phases of system adoption and use.

Homo Googlematicus Example

Since 1998 when it was founded, Google has become a home brand for Internet search. It reached a dream goal of coupling effectiveness, efficiency and ease of search. Its own database products and continuous automated indexing and evaluating of the Internet content are some of technological levers behind Google's success. To be sure, the company has mastered a gamut of Internet-based services and software products. (Note that the popular name "Google" is used in this discussion even though the company has got through a differentiation of lines of business and name changes.)

Google's employees, Googlers, are an example of a raw model homo informaticus. In the IVO parlance, we can call them "Homo Googlematicus" (Travica, 2015). A software engineer by professional vocation, Homo Googlematicus enjoys enviable work conditions and professional resources. Innovation is a goal set before each employee. They are expected to work 80% of the time on core search products and 20% on their own inventions. The delivery and evaluation deadlines are not firmly set, and success of an innovation is not necessarily expected.

It goes without arguing that Homo Googlematicus is a technophile, early adopter of new technologies, as well as IS designer and evaluator. He/she resembles the converger type of learner for being strong on the thinking side, while having the ability of promptly converting ideas into action. Homo Googlematicus is also an experimenter and improviser, as both capabilities may spawn innovation. In the IVO framework, these are marks of wisdom. On the one hand, a Googler is focused on rational seeking of a solution to a clearly defined problem; on the hand, the engineering work requires flexibility in the beginning of a

project. Within the emerging world of breakthrough technologies and associated social forms, it may not be easy to grasp upfront what precisely is the problem to be solved. Sometimes, a solution may come before the problem, as posited by the model of garbage can decision making. Indeed, a solution may help to define an ambiguously sensed problem. Or it may not be clear upfront what the full range of problems is possible to solve with a solution to a target problem. Homo Googlematicus faces challenges and opportunities of this sort. However, playing by wisdom at the start of an innovation process is balanced by rational, rigorous, data-driven methods for evaluating ideas (Iyer & Davenport, 2008). Homo Googlematicus is a pillar of the dynamic capabilities strategy that explains Google's success and is discussed at other places in this book.

SUMMARY

This chapter explored the concept of homo informaticus—the individual organization member framed in the IVO perspective. Homo informaticus has been portrayed as a cognitive microcosm. Homo informaticus performs complex cognitive processes, engages in decision making and satisfying of informing needs, evaluates IS, and can participate in designing IS.

The cognitive processes explored refer to thinking, feeling, perception, memorizing and recall, and learning. These key cognitive processes are involved in the fundamental informing process in IVO, which starts with perception of external data, continues with applying knowledge to data, and ends with inferring information. The perspective of key cognitive processes enriches this model: perception is driven by previous knowledge, memory retrieval is engaged, and thinking is an overall driver, engaging both ratio and emotions.

Cognition has limitations. Memory is not infinite, perception is prone to illusions, and thinking may be biased. These limitations influence the outcomes of informing (information created) and learning (knowledge acquired). Decision making is affected as well, as indicated in its various models that reveal non-rational aspects.

Furthermore, homo informaticus is subject to informing (information) needs and actively seeks to satisfy them. Several models in this realm were examined. The discussion expanded into cognitive and learning categories or types that can be used for understanding diversity characterizing homo informaticus. Karl Jung's typology, which survived to date through popular survey instruments, was coupled with the dimensions of data scope, location and processing mode. Kolb's learning styles are discussed in turn. The system evaluation capability of homo informaticus was demonstrated in the context of system adoption models. A system design capability was identified with the historical example of Scandinavian experience. Finally, a Google professional was framed in light of homo informaticus.

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ENDNOTES

- ¹ Social informatics is interested in the social shaping of ISEs as well as in impacts of ISEs in various contexts. In words of its promoter who was also responsible for the label “social informatics,” this is “the interdisciplinary study of design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts” (Kling, 1999). IVO shares this interest in the subject of research, while being focused exclusively on the organizational

context at different levels (group, department, firm, community, and broader delineated contexts). Lamb and Kling (2003) highlighted the agency aspects and institutional grounding of individual organization members, which are also compatible with the IVO approach. Cohen (1999) defined interdisciplinary research called “informing science” that is tasked with providing its “clientele with information in a form, format, and schedule that maximizes its effectiveness.” The framework draws on the model of sender and receiver (called informer and client) that are connected via a delivery system that can be understood in terms of IS and formal/informal practices. Informing takes place in IS contexts as well as in others, such as education and mass media. IVO shares the assumption on client and interdisciplinary approach, while deploying different conceptualizations of information and communication (Travica, 2006). As for overlaps between IVO and structuration theory, the reader is advised to consult the subject index for several references to this theory.

² As Jung cyclically swings in and out of fashion, it may be instructive for the reader to have a look at Jung’s original concepts. Jung’s categorization has a hierarchical depth and a dialectical character. His concept of “perceiving” is somewhat different than the one used in the Meyers-Briggs’ instrument and in this discussion. In addition, a differentiation between conscious and unconscious levels adds another layer of complexity (and dialectics). Moreover, two fundamental psychological types in Jung’s (1921) categorization are *Extraverted Attitude* and *Introverted Attitude* (p. 412). An extravert’s thoughts, feelings, decisions and actions are related to objective data and determinations. In thinking, an extravert always starts and ends with objective data, external facts and generally accepted ideas. Examples include the merchant, engineer, natural science pioneer, and philosopher working with abstractions from objective experience and ideas borrowed from the intellectual atmosphere of the time (ibid, p. 429). Feelings of an extravert are also externally influenced (see Figure 4). These spring from social values and traditions, and can explain why so many people flock to the theaters, concerts, church or what is considered a socially suitable marriage partner (p. 447-8).

Feeling and thinking are modes of judging or reasoning, and one of these is typically dominant in an individual. These mutually exclusive modes of judging define “special types” of personality. Another basis of differentiating on subtypes refers to the way of perceiving (see Figure 4). Two mutually exclusive ways exist—sensation and intuition. Sensation is based on sense data, while intuition draws data from the inner world of an individual. With extraverts, both these have their primary source in the outer world. While sensation is “an action that seizes and shapes the object,” intuition is “an active, creative process that builds into the object just as much as it takes out” (p. 462). With an introvert, both modes of judging and of perceiving are inward-oriented. This type is characterized by thinking “that proceeds from subjective data and is directed towards subjective ideas or facts of a subjective character” (p. 431). Perception of an introvert is based on his experience and ideas. Attention to objective data could be paid, but “facts are collected as evidence or examples for a theory, but never for their own sake.” Jung notes: “What, apparently, is of absolutely paramount importance is the development and presentation of the subjective idea” (Jung 1921: 481). Also, an introvert may be sensing things quite differently than others as intuition—being an internal process—is a natural way of perceiving for introverts. Even when this introverted intuition receives impetus from outer objects “it is never arrested by the external possibilities” (p. 505). An introvert may end up with knowledge nobody understands (“symbols of the unknown,” “mysticism”) warns Jung, while stipulating: “Had this type not existed, there would have been no prophets of Israel.” (p. 507).

The introvert's "creative power is proved by the fact that this thinking can also create that idea which, though not present in the external facts, is yet the most suitable, abstract expression of them." Jung also notes that extremes are bad in overemphasizing both objective facts and subjective reality: "for in the former case the purely empirical heaping together of facts paralyses thought and smothers their meaning, so in the latter case introverted thinking shows a dangerous tendency to coerce facts into the shape of its image (pp. 481-482). It is clear from Jung's argument that individuals are not pure types. Rather, individuals possess combinations of these characteristics (Jung 1921: 513). This has to do with dynamics of the characteristic. One segment of the dynamics concerns the differentiation between the conscious and unconscious level. For example, an individual who at the conscious level is extravert in thinking may, at the unconscious level, be introvert in feelings; or one may consciously be more on the perceiving side, while having a thinking side suppressed. The concept of conscious-unconscious dynamics is borrowed from Sigmund Freud, and, accordingly, unconscious is the domain of the repressed, infantile, and primitive. Another dynamic takes place in the conscious domain. There is a leading function (characteristic) and a secondary one, which is different but not antagonistic to the leading function. For example, an individual may have a leading intuitive perception and a secondary thinking judgment. But, the opposite characteristics cannot pair up (e.g., thinking and feeling, sensing and intuiting, or judging and perceiving). (ibid., pp. 514-515).

- ³ Wittgenstein's (1953) concept of language game is complex. Here it suffices to note that it rejects the notions of correct meaning and objective truth. Instead, language game brings to the fore the notions of relativity of meaning (to context, situation intention) and intersubjective truth. For example, the sentence "A large bear came upon the scene" is understood differently if one thinks of it as reporting of an event, the telling of a story, or describing a film plot. Another source of variation in meaning is a speaker's intention; thus, he/she can convey a fact, warn, scare, entertain, disguise some other detail in the episode, etc. A similar idea underlies the theory of speech acts. The implication is that there are different rules for inferring meaning in different language games. Languages games can be identified everywhere; for example, in giving and obeying orders, in giving measurement of an object, presenting results of work in pictorial and tabular forms, greeting, thanking, public speech, and so on. Indeed, language games are what make languages in various contexts (including organizations) and whole national languages are language games.

Chapter 3

Groupomatics

ABSTRACT

The chapter discusses the concept of group informatics (groupomatics), one of the topics in the informing view of organization (IVO). One running theme in the chapter is the emphasis on cognitive aspects of work groups. Another theme is communication conceived of beyond the conventional conduit metaphor. The chapter also addresses the theme of uncertainty and ambiguity plaguing the deployment of team-work and group support systems (GSS). Ample evidence indicates unexpected outcomes of deploying GSS. Group context complexity reduces predictability of GDSS effects. Distributed (virtual) teams and distributed GSS bring up new challenges that the discussion addresses. The chapter also introduces a concept of mobile enterprise strategy.

INTRODUCTION

Work groups or teams have become a popular topic since the 1980s. In parallel, interest in technology for supporting groups has been developing. Group decision support system (GDSS) used to be the technology of the day, typically implemented in the same place/same time mode for brainstorming purposes. The topic of workgroups, thus, became legitimate in the IS field. Along with this topic came experimental design as the research methodology, which previously had been just occasionally used. Much of the research had a focus on technology use and impacts on quantity and quality of data generated by using GDSS. GDSS technology was in the focus, along with certain aspects of GDSS sessions, although this IT was treated abstractly as a modus of making decisions as opposed to the face-to-face modus.

Another stream of research evolved around systems for supporting workflow, collaboration, communication, and sharing of knowledge. These are often called group support systems (GSS). The champion technology was Notes™, a programming environment for group applications, and the staple research method was a case study. This research has sometimes been labeled with terms “collaboration work and technology” and “groupware.” Generally, a more balanced approach in addressing both cognitive and technological informing agents has been achieved in research. The next surge of interest in groups and IT was marked with a shift toward teams with dispersed membership. This research stream was somewhat inspired by perspective of virtual organization. An example of virtual organization aspects is the

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development of trust between spatially distributed teammates. Communication technology became the center of attention. An emphasis on behavioral group issues is the social complement in this research, while problems of group cognition have not been given sufficient attention. More recently, attempts have been made toward bridging GDSS and communication systems research.

Communication is an indispensable part of the group context. Group support technology, therefore, needs to have data transfer capabilities. This is particularly so in the context of distributed groups. Collaborative work processes are carried out by communication channels, and thus communication is instrumental in sharing data, opinions and expertise, group thinking, the development of knowledge, and management of group memory. In the IS field, this communication is usually called “computer mediated communication” (CMC) or “computer assisted communication;” in other fields the label “telecommunication” may be used. Data in this sort of communication still take the form of text and audio for the most part, even though image and video formats steadily increase their share with technological advances and cost reduction. Also, wireless communication gradually claims its place alongside wired communication or even dominates in geographical regions that have never seen elaborate telephone and computer networks.

Scholars have disagreed with regard to the role of group systems and their relationships with structure, process, action, and, apparently, methodological issues. While some look at GDSS as an instrument for achieving better ideas and decision making, others maintain that random social effects can be nonetheless valuable. While some researchers find that people supported by email and the telephone can develop trustful relationships in the dispersed team context, others discover that even custom-built group support systems have just a limited value. A remarkable message from all this research is that groups and the associated informing agents do not yield easily to the efforts of understanding and controlling them. Technology in particular is the subject of more complex social processes than in the individual user context. The themes of “open-ended” character of group support systems (Weick, 1990; Orlikowski et al., 1995) and technology’s “drifting” (Ciborra, 1996) characterize well this challenge to management control.

The discussion in this chapter will touch on all of these research streams, while “reconstructing” the discourse according to the IVO framework. A particular emphasis will be given to understanding groups as a form of intelligence, which is an agency performing cognitive processes similar to individual cognition. The title of the chapter comes from words “group” and “informatics.” The term informatics reflects the IVO approach of looking at organization of group from the perspective of informing agents.

While being organization in its own right, a work group is embedded in a larger organizational context. The group jells up and obtains survival resources from the home organization. The group is tasked by the home organization that, in turn, depends on the group’s deliverables. Therefore, it is not possible to fully understand the work group without its relationship with the home organization. Nor is it possible to fully understand the home organization without its relationship with the group aspect. IVO makes these connections between the group and an organization. The reader is, this, advised that the discussion in this chapter will make conjectures to other IVO aspects that are addressed in different chapters of this book.

GROUPS IN ORGANIZATIONS

Some management scholars who attempted to understand the background of the Japanese economic success are responsible for the recent arousal of interest in the topic of work groups/teams. For example, Ouchi (1981) studied Japanese organizations and management and concluded that group work takes

an important place in the organization of work, socializing, decision making and other domains. Traits of a larger collectivistic culture in the “land of the rising sun” are complementary to the deployment of group work in organizations. However, workgroups are not a Japanese invention. The Scandinavian countries, for example, also harbor a strong tradition of group work along with consensus making and conflict resolution.

In other Western countries there have been certain industries that used workgroups as a standard building block in organizing. For example, the public accounting industry has used a two-member engagement team since the days of its modern inception in the 19th century. Working in teams eases the burden of work, improves accuracy and overall quality, makes the professionals more readily available to the client, and so on. Teams in the public accounting industry give a stamp to the overall design of a typical local office (Travica, 1999). Workgroups have populated other industries as well, including mining, various project-driven firms (e.g., civil construction, and aircraft manufacturing), and organizational functions (research and development units).

Relationships between groups and organizations are intricate and sometimes distinctions between them are not all clear. Sometimes, groups make a firm (the simple structure of the “mom and pop” business); at other times groups populate firms (the typical example is the matrix organization). Apparently groups are smaller, but are there any other differences? Not really, as the discussion below will demonstrate. Groups and organizations share many characteristics, and the only difference appears to be the length of life span (longevity)—organizations last longer. Also, more often than not, groups command smaller resources than organizations do. But exceptions exist, and examples include the interdepartmental team that built IBM System 360 (the first business purpose computer released in the early 1960s), strategic NASA projects, and the Manhattan Project.

One of the distinctive characteristics of groups is that they can be more flexible than larger organizations. This may be due to a smaller size, the purposive character and limited longevity of groups. At any rate, the flexibility of groups brings them close to new organizational forms, such as adhocracy, which keeps on changing in accord to the needs as they are emerging. This dynamic character of groups inspires one approaching IT in the group context from a dynamic rather than static perspective. Thus, one can think of the classical structural dimensions (e.g., centralization and formalization) as being continuously in a process of change. For instance, given the life cycle of project teams that has an identifiable beginning and development stages, one may trace the unfolding process of structuring and how the roles of IT are evolving. Approaches that draw on theories of action and structuration play a part in this respect. And some of these have indeed been applied in IS research. Before turning to IS research, let us take a look at some basic issues in the context of work groups.

Behavioral Aspects of Groups

Work group (“group” or “team”) refers to a set of organization members that work on accomplishing a common task. Group members are interdependent in their work and usually share a feeling of belonging that differentiates themselves (insiders) from everyone else (outsiders). This orientation is a key psychological aspect of group members. Therefore, the strong task orientation and socio-emotional component are distinctive characteristic of groups. Groups usually fail when the task is not clear. Task is what defines the goal of a group, its *raison d’être*. Similarly, a lack of socio-emotional ties can weaken—if not debilitate—a group, even if a clearly defined task is extant. The aspect of task does for groups what organizational purpose (the business it is in) expressed in organizational vision/mission and strategic

plans do for the larger organization. Still, organizations shift their missions, change plans, and can exist over longer periods of time with conflicting goals.

Groups are much more sensitive to the clarity and consistency of goals. We can say that the socio-emotional component does for groups what organizational culture does for an organization. But again, the concerned connection is stronger in the group than in an organizational context. While a team that is performing successfully owes much to fuller socialization of its members, the performance-socialization relationship is not that straightforward in an organization. For one reason, an organization can have multiple cultures, which can be in tension. Consequently, strongly indoctrinated organizational members can be permanently involved in a destructive conflict that blocks the organization. But, the conflict can also be productive. The corollary is that the relationship between the degree of cultural indoctrination and organizational performance is indeterminate. Therefore, the comparison between groups and organizations on the basis of purpose and socio-emotional orientations renders groups as more tightly coupled systems than organizations. Consequently, deviations in any from the two key aspects (the task and the insiders' feeling) makes the group more brittle than its counterpart.

A group consists of individual members that bring in their personalities, cognitive characteristics and other individual aspects. All of these aspects underline the importance of understanding individuals (*homo informaticus*) as part of understanding groups.

To accomplish the group purpose, group members divide labor in practice. In the realm of group psychology, the division of work is manifested in expectations of what one is supposed to do—the roles. Roles reach beyond work, encompassing the socio-emotional component. So for example, in a team of door-to-door vacuum cleaner salesmen are bracing themselves for a record day sale, the role of the team's cheerleader is to boost optimism and courage. In performing in their roles, team members manifest mutual dependence—interdependence. This interdependence also makes a group a tightly coupled system. While non-teamed organization members can also be highly dependent on each other, it usually is the case that a missing worker can be more easily substituted for than a missing teammate.

Group members have to respect certain formal rules and norms (unwritten, informal prescriptions of behavior). These are similar to organizational structure and culture, respectively. Recall that the feeling of belonging is also part of group culture. Rather than being merely a metaphor, group culture has recently been conceptualized in terms of a set of customs and shared understandings of the group norms on members (who is good at what; what cliques exist) and work (its purpose, and how it should be evaluated) (Levine & Moreland, 1991; Moreland et al., 1996). Moreover, the horizontal division of roles is complemented with the vertical one. Groups have leaders, who either are formally appointed/elected or are emerging through internal group dynamics. This depends on the manner in which a team is founded; for example, a project team formed on a superior's order in a civil construction company can be different in this respect than a self-managed assembly team in Volvo's factory. Leadership is one of those important aspects that are responsible for the making or breaking of a group. Communication is also important, although it is often treated as a dependent variable. Communication is the medium of a team's existence. Since communication is part of work processes, it helps build/maintain the insiders' feeling and group culture, and it mediates in leadership issues. Methods of social network analysis can help discover patterns of communication, such as hierarchical or flatter ones. (Note that a work group should not be conceptually equated with an informal clique—a clique can be a part of the group, or it can stretch across groups, or it may not exist at all).

Moreover, groups have cognition. Groups can perceive through the lenses of the insiders' gestalt; they can think through working collectively on solving a problem; they can learn a work process by allocat-

Table 1. Group aspects, types, and teams

Work Group Aspect	Description
Task orientation	Goal-oriented work behavior, the reason of a group's existence
Feeling of belonging, socio-emotional component	Staple of team member psychological
Division of labor, Roles	Expectations of work and other behavior
Interdependence	Reliance on others, coordination in performing in roles
Rules	Formalization of relationships within group
Norms	Group's culture; beliefs on the purpose of work and other issues, and patterns of communication and other behaviors
Communication	Interactions involving the creation of meaning
Leadership	The distribution of influence and decision making
Cognitive processes	Transactive memory, collective mind/thinking, perception, and learning.
<i>Work Group Type</i>	
Committee	Usually permanent non-production groups simulating an extension of organizational structure; usually with little authority
Task Force	Temporary non-production groups formed for certain task
Ad hoc vs. Intact Work Group	Temporary vs. permanent group
Team	Production groups, furnished with resources and authority (Continued)
<i>Team Type</i>	
Production team	Permanent workgroup; can be self-managed
Project team	Formed for a project; can be cross-functional
Management team	An example is steering committee
Parallel team	Temporary addition to existing structure; e.g., task force
Ad hoc team	Members have no history of working together
Local (Collocated) team	Members are in the same location and face-to-face communication exists
Distributed Team ("Virtual Team")	Members are dispersed in space and communication is mediated via IT

ing pieces of knowledge to different group members; and they can memorize and retrieve that memory through group members' interaction. Although conceived long ago, cognitive aspects of groups have only recently aroused more of scholars' attention. It is these aspects that are particularly interesting from the IVO perspective, which attributes the metaphor of intelligence to organization. Meaning, knowledge and wisdom are cognitive entities, and therefore these can be understood better by understanding the cognitive processes leading to them. Communication issues surface again in this realm, pulled by the umbilical cord between informing and communication.

Groups can be more or less democratic, flatter or more hierarchical, and placed anywhere along the mechanistic-to-organic continuum of designs. In organizations, groups actually come in different forms, although so far we have referred to all of them in a simplistic way. As Table 1 shows, there are task forces established for a certain purpose and with the longevity varying from days to years. There are also committees, which resemble permanent attachments to organizational structure (usually with

limited authority). And there are teams. In contrast to the first two types, a team is typically formed in the production core and has a budget and authority in the assigned domain of work. Teams can be of various sorts, as depicted in Table 1. The fuzzy borderline between groups and organizations resurfaces again. For example, a sport team can be categorized as a production team, but it can also be understood as the production function of a larger organization, which includes marketing, administration, and various support staff. Experimental research on groups and group support IT is usually focused on ad hoc work groups that simulate real-world teams.

Groups evolve through stages. A standard model would depict a cycle that starts with establishing a group and then progresses through the stages of shaping the leadership, defining the division of labor, setting up communication channels, performing on the task, evaluating performance, and closing. Or in other words, the stages can be conceived in terms of forming (in which the focus is on staffing), storming (focus on power), norming (focus on roles), performing (focus on production), and disbanding (focus on staffing and ownership of remaining resources and group work results). Experimental studies in the IS area rarely account for group development aspects.

Similar to other software firms, project teams are the corner stone of the Google organization. The teams consist of up to five people and have lots of discretion in their operations. The company tends to keep team members collocated, assuming this method makes the work communication and coordination more efficient. In addition, reaching a consensus in team's decision making is often the goal and team management is mostly about aggregation of viewpoints. (Eideman & Eisemann, 2011).

When valuable knowledge is developed through teamwork, managers would try to preserve it even though the particular project is abandoned. The case in point is developing a new storage system at Google in the mid-2000s. Two project teams competed by developing two different solutions. The winner was a solution with a higher scalability, suiting Google's growing needs for digital storage. The other project was canceled. However, managers in charge realized a value of the technical knowledge embedded in the losing solution and moved its members to a future storage project. In this way, the group knowledge was preserved and could be moved into the new product. (Hill & Stecker, 2010).

Cognitive Aspects of Groups

Groups create data and infer meaning via informing processes that resemble those pertaining to individuals. IT and IS for groups (e.g., systems for supporting decision making and other tasks) can, therefore, be meaningfully approached from the perspective of its support to group cognitive processes of perception, learning, memorizing/retrieving memory, thinking, and knowledge development. And groups are intelligent agents indeed. Psychologist Kurt Lewin (1948) provided early leads for thinking in this direction. He postulated that groups can be understood in terms of perception, thinking, and remembering. Janis (1982) contributed by theorizing on groupthink—a conformist behavior that captures aspects of both group perception and thinking. Sociological and communication research on groups is in agreement. Intelligence, dogmatism, and criticality (Phillips, 1973) are among the dimensions considered that have a relevance for group intelligence.

More recent research on small groups is promising in this respect (e.g., Fiske & Goodwin, 1996). Management literature has also contributed to the study of group cognition; Walsh (1995) has provided an instructive review. IS research has tackled some issues of group thinking, most notably within the area of GDSS. Case studies on groupware have also helped develop anecdotal evidence of group intelligence, while also diverging to issues of action and organizational context (e.g., organizational structure, culture,

etc.). Research on distributed teams is reinforcing the behavioral accent by focusing on relationships (e.g., on the issue of trust between physically dispersed teammates). Still, much of IS research appears to be driven by IT trends rather than the informing purposes of IT/IS. These include cognitive processes in groups (perception, memory, thinking), the creation of meaning out of data managed in the group context (at the individual level and as one aspect of group thinking), and group knowledge representation and management.

In the IS area, research on groups supported by IT has been conducted under the umbrella of computer supported cooperative work (CSCW), collaborative work and technology, group decision support systems (GDSS), and group support systems (GSS). While the focus on technology has been strong, the issues of knowledge, data and meaning have been studied to a smaller degree. In contrast, group psychology has studied cognitive processes, but it misses the IT perspective. Cross-pollination between the two fields of research could benefit both of them. The discussion in the section below will concentrate on some group cognition issues—transactive memory, thinking, and perception.

Group Memory

The basic idea behind the concept of group memory is that a group can know more than any individual member. For example, a team working on a project can create new meaning and knowledge that no individual member possesses in full. As a general principle, the division of knowledge on the individual basis is a universal phenomenon created partly by organizational design and partly by human capabilities and limitations. Teamwork serves as the counter-balance to this division. For example, intact work teams in car factories bring in and further develop a set of matched expertise. It takes a whole team to put in both the individual expertise and the team's cognition in order to assemble a car successfully.

An indication of shared cognition surfaces in the situation of deprivation. When a team member is missing, then processes and tasks cannot be completed with success or at all. An application of this is in securing some knowledge of a high importance by dividing it across individuals. Since the days of Egyptian pyramids to contemporary banks, knowledge about a whole “sacred thing” (be it the path to a pharaoh's tomb or a process of withdrawing money from outstanding bank accounts) has been divided among different individuals. Only by putting together what these individuals know can the whole picture be assembled (see also the related discussion on infostructure in Chapter 4).

Introducing IT in the work group context creates new opportunities for developing and managing group memory. One interesting idea is that computer can be treated as a teammate that has more than a partial role in a team's division of labor. The computer can store the team's memory, which reaches beyond individual memories (e.g., not only a calendar of events, but also discussion records and other documentation resulting from the work). This capability can then be used for socializing new team members (see Johansen, 1988). Furthermore, contemporary research on social cognition has revived interest in group memory. One interesting aspect of group cognition is *transactive memory*. The assumption behind the concept of group transactive memory is that people rely on external aids in supplementing their own memory, which often can be sketchy and faulty (Wegner, 1987). External aids are other people or some kind of data storage (e.g., “to do” lists, address books, and notebooks). When a team member cannot recall some piece of task-related data or work procedure, the member can turn to teammates for help. For a transactive memory system to exist, first, individual group members need to possess relevant knowledge know, and second, awareness of who knows what has to be present (Moreland et al., 1996). The later condition resembles the concept of knowledge index or map that is relevant in knowledge man-

agement (Davenport & Prusak, 1998). The last condition facilitates realization of transactive memory and it refers to communication or transactive processes between individuals. All these are sometimes referred to as transactive memory system (TMS) (Ren & Argote, 2011).

Psychological research on transactive memory has been focused on people aid. The role of transactive memory in group performance has been one of the more studied issues. Some laboratory evidence shows that transactive memory helps individuals perform better in decision making tasks. Libby and colleagues (1987) found that bank loan officers were able to predict whether a certain company would go bankrupt more accurately based on the diversity of expertise and the ability of groups to recognize expertise. In another experiment, Strasser and associates (1995) found that informing a group about each member's areas of expertise helped to solve hypothetical crime cases. Liang and colleagues (1995) investigated the role of transactive memory in performing the experimental task of assembling radios. Subjects were trained individually and in groups to assemble radios according to certain procedures. A week after the training, the individuals were organized in groups. Both the new groups and the initial groups were subjected to a radio assembling test. There was no significant difference in time across the two kinds of groups. However, the initial groups (members trained as group) demonstrated better recall of assembly procedures and committed significantly less assembly errors.

Liang and colleagues (1995) also measured behaviors that were assumed to indicate existence of transactive memory, by having independent judges analyzing the videotaped testing events. Three factors were discerned: (1) *memory differentiation* (the capability of dividing the cognitive load so that certain members memorize certain parts of what is learned and then recall these when needed; a team with transactive memory developed would have members that memorize where certain components go, others that know how to wire these, etc.); (2) *task coordination* (the ability of group members to work together smoothly; stronger transactive memory reduces misunderstandings and confusion and increases cooperation); and (3) *task credibility* (a special type of trust related to knowledge, implying that group members trust each other's knowledge of a task; transactive memory facilitates better acceptance of any procedural suggestions, less criticism, and less claiming of expertise). These factors turned out to be highly correlated indicating the underlying phenomenon of transactive memory.

The researchers found that transactive memory was associated with both the group training method and better group performance (better recall of assembly procedures and fewer assembly errors) and that this memory had a mediating effect on group performance. In other words, the group training method created transactive memory, which in turn led to better performance than in groups whose members were individually trained. The development of transactive memory in the groups trained in the group manner, as well as the contribution of transactive memory to group performance, was replicated in a similar experiment by Moreland and colleagues (1996). These groups outperformed the groups in the individual training condition and all other kinds of groups (one kind had individually trained members that subsequently went through a team-building exercise; another kind of group had members trained in the group manner and then randomly assigned to new groups). Owing to transactive memory, the groups trained in the group manner performed better than these other groups.

Subsequent research confirmed the earlier studies (Ren & Argote, 2011). Technology mediation in the transactive memory creation and use has increased, and the context of distributed teams has gained a prominence. Various communication systems wikis, blogs, and social media generate a content that can be automatically mined in order to understand who knows what and whether social networks for sharing particular knowledge exist (Majchrzak et al., 2009; Su, 2012; Zammuto et al., 2007). However, transaction memory creation and use is not warranted. Sometimes, emergence of transactive memory

may depend on the characteristics of member distribution so that a single member per location model is superior to multiple member models (O’Leary & Mortensen, 2010). Distributed teams may not be able to develop transactive memory due to a number of blocking factors inherent to these teams (Cordery & Soo, 2008). CMC via email may be inferior to face-to-face communication with regard to facilitation of transactive memory, while the effectiveness of telephone-based communication varies (see Ren & Argote, 2011). Trust in its various modalities may also play a role (Mitchell & Zigungs, 2009).

Collective Mind

The topics of memory, thinking and knowledge are related, as it is shown in the discussion on individual cognition in Chapter 2. The same applies to the group context. In his review of the literature dealing with “emergent knowledge structure” in groups, Walsh (1995) cited a number of terms used to refer to these phenomena, such as collective cognition map, team mental models, hypermap, dominant logic, negotiated belief structure, and inter-subjectivity.

Yoo (2001) studied experimentally *collective mind* in conjunction with *transactive memory* in the context of international teams with dispersed membership (also called “virtual teams”). *Collective mind* was conceptualized in terms of a socio-cognitive system in which group members heedfully interrelate their actions (Weick & Roberts, 1993). The experimental task spread over eight weeks and involved using a business game in which teams competed against each other and had to organize internally into standard business functions. The teams used email and a Web-accessible database supporting decision making and projects tasks. The researchers investigated collective mind through several variables—the extent to which members shared a perspective, the extent to which they made decisions aiming at maximizing overall team performance, the degree of interrelating individual actions, and how much they understood coordination among duties in the experimental task. Communication volume was also investigated.

One finding was that both *transactive memory* and *collective mind* had contributed to the teams’ performance. A collective mind was a condition for a transactive memory to develop. Team members communicated intensively about each other’s expertise. This helped to engender collective mind, one manifestation of which was that some team members exchanged roles to achieve an organization that better aligned project needs with the team members’ expertise. Other instances of collective mind included deliberate changes in decision making strategies and self-corrections in individual actions for the sake of improving team performance. Once collective mind morphed, it mediated influences of transactive memory on team performance. Collective mind was instrumental in connecting team members and coordinating their knowledge toward the common goal. The primary role of communication turned to be its support in developing transactive memory. The communication volume dropped in the performing stage of the teams’ cycle. For instance, members in successful teams rarely discussed their decisions once they understood how the task game worked.

People working in groups influence each other, and this mutual influence determines the content of ideas and possibly their range. This general finding has resulted from Nijstad and Stroebe’s (2006) research on modeling idea generation in individual and group brainstorming, and it can be considered a contribution to theorizing on collective mind. The authors have developed and tested a model called Search for Ideas in Associative Memory (SIAM). SIAM postulates that idea generation is a process of searching for ideas in associative memory, progressing through the steps of knowledge activation and idea production. For example, when facing a problem of attracting tourists to Amsterdam, previous knowledge is activated by retrieving an *image* “canal” with its features, such as “has bridges” and “has boats.” These

features are used to produce ideas to solve the problem (e.g., “decorate bridges”). The process continues until the image can trigger new ideas; then, a new image is retrieved. The process terminates when no new image is retrieved. (See Nijstad and Stroebe, 2006:193-194.) Through experiments in the group context, the authors established that ideas suggested by others aid the activation of problem-relevant knowledge. When attended to, the ideas of others serve as external cues that a person uses to probe own memory for new images. Cognitive uniformity may be an outcome of group brainstorming. Alternatively, when group members come up with very different ideas, the process can produce a wide range of ideas.

In addition to illuminating the critical relationship between individual and group levels in creating collective mind, this research contributes to the practice of facilitating GDSS sessions. The authors brand electronic brainstorming superior to the traditional mode because of avoiding process losses from turn taking and note taking. To realize benefits of group brainstorming, group members should be encouraged to pay attention to each other’s ideas, discouraged to engage in off-task discussion or explaining of ideas, and helped in distinguishing specific subcategories of a larger problem.

Perils of Group Perception and Thinking

In contrast to beneficial aspects of group work, certain downsides are extant. The initial zeal that came up with the group work initiative in the 1980s gave place to sobering realism: group work may deliver valuable results, but this does not happen inevitably. Groups are not perfect, and indeed it takes significant effort for a workgroup to perform well and deliver valuable results. It is not only an individualistic macrosocietal culture that can engender an inhospitable context for group work. Making this sort of work a success takes serious preparation and organizational changes. There are practical challenges of composing personalities and cognitive styles (see the chapter on *homo informaticus*), equitable division of labor, valuing works and rewards, and so on. In fact, the drawbacks have been known for quite some time. Elton Mayo, for example, found in his well-known studies at Western Electric that peer pressures within groups can attenuate individual performance. And there are also eminently cognitive drawbacks of loafing and groupthink, which are discussed below.

Cognitive Loafing

The phenomenon of social loafing or “free ride” has been detected in the group context. This potential downside of group work essentially means that some members may not put their equitable contribution to the group effort because they expect that others would compensate for the missing part. Social loafing can happen in any group task, including manual ones: tasks in teams assembling cars, for example. Cognitive loafing is part of social loafing, and it can be understood as the taking of a free ride in the domain of cognitive tasks. Evidence indicates that cognitive loafing tends to occur when groups deal with some tasks in the face-to-face context (e.g., Diehl & Stroebe, 1987; Harkins & Petty, 1982). Briefly, some members participate little in brainstorming unless their contribution is specifically recognized or if they do not believe that their contribution is crucial for the success of the group task. Cognitive loafing can also happen when IT is part of the group context.

Shepherd and colleagues (1995) studied the use of GDSS, intending to understand if cognitive loafing develops and, if it does, how could it be curbed? On the basis on their experiments with student subjects, the researchers identified occurrence of social loafing, which was associated with anonymity. This is the same feature of GDSS sessions that helps to equalize discussion opportunities and increase

the quantity and quality of session results. The researchers also found that changes in GDSS design in conjunction with facilitation are instrumental to reducing cognitive loafing. For example, the groups presented with a comparison of their own performance (the amount of new ideas brainstormed measured as the number of text lines) against the performance of a fictitious group performed better than groups with no such social comparison. This sort of feature can be implemented in various ways in a GDSS, and the facilitator needs to direct the group's attention to this comparison during the GDSS session. The facilitator alone can boost the brainstorming outcome by using vivid, jocular statements while calling attention to social comparison.

Therefore, cognitive loafing can be a side effect of electronic brainstorming, and this loafing can be reduced with methods of social comparison. Social comparison is managed by the session facilitator and can be technologically supported. For battling social loafing, it matters how technology is designed and used. It would be interesting to see if IT could help battle cognitive loafing as the phenomenon by comparing GDSS-supported groups with face-to-face groups, and by manipulating social comparison methods.

Groupthink

If everyone thinks the same, nobody may really think. Groups can be exposed to perils of thinking in resonance that could lead to sub-optimal outcomes, while being unaware of this. The concept of groupthink captures such a challenge. Groupthink refers to the propensity of groups to respond to interpersonal pressure in such a manner that group members' strivings for unanimity override their motivation to analyze alternative courses of action realistically (Janis, 1982). Thus, groupthink refers apparently to a problem in the group thinking: instead of thinking critically, individual members are pressed to conform to a mainstream thinking within a group. Groupthink usually results in poorer decisions. One should make a distinction between consensus as a result of groupthink and consensus that is a result of the democratic discussion and the proper evaluation of decision alternatives. Democratic consensus is natural and provides a balanced view of a group. Groupthink consensus is forced and biased toward a certain view within the group.

Groupthink can come into being because opinions of a strong leader (authoritarian, directive) influence other group members. Illustrations from the literature include some abortive moves in American foreign policy that were decided by certain presidents and their teams. Or one can think of the Abilene effect: a family is deliberating on how to spend Sunday, and then the father proposes a drive to Abilene—an option nobody really wanted but nobody opposed either. Groupthink is also caused by group perception: input data from the group's environment (the larger, host organization) is filtered out so that it fits the dominant thinking. In effect, this extreme in collective mind resembles a closed system. Homogeneity in worldviews ("ideologies") and loose procedures of data processing and decision making can contribute to it and its groupthink manifestation (see Janis, 1982). Janis's model also included the more classical behavioral dimension of group cohesion to which the author assigned the greatest weight. Evidence supports this modeling of groupthink.

The argument of Deutsch and Gerard (1955) that predated theorizing on groupthink is in agreement with the elaborated theorizing. The authors proposed and tested a construct of *informational social influence*, meaning "an influence to accept information obtained from another as evidence about reality" (p. 629). According to the authors, informational social influence usually accompanies pressures to conform to group norms (*normative social influence*). Therefore, a group member is pressed to both trust com-

munications of other group members and to behave according to group norms. Thus, taking for granted what is communicated by others as truthful evidence about reality is likely to facilitate groupthink. It is noteworthy that Deutsch and Gerard (*ibid.*) stipulated that the source of informational social influence can be computer, at least in research experiments (p. 635). The reader should keep in mind that this concept is different from the concepts of infopower which refers to an influence with historical stability (see Chapter 7). For the discussion in this chapter it is important to note that the connection between groupthink and filtering of environmental inputs makes groupthink a phenomenon of group perception and not only of group thinking.

Groups with directive leaders may generate fewer solutions and use fewer sources to get informed than do the groups with more participative leaders. Inappropriate decision making procedures in cohesive groups may lead to poorer decisions (Callaway & Esser, 1984). IT may reduce the perils of groupthink. Smilowitz et al. (1988) replicated Ash's classical experiment (which was conducted in the face-to-face context) with an IT-based modification. In their study, 45 college students judged the lengths of lines displayed on a computer screen. Through the same medium, they were continually informed on a judgment of a fictitious group. The members of the experimental group demonstrated considerable independence in estimating the length of the lines, because they did not comply significantly with the suggestions of the fictive group. This was a reversal of Ash's finding that group members yield to the opinion of the person who is physically present and speaks up – even if the opinion is wrong. Although this experiment did not directly address groupthink, it can be considered anecdotal evidence that IT could make a difference. But this is not always the case.

The experiment by Satzinger and associates (1999) using a GDSS delivered different findings. The researchers were interested to see whether the content of ideas presented by a fictitious subgroup would influence group members' brainstorming on improving the parking situation on campus. Although the authors couched their study in a specific framework of creativity and GDSS memory, the experiment can be considered a contribution to understanding conformity due to peer pressure, a basic groupthink aspect. The fictitious subgroup fed the shared discussion space with two types of proposals – conservative ("paradigm preserving") and progressive ("paradigm modifying"). The study found that the external impact of the fictitious group had an effect, since groups generated ideas consistent with the type of proposal.

Shaila and Saunders (1995) addressed directly the issues of groupthink in the GDSS context, and provided evidence in line with Smilowitz and associates (1988). The authors conducted an experiment with groups using a GDSS (VisionQuest). Each experimental group used a different type of task. One was choice making task ("intellective task"—one of three software vendors had to be selected based on certain criteria), and the other was judgmental (subjective assessments based on values and potentially involving cognitive conflict in the course of solving an ethical dilemma). The categorization of the tasks was based on McGrath's (1984) framework. The authors investigated whether the use of GDSS is related to the use of external data, the number of alternative solutions considered in the decision making process, and the quality of decisions as compared to the baseline no-GDSS groups. They found that the GDSS-supported group indeed used more of external data (the system allowed for online access to it) and considered more alternative solutions. Therefore, GDSS helped prevent causes of groupthink in the domain of perception. It is interesting that the GDSS group spent less time on discussing alternative solutions. The authors were unsure if this was due a higher efficiency of the group or because of a premature closure of the discussion. With regard to the quality of decisions, the GDSS group performed better on the judgmental task, while the classical group performed better on the intellective task. In some contexts, judgmental tasks are more susceptible to groupthink (Whyte, 1989). This experimental study,

thus, provides a piece of evidence on the capability of GDSS-supported groups to circumvent the usual sources of groupthink on tasks that are likely to invoke groupthink. A clarification on the antecedents and effects of the shorter time for discussing decision options is needed.

GROUP SUPPORT SYSTEMS

A surge of interest in group support systems (GSS) coincided with the introduction of group work in management literature. (Sometimes, “groupware” is used synonymously with GSS.) The important professional conference on computer supported cooperative work (CSCW) started in 1987 and it helped the evolution of a viable community of researchers and practitioners interested in social and technological aspects of work groups and group work. IT for electronic communication (email, electronic bulletin boards, etc.) pioneered in the role of group technology. Plain text email or email with enriched functionality (e.g., email with predefined templates that were supposed to channel communication and model social relationships) were studied as enablers of group communication and work. Provided the assumption that a group must have at least three members (Fjermest & Hiltz, 1998-99), these systems have been studied under the rubric of computer mediated communication systems (CMCS).

The next entrant was group decision support systems (GDSS). These systems have supported idea generation in groups and other cognitive tasks that are involved in problem solving and decision making. Systems for supporting workflow were another kind of group systems that hit the marketplace and the researcher’s and consultant’s desk. These had been implemented in the off-the shelf software, such as Notestm (formerly Lotus Notes, the first commercial groupware that supported private email, electronic bulletin boards, and file sharing). Notes-based systems attracted considerable research interest. Interest in distributed groups arising in the late 1990s shifted attention back to CMCS. The discussion that follows will address each of these in turn.

Group Decision Support Systems: Good, OK, Unexpected

Since its inception in the late 1980s, research on GDSS created a proliferate mini-field of study, reaching a peak by the mid-1990s. Although “GSS” has been often used more recently, “GDSS” will be preferred in this discussion in order to preserve semantic clarity, which is based on the common functionality-based categorization of systems for groups mentioned above. Much of GDSS research evolved around the GroupSystemstm software by Ventana Corporation that went through several generations of technology (e.g., flat files and DOS operating system, a Windows-based edition, and then a client-server and Web based design). Another much studied system is SAMMS, which originated at University of Minnesota. These two universities have made a mark in terms of academic research on GDSS, while IBM, Boeing, and the U.S. Army have been among the biggest adopters of this technology.

In order to understand GDSS, one may think of more traditional techniques of brainstorming and nominal group technique. In a brainstorming session, participants strive to come up with a large number of ideas without paying much attention to their consistency, profoundness or other characteristics of quality. The nominal group technique makes individuals write their thoughts on a subject on a large piece of paper and then display these to be discussed by the whole group. But the analogy has limits. In a typical GDSS session, group members use GDSS software and hardware within a dedicated space and time and with help of a facilitator. Technology possesses certain capabilities and limitations. As an

illustration of these, here is a description of the system called Software Aided Meeting Management system (SAMMS), which was used in one of experimental studies discussed below (Poole et al., 1991). The functionality of SAMMS supports (1) brainstorming (entering ideas privately prior to their public display); (2) a structured set of activities for the group to utilize; (3) voting facilities (preference weighting, ranking, etc.); (4) electronic input and display of ideas by each participant in an anonymous manner; and (5) public and private screen displays (Pool et al., 1991). One should also note that this is a same place/same design and a Type I system (supports brainstorming and some structuring of decision group processes; in contrast, Type II systems support various decision making models, while with Type III systems an expert system guides decision making; see, DeSanctis & Gallupe (1987).

GDSS technology poses a challenge to untrained participants. Beyond that, its deployment can give various results, sometimes quite unexpected. Part of the puzzle is the complexity of GDSS: combining modules in different ways results in different systems; the GDSS technology can be used (adopted and adapted) in different ways; the same GDSS can be used for different tasks, and so delivering different results; and the process of facilitation of a GDSS sessions can play a significant role, and so can a lack of facilitation. All this can affect meeting outcomes.

Group members supported by GDSS may have a history of working together (an intact group) or they can be strangers gathered just for that occasion (an ad hoc group). Group members are given a task and instructed to brainstorm on it individually rather than as a group (a nominal group). Group members type their contributions at individual computer stations that are connected into a local area network. No group member sees what others are typing. This is the first key feature of GDSS – the principle of anonymity. Once the brainstorm step is complete, individual contributions are displayed in a shared space (e.g., on a large white screen and on individual stations). Again, authorship is not identified. Then, some sort of analysis is implemented in order to organize ideas (e.g., a simple, common sense comparison of similarities and differences can lead to a categorization of ideas). An outcome of this step is a smaller number of ideas. These can further be prioritized and even more “collapsed” through a consensus or majority vote-based decision making. This analytical step is characterized as *convergence* as opposed to *divergence* that marks the idea generation step. Additional processing is possible, depending on the task at hand; for example, if the group created guidelines for a mid-range plan, then action steps toward the plan can be discussed next. In the process, different system modules can be used that support various specific tasks. The principle of *anonymity* in the discussion is commonly considered a major design feature of GDSS. Anonymity can facilitate the social space for *more equal participation* in the discussion because power differences cease to be an obstacle to participation. Consequently, people can express their opinions more frankly and be more objective since they focus more on ideas than persons.

GDSS technology makes it possible for individual group members to enter their opinions at the same time, that is, in a *parallel* fashion. This is different from the way the discussion is conducted in a face-to-face meeting, where turn-taking must be sequential. A possible effect is *more equal participation*. If t is discussion time and N the number of members in a group, then each member has t available for the discussion rather than the limited t/N available in the sequential mode. Anonymity can help here as well by removing *evaluation apprehension* – the reluctance to disagree with those in authority or to risk the ridicule of peers (see Shepherd et al., 1995). Both anonymity and equal participation are considered the basis of beneficial outcomes from GDSS – see Table 2 (Dennis et al., 1988; Nunamaker et al., 1993, 1996/7). These potentialities have materialized to some extent, although evidence paints somewhat a more complex picture (see the discussion below).

Getting back to the analogy with the nominal group technique, similarities run from the basic setup mentioned above to the features of anonymity and parallel work. However, GDSS software automates manual tasks and introduces new tasks and capabilities. For example, GDSS technology includes capabilities for group writing, smooth access to documents in electronic form, data transfer, communication, automated voting, decision modeling, etc. The ease with which one can toggle between or keep mixing the anonymous and personalized mode of discussion also differentiates GDSS from the nominal group technique. And each module of a GDSS can interact with the social context in various ways, which introduces another layer of differences and complexity.

Outcomes from GDSS

Efforts to understand issues of GDSS uses and outcomes generated a separate, prolific mini-field of study. Summaries of findings and research directions have been periodically made (for example, Benbasat & Lim, 1993; Fjermestad & Hiltz, 1998-99; Nunamaker et al., 1996/7; Valacich & Jessup, 1993). The mainstream GDSS research has been based on experimental design using ad hoc groups of student subjects; the same time/same place model (“decision room”) is usually deployed. Tasks in the laboratory setting simulate brainstorming on various issues and solving problems, which vary in terms of structure. Field research in real world organizations makes a much smaller segment of GDSS research. Tasks include brainstorming on planning issues, policy evaluation, generating ideas for policymaking, conflict resolution, etc. Experimental design follows standard logic for this sort of research. An experimental group uses GDSS technology while working on a task; a control group (the baseline, group) does not use GDSS but works in the face-to-face mode on the same task. The entire process is the subject of investigation, with input, process and output components. Specific input aspects investigated include task complexity, structure degree, and user dimensions. The process aspects investigated include anonymity, facilitation modes, timing, participation degree, consensus process, modes of discussion, attitudes toward GDSS, the demonstrated use of GDSS, information overload, cognitive loafing, and groupthink. The output aspects investigated include the time for making decisions and reaching consensus, number of ideas generated, quality of ideas and decisions, consensus characteristics, and members’ satisfaction.

GDSS research in the real world organizations shows more variation and creativity. The go/no-go choices that are familiar in individual decision making may not always be the outcome of a GDSS session: GDSS technology proved to be more suitable to unstructured problems. This fact, then, derails the phases of the typical rational decision making model—the problem definition, intelligence gathering, defining alternative solutions, comparing the alternatives, implementing the highest ranked one, and conducting a post-implementation evaluation. In contrast to the laboratory tasks, the range of tasks in real organizations tends to be more balanced, encompassing both simpler tasks (brainstorming) and more complex ones (planning and policy making). For example, this author found that a rental GDSS facility used by users from government, education and business have often ended GDSS sessions with some form of a statement, a list of priorities or a planning document (Travica, 1998). Table 2 summarizes outcomes of GDSS sessions in both laboratory and field applications. Field studies of GDSS at IBM and Boeing discovered efficiency gains. Specifically, in project teams using GDSS labor costs were halved while the overall project time was reduced up to 90% (Nunamaker et al., 1996/7: 174-5). Other studies have also found the association between use of GDSS and a reduction of meeting time (Fjermestad & Hiltz, 1998-99: 58). However, laboratory findings are not as conclusive. Summarizing findings from 135 experiments in which 1,029 hypotheses were tested, Fjermestad and Hiltz (1998-99) detected that

in 17% of cases, GDSS groups took longer to come to a decision than face-to-face groups. Findings on decision quality are even less conclusive. Fjermestad and Hiltz (1998-99) identified higher effectiveness of GDSS groups over baseline groups in 21% of the sample of experiments they reviewed.

Anonymity can play a role in making people more frank, critical, and focused on ideas rather than persons. Still, anonymity should be managed rather than unconditional, as discussed below. Also, criticism may lead to better discussion and decisions, and variation in modes of discussion might improve session outcomes. For example, it was experimentally found that a dialectical discussion (a debate-like defense of opposing positions) is associated with a higher quality outcome than the discussion based on either consensus or devil's advocacy (revising a decision through repeated criticism, and reaching mutual acceptance) (Tung & Heminger, 1993). But the real boost for group performance comes indeed from facilitation: to be precise, not just any facilitation, but a good one (more discussion is below). Other benefits associated with using GDSS include user satisfaction with the session/outcomes as well as increased buy-in of decisions. It is interesting that user satisfaction is almost a standard accompaniment of session outcomes. However, it is not clear what precipitates user satisfaction. There may be a feeling of satisfaction stemming from group work as such, satisfaction related to using GDSS technology, satisfaction of using a "new toy" regardless its task-related value, some mix of these, or even something different. This is uncertain particularly given the demonstrated tendency of GDSS users to overestimate productivity. Social comparison processes may take place among group members, so that a member believes that her own work is more productive than if she were working alone because she takes credit for the work output of other members and/or the whole group. In factuality, however, the output of individual brainstorming is usually larger. (See Paulus et al., 1993) Indeed, experiments with GDSS typically use comparisons between groups only—GDSS-supported versus not supported groups. Also, a higher quality of decisions elicited by critical remarks may be inversely related to user satisfaction (Bikson, 1996). It may be that user satisfaction may be more important for GDSS adoption than for group performance. In addition, the greater buy-in of decisions occurs in classical groups as well, and so it is merely replicated with GDSS. Subjective estimates of greater buy-in found in GDSS experiments, therefore, need to be complemented by follow-up assessments to prove credibility.

Conflict management and resolution is one of more complicated tasks that have not been attempted often in the experimental situation. It can be considered a special case of "group reasoning or judgment." Poole and colleagues (1991) studied this sort of task and found that GDSS can help "bring order" into conflict management (see Table 2). Specifically, the authors compared a group using the GDSS product called Software Aided Meeting Management system (SAMMS; described above) with both a group using a manual version of the same decision making procedures built into SAMMS (the manual group) and a baseline group (no specific procedure imposed). The task was to allocate a charitable foundation's budget among six competing projects that could stir up conflict because of different preferences of individual group members (this type of task is sometimes called "Foundation Task").

Poole and colleagues (1991) discovered differences in the level of conflict in the GDSS group as opposed to the others. The GDSS group was less likely to engage in high conflict. The authors (ibid.) attribute this fact to "the structure built into the system," and "bringing order to sessions." For instance, SAMMS-supported group members were focused more on written materials, developed somewhat depersonalized relationships that defused conflict, and showed that decision-making procedures had more salience for them. In general, "structure" (decision procedures supported by SAMMS) brought more order to the SAMMS group. Technology also made decision procedures "more salient" via the features of private and public screens, the computational support provided by the computer, and the electronic

communication channels (*ibid.*, p. 933, 948, 950). The manual group started with a low key conflict, engaged in hard bargaining and ended up in a consensus.

Both the GDSS and baseline group aired interests and open opposition between members that had to be tempered with negotiations and some conflict avoidance behaviors to be eventually effective. The GDSS group members discussed their conflict management process more than the other two groups. Therefore, it appears that the group technology made a difference in conflict resolution. Still, the manual group was effective and exhibited the greatest shift toward consensus. This is to be attributed to the “procedural structure” the group drew on. This indicates that it is the group decision process that is responsible for the differences across groups rather than the system itself. This is consistent with the authors’ position, since they believe that GDSS can be used (adopted or “appropriated”) in various ways.

Another indication of the process impact is in the differences between GDSS users. The actual research design which Poole and colleagues (1991) deployed included a number of groups for each of the three types studied. There were 13 groups supported by SAMMS; six of them were more effective and seven were less effective in handling the conflict-ridden foundation task. Seeking to get informed in a non-confrontational manner, expressions of supportiveness, and demonstration of a desire for reconciliation characterized the effective groups. The less effective GDSS groups would make jokes about GDSS and so avoid dealing with the conflict. They would also deny that a conflict existed, make noncommittal remarks, keep on switching topics, or make hostile remarks and plain statements of disagreement. Again, the differences are interpreted by different ways of adopting the group technology.

From the IVO perspective, this study exhibits several interesting points. It captures well the complexity of GDSS use and the resulting variation in outcomes of the GDSS session. The authors looked at GDSS technology as a material thing with tangible functionality, which could facilitate social order.¹ Still, they escaped technological determinism: GDSS’ functionality may be used as given, or with alteration, or not used at all. On the other side, although we are reminded that conflict management is a process (Poole et al., 1991: 928), this premise did not make it clearly into the formulation of findings. IVO posits that decision making is an infoprocess containing both structure and action elements. While the structural component (decision procedures) stands out in analysis, the action component is rather obscured under the rubric of “group/social dynamics.” Indications of action of group members can indeed be found both in different uses of GDSS technology and in conflict management behaviors (GDSS users would shorten a discussion by resorting to voting; there were expressions of mutual supportiveness among GDSS users; and there were jokes about GDSS as a deliberate activity of avoiding conflict). This study is also interesting as application of the ontological assumptions underlying adaptive structuration theory (AST) (Poole & DeSanctis, 1990).

Bikson (1996) investigated the case of GDSS at The World Bank. Her study confirmed that GDSS could lead to a more open expression of opinions and unintended learning effects. The World Bank implemented a GDSS in order to improve its numerous meetings that cost millions of dollars monthly. This organization is one of a kind, a non-profit bank founded by a number of countries. The member countries purchase stakeholder shares and provide part of funds, while another part is borrowed in the financial market. The funds are allocated through loans for investment projects. The process of deciding on loans and the performance of the loans are two important aspects of the Bank’s operations. A bureaucratic structure and intense politics play a big part in both the strategic and operational domain of the Bank. The Bank implemented the GroupSystems™ product. At the time of data collection for Bikson’s study, savings on time spent in meetings and on subsequent report preparation time have already accrued from using the GDSS (*ibid.*, p. 147).

Table 2. Outcomes associated with use of GDSS

Outcome	Description
Increased productivity in brainstorm (field)	- Discussion in parallel fashion, anonymity and facilitation methods help remove obstacles typical for face-to-face discussion. Decisions can be reached faster than in classical meetings. - Measures: time to reach decision, the amount of documents generated, number of alternative solutions examined, etc.
Improvement in quality of ideas and decisions	- Anonymity and criticism focused on ideas can lead to improvements in quality of ideas and decisions. - Anonymity, facilitation and variation in discussion modes may result in more openness and better ideas. - Measures: quality of ideas generated, quality of decisions, etc.
User satisfaction, Decision buy-in	- Satisfaction with process, outcome, overall. - Measures: Self-reported.
Bringing Order to Difficult Tasks	- Conflict management facilitated through decision procedures made salient with GDSS.
Learning	Group interaction provides opportunities for learning about opinions of others.

The Bank's system was most frequently used for brainstorming (including generating the material for other meetings), focus groups, evaluation of the Bank's programs, decision making, and planning. It is interesting that decision making made just a small percentage of the sessions, while focus groups—unaccounted in the mainstream GDSS research—were a much more frequent way of using GDSS. The limited use of the GDSS in decision making had to do with the structure and culture of the host organization. While experts could use GDSS, managers had real power in decision making. This fact reduced motivation on the expert side. But when experts made decisions with the GDSS, a particular cultural belief may have intervened: the voice of each expert did *not* have the same weight. This had repercussions for anonymity and its usefulness. The culture also made the decision making process “extremely thick”, “dense” and hard to break down (ibid. 168-169). In addition, the GDSS users valued the quality of decisions over the speed of decision making. These findings are also interesting from the perspective of contrasting case research with laboratory experimental research.²

If the value of The World Bank's GDSS was limited in the decision making area, more beneficial effects emerged in some unexpected areas. Bikson (1996) termed one as “breaking of a conspiracy of silence.” In GDSS sessions, people were able to say the unsayable, to express critical remarks that would have gone unspoken in face-to-face meetings. No matter how sensitive an issue could be, displaying it on a shared screen would give it legitimacy. This improved the quality of ideas on which subsequent decisions could be based. The capability of anonymity proved a value in this instance of GDSS use. It helped with another non-decision making task as well. The GDSS was deployed to follow-up attitude surveys that the Bank periodically employed as part of assessing organizational performance. Via anonymous communication supported by GDSS, the employees discussed survey findings. This led to a discussion, which would eventually provide guidelines for management.

Anonymity

Anonymity is a socio-technical capability associated with GDSS products. It has been learned from GDSS research and experience that anonymity should be treated as a matter of scale rather than a discrete yes/no choice. In other words, it should be managed. Fjermestad & Hiltz (1998-99) report that both anonymity

and identified participation matter: in 19% of hypotheses testing cases, the identified participation produced positive effects as opposed to 17% of cases showing that such effects are associated with anonymity (rounded numbers are used). Sometimes, it is useful to have an absolute anonymity. In a GDSS session of members of a firm engaged in producing medical technology, the company's founder got angered by an anonymous comment. The comment pointed to a problem with the interface of a system under development. The angry founder pounded his PC and called for the author to get self-identified—alas, in vain. After some investigation, he returned to the group admitting his ignorance about the problem. (Nunamaker et al., 1996/7) At other times, anonymity should be limited. For example, it may be important to clarify authorship of an idea in order to get a clarification or expansion from the author. Aliases can be used for individuals or names for subgroups as another way of fine-tuning anonymity.

Anonymity can be reduced inadvertently. There can be many ways of breaching anonymity. This author witnessed a GDSS session in which an executive brought his secretary to the decision room, and tried to convince the facilitator that the secretary was necessary because he could not type. The facilitator did not yield, and the executive eventually typed by himself. However, his typing speed and style did not fit smoothly in the flow of the session. For example, the executive would continue his two-finger, slow typing even when all others would finish, and this detail would reveal the last comment arriving to the shared white screen was from him. If the typing speed had a correlation with age and hierarchy in this case, other factors impinged on anonymity in international student teams this author taught. For example, certain grammatical errors would identify a group of non-native English speakers. Yet another inadvertent breach of anonymity can happen with intact groups in the student or professional context when group members are able to recognize each other's writing styles.

Anonymity may not be desirable in highly politicized organizations, as convincingly argued by Bikson (1996) in the previous section. Another instance concerns members of a project team in manufacturing companies, who often need to openly contribute a special set of skills and expertise required for a specific project component (Gillenwater et al., 1995). Although anonymity is a technological capability of GDSS products, the examples above show that its scaling—either intentional or unintentional—is mediated by the human factor. The facilitator in a GDSS session and group members modify anonymity as the technological feature. Therefore, it is the interaction between technological and social dimensions in a GDSS socio-technical system that regulates anonymity.

Facilitation

Much of experimental GDSS research was conducted with no facilitation (Fjermestad & Hiltz, 1998-99). This fact may be partially responsible for session results. In contrast, a number of researchers conducting systematic study of GDSS have pointed out that facilitation is important (Bostrom et al., 1993; Chidambaram, & Jones, 1993; Shepherd et al., 1995). Facilitation is an important component of the use of GDSS, because it is the social process through and by which group's informing agents can be shaped in this or that direction. More formally, facilitation refers to a set of activities carried out before, during and after the GDSS session, in order to help the user group to achieve its own outcomes (Bostrom et al., 1993). Facilitation is conducted by the facilitator (sometimes called chauffeur). The facilitator leader exercise various levels of leadership, inclusive of instructing decisions makers (the users) on using GDSS software, deciding what needs to be done and when, guiding the users' discussion, deciding if the screens at individual computer stations will be private or shared, timing session steps, and managing opinion conflicts. Indeed, there are two roles – social and technical facilitator. The same person carry

both of these or each role can be allocated to a different person. The focus here on the social facilitator (“facilitator” in further discussion).

A facilitator can be an outsider to the group and its home organization, a professional specialized for facilitation. Alternatively, the facilitator can be an insider. Facilitation happens throughout a GDSS session. Therefore, the facilitator is in the position to influence all informing activities and the corresponding decision making steps (the group thinking process). This influence reflects downstream on the group performance as evidence shows. The facilitator intervenes in group learning as well. The discussion on cognitive loafing in this chapter demonstrates that even small interventions of the facilitator could have a significant impact on the creation of data and meaning (Shepherd et al., 1995). Bostrom and associates (1993) shared such a conviction and proposed a framework for studying facilitation in a broad fashion that included facilitation capabilities of software as well as people. Summarizing findings from over 900 GDSS sessions at IBM, McGeoff and Ambrose (1991) concluded that the quality of GDSS sessions has predominantly depended on the quality of facilitation. DeSanctis & Poole (1994) posited that the facilitator could influence group members’ attitudes and behavior, the agenda, the structure of the meeting, the definition of group task, the use of GSS technology, and the use of the meeting space. Similarly, in a meta-analysis of comments of users of GDSS facility, Davenport and Travica (1995) found that facilitation was crucial for user satisfaction with GDSS sessions, while their criticism targeted “overweening facilitation,” which coincided with the users’ feeling of “being forced to consensus.”

Nunamaker and associates (1996/7) warned that that the facilitator’s choice of words made big differences in group dynamics; also influential were nuances in the setup of GDSS modules. Early GDSS research detected that facilitators’ fatigue and biases could influence GDSS sessions. Anson and colleagues (1995) added personality, knowledge and facilitation style to the list of factors. They also found that poor facilitation is associated with group efficacy that is equal to efficacy of a group without facilitation. Findings of Niederman and colleagues (1996) concurred. Thirty-seven facilitators they interviewed concurred that facilitation was critical for the meeting success, and particularly in driving the focus on task, group members’ participation, and avoiding dysfunction. It is interesting that the facilitators placed technology in the background. Neither was it a critical for success of meetings nor it made a difference for the critical facilitation skills. All in all, facilitation as the social process makes a significant difference in using GDSS. The reminder of the section consolidated this argument by drilling more down into the facilitators’ view.

Travica (1998) studied three facilitators that worked in a GDSS facility, which was a unit of a larger public institution. The GDSS facility used the GroupSystems™ product, and sold GDSS service to various internal and external user groups, mostly of the intact type. One facilitator had six years of GDSS experience, another five years, and the third five months. The study methods involved iterative interviewing and observing GDSS sessions. Findings of the study represent categories capturing facilitators’ thinking and behavior in apposition to GDSS users. These will be commonly called *modes of imposing facilitation*.

Framing Users. The facilitators studied characterized users GDSS users as “passive,” “active,” and “dominant” as the variant of “active”. Facilitators had dealt mostly with “active users.” The active user “participate actively,” “are vested in the process,” “are very interested in doing a good job,” and “take ownership of ideas.” In contrast, “passive user” “just sit back,” “are disengaged,” “are not vested,” “are happy when someone else takes control,” “enjoy being called on,” “do not speak up for their ideas,” “are unsure what to do or say,” and “are disinterested because they are powerless outside the GDSS room.” Finally, “dominant users” “show patterns of domination,” “give push to other users and facilitators,”

and “enjoy leading.” The facilitators interviewed have shown preference for the active user and aversion for the passive and dominant user.

Pulling/Pushing Users. Mostly when dealing with passive or dominant users, facilitators described their actions using a local lingo. So the facilitators had to “twist user arms,” “pull the users all the time,” “push the users,” “gets brain dump from users,” and “peak over users’ shoulders to figure what’s going on.”

Succumbing to Group Dynamics. Users can shape the behavior of facilitators against their will in several cases: (a) when users belong to the dominant or passive kind; (b) when users come into the GDSS room in unexpected numbers; (d) when users demand changes in session design right prior to the session; (e) when users create difficulties in terms of group composition; and (f) when users form cliques. On the facilitator side, these stimuli can create surprise, which appears to be particularly detrimental if it happens early in a GDSS session. Both the facilitator’s motivation and the ability to make sense of the session process can be affected. ***The Clicking vs. Difficult Experiences.*** Sometimes, facilitators and users could form a coherent group. A prolonged session with overnight stay created a favorable situation for the two sides to socialize outside the GDSS room. Exchanges on the personal basis happened, resulting in narrowing the institutional gap between users and facilitators. This social episode could have consequences on the next GDSS sessions. As one facilitator explained: “The next morning I felt more like a user than like an outside consultant. I was not locked into the process, did not worry much about the agenda. I listened to the group and tried to adapt myself to the changing situation.” This episode was described as the session that “clicks well.” The opposite case was described as “complex session experience.” The challenges included a sizable and divided user group, appearance of user cliques, and facing both dominant and passive users. The facilitators felt as not being in control, while the users felt—as revealed in the post-session evaluation—that time was wasted, the facilitators rushed them, and they got less than they expected.

Sense Making Challenge. At occasion, our facilitators had problems with making sense of the developments in the decision making room. As one of them put it: “It is very hard to even generalize what’s happening in decision making processes as the meeting is flowing. Sometimes it [the agenda and GDSS technology] works, but at other time it either doesn’t go as well or it changes drastically but fortunately.”

Coping with Accidents. Random events can occur in GDSS sessions. “A lot of things in the GDSS session are accidents” – said the most experienced facilitator interviewed. For example, the order in which users arrived at one session and so were seated appeared to have had consequences on power dynamics in that session. Another example is facilitator’s “brainstorms, accidental ideas on altering the planned use of GDSS technology. The results often were something the facilitators did not expect. ***Managing Anonymity.*** Anonymity had been manipulated according to the facilitators’ ideas. As they put it: “A session can be as anonymous as you want it to be.” Sometimes, the facilitators created subgroups that worked on shared single computer stations. Users would reduce also break anonymity by claiming ownership over ideas when the classical discussion without GDSS would start. But they would also work backward to re-institute anonymity: the items over which no one claimed ownership in face-to-face discussion would get resubmitted once the session returned to the anonymous mode.

Imposing Consensus. The facilitators practiced pushing users into making consensus as the final outcome of the GDSS session. They often mentioned that their ultimate goal was “to get the users to reach consensus and make them happy.” The consensus goal and the interpretation of user happiness reflect the culture of the GDSS facility.

The categories above reveal the facilitator’s active involvement in relations with GDSS users. Facilitators labor, cognize, cope, control, impose... Unabashed power springs from their action, making this

facilitation imposing in character. Modes of imposing facilitation contribute to explaining the complexity of GDSS workings. The decisive role of facilitators may be understood in terms of communicative influence. If GDSS becomes a standard part of group decision making, this influence may metamorphose into infopower, the forms of expert power and meaning management. Another message from the discussion in this section has a more general significance: the centrality of facilitation and facilitator-user interaction in an act of using of using GDSS modifies the traditional concept of IS that does not include system users within the system boundary. The discussion clearly shows that both the facilitator and users are *in* the system as its components along with IT. Even with a higher level of automation that pushes users outside the system boundary (say by moving decision making steps into software), the facilitator remains within the GDSS, unless facilitation is an auto-pilot function.

Group Support Systems for Production: Hope Helps Cope

Apart from brainstorming and decision making, GSS have been used for supporting collaboration in a broader sense—work flow, specific tasks and processes, and so on. Investigations have focused on the Notestm product and some home-grown systems, although there exists a plethora of GSS.³

Failla (1996) investigated Configuration Management Version Control System (CMVCS) deployed in an IBM facility in Rome, Italy. The purpose of the CMVS was to help programmers keep track of who is doing what, what version of each software module is being worked on, who works on particular versions, what code still needs revisions, etc. The system also managed authorized access to the code and had a number of notification and other procedures automated. Reporting was another important function and it applied to overall project management, quality control, documenting the development phases, and auditing. The heart of the CMVCS was a database managed by a database administrator. Within the database, there were segments related to particular software under development. Each segment was managed by a “family administrator.” Each family consisted of teams of software developers, and each team had a coordinator. Teams were collocated and distributed. The use of the database was based on rules that were gradually developed. This elaborate infostructure developed through negotiations of all these players over time. It is interesting that the CMVCS was not intended to be a GSS. Databases and the tracking/notification/reporting technology could be used for individual work, and such a perception indeed was detected at the time of study. However, the negotiated development of access and use rules and everyday work practiced by teams and “families” turned the CMVCS into a GSS. As one developers put it,

The CMVCS is a tool, which links up designers, developers and the people who maintain and test the product... This database is a point of reference for all of us in every aspect of our work. (...) There are different development groups all over the world. There are colleagues in Brazil or in Japan who work with us, and it is the CMVCS that allows us to work together over such great distances. (Failla, 1996: 79)

Therefore, the CMVCS could be understood as a system that has opportunistically evolved into a GSS. There were different user groups of the CMVCS that precipitated this metamorphosis through their negotiation and work-related interactions.

In contrast to the above case of evolving a system toward group purposes, the following case demonstrates that such an opportunity was rather missed. Ciborra (1996) studied the system called MedNet, a corporate-wide distributed repository of product data used at Hoffman-La Roche, a multinational

pharmaceutical company located in Switzerland (Roche, in further discussion). MedNet was initially envisioned in the mid-1980s as strategic systems enabling marketing documentation to be communicated from the headquarters in Basel to local companies and further to their customers – physicians. An extension of the system was then planned to include patients of the physicians. A curious detail is that MedNet was championed by the Marketing function, thus bypassing the corporate IT function. The system was expected to improve data flows on products under development and clinical trials of drugs, and circulation of scientific literature. The clinical trial reports were supposed to improve coordination of clinical trials and thereby help eliminate duplication of work and unnecessary costs.

For customers, MedNet was expected to improve delivery of product documentation, including drug safety aspects. The system was rolled out in 1991 and coupled with the company's network, and soon there were hundreds of users across 34 countries. In addition to the core database, MedNet included data retrieval functionality and even an email module. Although MedNet was not conceived as a system for supporting teamwork, the capabilities of sharing important data resources coupled with corporate-wide email had a potential to facilitate collaborative work. However, MedNet did not develop into a groupware and even its main modules—the product database and the database of clinical trials—never attracted a notable individual user base.

Ciborra (1996) points out that the main obstacle for MedNet was the bureaucratic design of the company. It had been a large bureaucracy with a hybrid of centralized and silo-like data management (rigid infocentralization along divisional lines). Infocentralization is reflected in centralized databases built into MedNet, while the silo model prevents documentation on critical trials from flowing steadily from the Critical Trials division to MedNet, managed by the Marketing division. Users outside headquarters have often felt frustrated with MedNet's content and service, but they had no leverage for changing anything in the system. Instead, some branches began developing their own databases that would serve local informing needs better. Another problem was the prolonged development time. Technological progress in the 1990s has turned obsolete what was advanced technology a decade ago. The slow development was partially caused by the lack of technical competence on the side of the Marketing division that forced it to seek risky outsourcing solutions. The outcome was paradoxical: started in revolt to centralized IT management exercised by the corporate IT function, MedNet became another example of the same (although now with Marketing in the driver's seat). The chance of promoting collaborative work in marketing across the company was missed. In the meantime, the corporate IT function started promoting groupware.

Orlikowski (1996) studied teamwork supported by a system implemented in Notes™. This system was located in a software company in the Midwest of the United States. The author focused on a help desk, which served external customers. The system was called Incident Tracking Support System (ITSS), and it was supposed to capture the call, problem description, steps taken in searching for a solution, and the solution itself. Thus, the entire incident history could be recorded. The study discovered that new work practices evolved using ITSS, some of which were not expected. In particular, the process of properly documenting episodes of solving customers' problems was worked out, and it became a standard with cultural underpinnings (see the discussion on this study in the chapter on infoculture). An unexpected outcome was that the management's initiative of instituting teamwork did not work out as originally conceived. The problem-solving work was supposed to be shared between front-line and back-line specialists; the former ones would take the customer's request and try to solve it. If they needed help, they were supposed to contact the back-line electronically. However, communication flows between two sides never came to life as expected, since the front-liners were reluctant to engage the senior colleagues.

The front-back line collaboration problem was corrected by inventing a new role of intermediary. The intermediary was a liaison between the two lines: he monitored a few front-liners and shifted a task to the back-line upon realizing that the front-liner was overloaded. Another unexpected outcome concerned a serendipitous utilization of IT by managers. They discovered that the system used for tracking clients' calls could also be used for online monitoring of the help desk staff. After initial hurdles, such a practice was indeed institutionalized. Furthermore, the specialists started sharing knowledge across the firm. This amounted to decentralizing new knowledge and instances of group and organizational learning. Moreover, the specialists and managers realized that rules of controlling access to new knowledge bases had to be introduced. Without this, it had been too easy to extrapolate old solutions to new problems, even if such inferring would be inappropriate.

All the changes associated with these home-grown groupware are opportunistic, spontaneous and unexpected, even though some changes have been desirable. The open-ended character of this technology (Weick, 1990; Orlikowski, 1992) gives a character of emergent changes in organizational developments associated with the use of technology. As we saw, unexpected emergent changes happen with GDSS as well. In the case of home-grown groupware, it appears that hoping that things will go as expected helps coping with the random way things eventually go. Chance is the only certainty. Improvisational mutual adjustments of the social and the technical lead to a state of equilibrium—for the time being. We can live with chance as long as it gives birth to the good. Or, do we have any other choice? Let us see if the theme of distributed groups and pertinent informing agents suggests any new answer.

DISTRIBUTED GROUPS AND INFORMING AGENTS

In the time of globalizing business operations, work groups (teams) are becoming increasingly distributed (dispersed). Teams with distributed membership are sometimes called “virtual teams”, but we will save this term for the special organizational design that exhibits other characteristics in addition to spatial dispersion. To contrast distributed teams with classical ones, the latter are sometimes called “collocated teams” (Table 1).

In the global environment, the spatial dispersion of the team members can also be accompanied with time differences because of time zones. In a way, contemporary work groups are breaking the Shakespearean principle of tightly coupled space and sequential time of the actors' environment. Instead, they re-introduce the “chaotic” model of antic Greek drama, where the time can flow back and forth and places can be randomly mixed in the same or different times. Does this breakup of the space and time bounds make a difference? A brief answer is—yes, some. And this “some” is perhaps less than conventional wisdom would expect. IT for supporting distributed groups has a history that is both short and long. If one looks at systems like videoconferencing and distributed GDSS (DGDSS), the history appears to be shorter than if one considers multipurpose systems with communication capabilities dating back to the 1970s (Turoff et al., 1993). At any rate, distributed groups and their technology are a topic with lasting relevance due to economic globalization and advances in telecommunications technology epitomized by wireless networks and mobile devices.

How do brainstorming and decision making look from the perspective of DGDSS? Chidambaram and Jones (1993) studied relationships between collocated and distributed groups: of the collocated group one used no IT (the baseline group), while the other used a GDSS (“electronic meeting system”, actually the GroupSystemstm product); of the distributed groups, one used a telephone channels for audio

conferencing (a conference call with speakerphones), while the other used the telephone channels plus GroupSystems (the system was not running in a distributed mode). In line with media richness theory (Daft & Lengel, 1986) and social presence theory (Short et al., 1976), the authors differentiated between *ambiguity* (a lack of clarity, conflicting signals, equivocal) and *uncertainty* (a lack of facts and knowledge). In this framework, audio conferencing is considered to be low on ambiguity resolution and high on uncertainty resolution, while GDSS is supposed to rank opposite on each dimension. This ranking led to hypothesizing that the collocated groups and the groups supported by GDSS would perform better than the counterpart groups on an ambiguous task (there is no single right answer). The experiment established that the distributed group equipped with GroupSystemstm and audio conferencing performed better regarding the quality of the design process and the number of alternative solutions considered. However, the quality of final decisions did not correlate with any of the locations (distributed or single). The authors concluded that GDSS proved to be able to augment “lean” ambiguity resolution capabilities of audio conferencing. Consequently, distributed groups with appropriate technological support may not be inferior to collocated face-to-face groups in resolving unstructured problems.

Tung and Turban (1998) reviewed the relevant literature and formulated differences between collocated and distributed groups listed in Table 3. As shown in the table, evidence indicates that collocated and distributed groups (supported by GDSS) are not different on the perceived equality of participation in decision making. No significant differences apply to quality of decisions (cf. Chidambaram and Jones, 1993) or the amount of ideas generated either, although the evidence on the latter is not conclusive. In line with common expectations, a collocated team can make decisions and reach consensus faster than its counterpart. It is less intuitive, however, that distributed groups would generate ideas of a higher quality. This finding indeed was reported in the study by Valacich and associates (1994) (also see Fjermestad & Hiltz, 1998-99). In managing conflict-ridden tasks, distributed groups can start slower but then improve faster than collocated groups; therefore, the aspect of group development does matter for distributed groups.

DGSS can support various tasks, not only decision making. Majchrzak and colleagues (2000) studied an interorganizational team and the system that was designed to support various tasks of the distributed team members. This team was multidisciplinary and composed of members from three organizations. The team worked on a new product and used specialized groupware with communication capabilities on a daily basis. The team successfully completed the project and the DGSS contributed to success. However, the authors found that the extent of using the DGSS was invariant of task uncertainty. Some of the potentially important functions were never used, such as, the indexing of new knowledge, which

Table 3. Collocated and distributed groups

Characteristic	Collocated	Distributed
Equality of Participation	Same	Same
Decision Speed	Faster	Slower
Amount of Ideas	Inconclusive	Inconclusive
Quality of Ideas	Lower	Higher
Quality of Decisions	Same	Same
Time for Reaching Consensus	Shorter	Longer
Conflict Management	Faster	Slower, improves quickly

was supposed to ease knowledge sharing. One reason was that the use of this functionality would require that professionals put in extra time. Another finding was that occasional face-to-face meetings helped in reducing challenges to effectiveness, which usually accompany weak professional and social bonds. Performed in the beginning of the project, face-to-face meetings helped in clarifying mutual understanding and expectations. Lurey and Raisinghani (2001) drew a similar conclusion on the role of IT. In the case of the team they studied, groupware technology was a weaker predictor of teams' performance than the relationships between team members and process variables. Both findings are interesting, as they indicate that IT or GDSS are a necessary but not sufficient condition for functioning of distributed groups.

Orlikowski and associates (1995) studied a Usenet-based communication system used by R+D teams in a Japanese company. Usenet refers to an Internet-based electronic bulletin board system (EBBS) for creating, storing and retrieving textual messages. This EBBS was emerged from a play of a small group of engineers. The group persuaded management in values of the system and started small, with a few discussion forums. The EBBS grew as informing needs dictated. These needs were discovered by the group as well as signaled by the workers and managers. As the system was shaping to become a major support to the project replacing even traditional meeting lunches, the team context was evolving as well. Specifically, new rules encouraging particular uses of the EBBS were created. Then, EBBS postings were categorized several times to respond better to project needs. The relying on the system for key project documentation became a norm and work practice. Norming extended to the length and placement of the postings. Data flows were reshaped as the EBBS were linked to an email system. Besides bringing interesting findings, this study falls into the line of research that demonstrates the open-ended character of GSS and mutual influences of IS and social structure. The system was molded by user action and it, in turn, influenced structure. The study findings also indicate some IVO aspects, such as infostructure (new rules on the system use, and categorization applied to postings), infoculture (norms affecting postings), and infoprocesses (new data flows).

One of the basic ideas in developing IT for distributed groups refers to bridging different physical locations. Communication channels are certainly essential in this respect, but effects may go beyond the conduit (sender-receiver) model of communication. Awareness of the dislocated others is one of the issues that have interested IS researchers and IS designers. Awareness can be understood in terms of understanding the dislocated others. This is a relational concept, since each side needs to understand the other. Understanding can refer to various aspects, such as, roles, activities, competence, and relationships between tasks and people (design of work processes). (See Ray, 1998). The aspect of understanding what others know to do likens awareness to the concept of transactive memory discussed in this chapter. In the distributed group context, awareness helps coordinate activities of the members.

An early IS for supporting awareness was Xerox's Media Space. This was a network of video, audio and computers that connected the PARC facility in California with a unit in Oregon. The teams working on these locations were for the most part engaged in creative work, developing new software and methodologies. Some teams working on same projects were not collocated. The members on one side could see and talk to the other side in real time, and screens and speakers were located so that both formal and informal (opportunistic) communication could be conducted and awareness supported. An environment was created in which it was easy to work with anyone, and to get in touch and share resources (Olson & Bly, 1991).

Xerox later developed another system for supporting awareness called Portholes. Networked computers with digital cameras mounted that serve a team display thumbnail images of each member. Images are periodically sampled and show availability and recent movements of the members. Another powerhouse

of technological research, Bellcore, also had its entrant into the area of technology for bridging physical locations. The company developed a video system with large screens located in two coffee rooms on different floors of the same building. A screen in one room would display the other room. The system could, in effect, help the organization members to increase awareness of those not physically present, and this could potentially lead to informal communication. Communication has apparently been a running theme in the context of distributed groups, and it will be addressed even more in the continuing discussion.

Key Role of Communication

Studies on CMC demonstrated limitations of electronic text in the individual context. Briefly, according to media richness theory (Daft & Lengel, 1986) electronic text is a “leaner” format of data that cannot communicate much of the meaning, which is pertinent to voice-based or face-to-face communication. The theory of task-technology fit rates technologies based on electronic text lower in terms of their task applicability. Email is good for transferring data rather than communicating knowledge, values, conflicting opinions, judgments, and the like. Does the group context make a difference? Initial evidence shows that it does.

Huang and colleagues (1995) tested some propositions of media richness theory (Daft & Lengel, 1986) by experimentally testing whether sharing goals within a group would make any difference in group members’ perception of media richness. The concept of shared goals included group achievement goals and group maintenance goals, thus capturing two essential aspects of groups—task orientation and socio-emotional aspects. The authors framed group goals as part of shared social constructions that could develop in groups with history, and pointed out that other aspects can also develop over time, such as interpersonal relationships, norms, and emotions. The experimental design included groups using a communication system (CMC groups) and groups communicating face-to-face (control groups), and each type of group was further broken down into those that were conditioned to develop shared goals and those that were not. In the former groups, the members were asked to define and develop goals that would help them in resolving the task. The experimental task was judgmental, hence carrying a potential for cognitive conflict. The authors found that in the condition of no social construction face-to-face groups perceived their communication as richer than the CMC groups. This was consistent with the classical media richness theory. However, in the condition of social construction there was no significant difference in the perceived richness of information (i.e., meaning) across the two types of groups. If electronic communication is a “lean” medium, then it follows that the group context can “enrich it.” Owing to the sharing of goals, group members were able to infer richer meanings from electronic text. The shared goals or social construction made a difference. Consistent with this inference was the finding that media richness was higher in CMC groups that had group goals than in those that did not.

The above suggests that groups can shape GSS, push technology limits, and augment GSS. A corollary is that the group context modifies the argument that IT can augment the human factor—the augmentation works both ways. In other words, media richness theory can be adapted with a social aspect. It is not clear, however, what specifically happens in the group cognition that compensates for limitations of communication technology? For example, it could be that transactive memory or collective mind develops as it is discussed in this chapter. Another interesting question is, What impacts do interpersonal relationships, norms, and emotions make on performance and system requirements of the intact distributed group?

The revision of media richness theory is agreeable with propositions, evidence, and theory from cognate lines of research. For example Lee (1994) argued that “organizational members are not purely

recipients of the textual message of email but, more importantly, they can enact richer meanings relative to and beyond the message through the social construction standing behind it.” Communication theory may help in interpreting the above findings as well. The theory of coordinated management of meaning (Cronen & Pierce, 1982) predicts that two communication actors who know each other well can attribute a range of meanings to denotative utterances. For example, a message that sounds offensive at the denotative level can be taken by the receiver at a level based on his familiarity with the sender’s habits and moods (the level of “life scripts”). In effect, the denotative meaning may be discarded and the message can be interpreted as an expression of a bad mood. This theory also views intentions, the context, contracts, and culture as the factors for creating the meaning on the receiver’s side. The theory has been supported with substantial evidence. Although it was not developed for the CMC context, the theory of coordinated management of meaning is relevant for emphasizing the relational and history aspects of communication actors in conjunction with variation in the meaning attributed to messages (indeed, the data that are conveyed). Invoking media richness theory, it follows that users of email can infer a range of meanings from “cold” electronic text data.

Ciborra’s (1996) study of GSS at Roche included a system for supporting distributed teams. This was Global Team Rooms (GTR) system, and it supported videoconferencing and presentations. GTR was deployed in the course of changing the company’s process of applying for the approval of a new drug (new drug application—NDA), modifying certain infostructural aspects, and pushing organizational culture toward teamwork with ramifications for power distribution. All this has been in the making while the technological support—the GTR—has been implemented and pushed over dramatic maintenance hurdles. More specifically, the main goal of the NDA process is to have a drug approved by authorities in the target market countries, and can take up to four years. It contains several steps, including the development of the documentation for drug authorities, the development of post-submissions documents, the creation of presentations for various audiences, and interaction with health authorities. The GTR was supposed to speed up the NDA process. The international teams within Roche were expected to work together via the GTR, particularly by using its videoconferencing system rested on the company’s network.

Problems started when developers began upgrading the system even before the original design was implemented. The software for an electronic whiteboard was not purchased, and yet computers for adding textual content to inter-team communications were added. Ciborra (1996) discovered that the outcomes from using the GTR have been mixed. Travel costs decreased, while the number of both classical and telemeetings increased. The teamwork improved, and teams proved to be capable of creating last minute presentations for health authorities. On the other side, teams could not concentrate the needed decision making power in their hands and had to battle gatekeepers of functional organization over access to data. One manager suggested that an orientation toward changing organizational design was jelling up from the entire experience. But the members faced contradictory demands. While pressed to deliver quickly the final documentation, the GTR users had to learn the procedures of using IT and new methods of manipulating data.

Jarvenpaa and colleagues (1998) investigated trust issues in teams distributed globally. The teams were composed of master’s students located in 15 countries, communicating via email on a short-term basis, and having no prior common history or anticipated future. The authors conceptualized trust in terms of an aspect of personal relationships and of past or future memberships in common social networks, which defines the shared norms of obligation and responsibility. Trust was self-rated by the participants. The study found that the teams that reported high levels of trust in the beginning and at the end appeared to be more capable of managing the uncertainty, complexity, and expectations of the distributed context

than the teams that reported low levels of trust. The authors interpreted this trust in terms of “swift, depersonalized, action-based trust,” building on the model proposed by Meyerson and colleagues (1996). The finding echoes common wisdom: “Unless one trusts quickly, one may never trust at all.” Still, it remained unclear what created the swift trust other than first impressions that randomly developed. The authors argued that trust might have been created swiftly based on the members’ imported propensity to initiate or to respond to the first electronic communication stimuli rather than based on any particular stereotype. The adage, “you can never give the second first impression” seems to apply to electronic impressions as well. Once swift trust occurs, it can be nourished via task and social communication expressing commitment, excitement, and optimism.

Piccoli and Ives (2003) investigated a case of management’s influence on trust in distributed teams. They found managerial interventions that focused members’ attention on deadlines and work progress to have an adversarial impact on trust. The interventions made salient the incidents of inappropriate behaviors (reneging and incongruence), which in turn reduced trust beliefs. Dennis and colleagues (2012) tested some implications of this finding in an experimental simulation of distributed team context. Contrary to their hypothesis, the authors found that behavioral controls weakened the impact of perceived reneging and fulfilling behaviors on trust among team members. A trust disposition (an initial inclination to trust or not others) was strengthened by the controls, thus confirming the common wisdom that trust lies in the eye of the beholder. A message drawn from these studies could be: if classical management control could not help trust maintenance in distributed teams, team composition deploying more trustful members could. The message underscores the importance of understanding organization members from a cognitive perspective, as the concept of *homo informaticus* advocates.

Research on trust in distributed teams has sharpened analytical lens over time, identifying a number of trust modalities fitting the socio-emotional and task rubrics (Mitchell & Zigungs, 2009). Examples are kinds of trust are based on action, affect, cognition, and competence. All of these result from a corresponding process, emphasize the authors; for example, delayed trust results from “a process that slowly progresses toward full cooperation, potentially slowed down through technology use” (Mitchell & Zigungs, 2009: 73). The authors posit that the process perspective, with concern for technological capabilities, can explain the way trust develops in the distributed team context.

Let us return at the end of this section to the issue of communication. Although it has been a frequent theme in IS research since the advent of the computer as a communication medium (e.g., Hiltz & Turoff, 1978; Rice, 1984), communication is rarely explicitly defined. Implicit conceptualizations of communication usually refer to exchange of messages or “information.” This is in accord with the “conduit metaphor” of communication (Putnam et al., 1996) that draws on the classical sender-receiver model. The basic idea is that of transmission. The background to this metaphor can be recognized in Shannon and Weaver’s (1949) model of communication in telecommunication systems, with concepts of sender, channel, message, noise, and receiver. The model leaves out nuances of communication actors including their intentions, previous knowledge, semiotics and semantics of communication, situational and contextual aspects, to mention a few. However, as the above cited theory of coordinated management of meaning suggests, different approaches to communication and organizational communication are possible.

Communication can be understood in terms of interactions at a micro level through which organization is continuously constructed, a process of representation through narratives and symbols, a linguistic discourse, a space in which voices are asymmetrically distributed—some are heard, others suppressed (Putnam et al., 1996). From the IVO perspective, communication contains an informing component, that is, the informing process. The other component has to do with establishing and maintaining social

relationships at the inter-personal, group, organizational, and higher social levels. As for the informing component, the assumption that communication is an unproblematic exchange of “information” between sender and receiver lays a very rough sifter over group and organizational reality. Shulman (1996) argued that most of GSS research left the problem of meaning out of its scope, implying that meaning was something simply transmitted from the sender to the receiver. For him, the shortcoming seriously undermined credibility of the research. Another provocative idea Shulman has advanced is that communication about IT, the way a meaning of a particular type of IT or of IS is constructed, constitutes a research problem in itself.

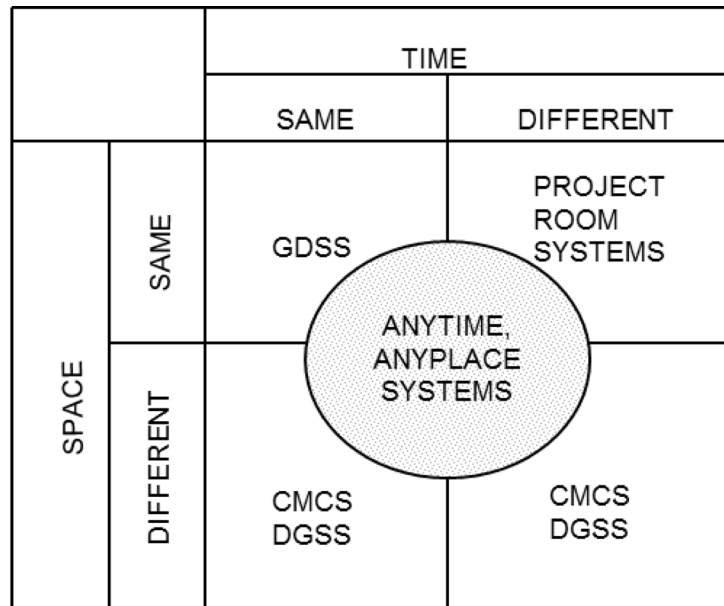
Coupling Communication with Cognitive Processes

GDSS systems are not the only choice for brainstorming, decision making, and planning. Summarizing results from 59 experiments in which 521 hypotheses were tested, Fjermestad & Hiltz (1998-99) established that CMC systems performed somewhat better than GDSS. The use of CMC systems made a difference in 2/3 of the experimental cases, that is, 10% more than in GDSS experiments. Moreover, in decision making tasks (selection from available options), CMC groups performed two times better than GDSS groups. The authors argued that these differences might be due to the fact that CMC systems left group members more time to reflect and digest decision alternatives before deciding on a final decision. On the other hand, CMC systems typically provided a “leaner” support, and exhibited the ratio of positive over negative effects inferior to GDSS (0.7 vs. 1.3, respectively).

Turoff and associates (1993) conceptualized the relationship between communication and decision making in distributed groups. They proposed associating CMC systems with GDSS in order to give a specific purpose to the former and instill distributed work support capabilities into the later systems. This coupling should also provide for breaking of temporal and spatial limitations pertinent to typical GDSS. The typical GDSS supports the same place/same time work, while CMC systems are tuned to different place and time (see Figure 1). Merging the two functionalities may amend each design and result in a new one. A resulting group support system (GSS) would, then, support anytime-anyplace group work. (One should note that the authors exclude CMC from the context of typical GDSS, although communication via computers actually does happen through GDSS. Even though communication is not the primary design purpose of GDSS, it is an indispensable component of decision making, which is the primary purpose.) The CMC today includes cell (mobile) telephone, tablet computers and devices, and other mobile technologies.

Turoff and colleagues (1993) analyzed real-world distributed systems with different functionality in order to demonstrate types of tasks that their proposed design should be able to support. One of interesting systems was EMISARI, introduced in 1971 to support crisis management in politics. The system connected up to 200 people around the United States and helped them track, interpret, and organize qualitative and quantitative data associated with the rapidly changing and unpredictable situation as well as to coordinate action. It kept policy makers informed on policy decisions from the White House, happenings in all the locations, and actions each member of the crisis management team was taking. To help decision making, EMISARI, among other functions, contained a table with time series collection that calculated a regression extrapolation each time a new entry was made, and flagged values that were not expected. Another interesting capability was creating a case of a potential violation of a policy by an organization requiring federal intervention. The system could map out steps involved in such a case and who was responsible for determining the outcome of each step. As a step was completed, the system

Figure 1. Relationships between CMCS and GDSS
(Turoff et al., 1993)



alerted those responsible for next steps to take over responsibility. EMISARI supported individual, parallel work of crisis management teams. Extrapolating on the experiences with this system, the authors proposed requirements for a DGSS:

- alternative communication channels and synchronization of communication processes
- structuring of group processes (anonymity, nominal group technique, Delphi method, voting, etc.)
- decision modeling (structural modeling, statistical analysis, simulations, etc.)
- management of content access and other aspects.

This repertory of functions is similar to the list of GDSS functionality by Nunamaker and colleagues (1995/6). Their list includes communication, access, and deliberation. Among specific functions are group memory and group problem solving procedures that must be coordinated in the distributed environment. According to Turoff and associates (1993), the character of the distributed group work can be understood along three dimensions: coordination mode, task complexity, and truth validation (Table 4). Coordination refers to interdependency among group members. Similarly to Thompson's (1967) model of interdependence, group members can work in sequential, parallel or reciprocal fashion. For example, the users of EMISARI approached their domain problems in parallel independently from each other, much like anonymous brainstorming is done in the same time-same place GDSS.

Distributed groups deal with complexity in different degrees (Table 4). Turoff and colleagues (1993) defined complexity from the perspective of equivocal (ambiguity), that is, the degree of problem clarity manifested in conflicting interpretations of an organizational situation. For example a decision making task requires making a choice among possible options based on some scoring method (e.g., choosing a software vendor). Such a task qualifies as more structured. As opposed to this go/no go decision, users

Table 4. General requirements for distributed GSS

Requirement	Type	Description
Complexity	Structured	No equivouque
	Semi-Structured	Some equivouque
	Unstructured	High equivouque
Coordination	Parallel	A acts at the same time as B
	Sequential	B acts when A finishes
	Reciprocal	A acts to B, B to A, A to B...
	Pooled	Similar to parallel, using group standards
Validation	Inductive	Solution follows from examining specific data and truth depends on it.
	Deductive	Solution follows from premises based on using some logic. Truth is dependent on premises and logic used.
	Relative	Solution follows from a set of options available through comparison of options. Truth is relative to the set.
	Negotiated	Solution follows from group negotiation. Truth is dependent on specific group's negotiation process regardless of external conditions.
	Conflicting	Solution follows from a conflict of opinions (dialectical or devil's advocate). Truth is the result of a critical examination of various problem aspects.

(Turoff et al., 1993)

of EMISARI dealt with less structured problems of a critical collision between policies and practice. Another requirement of DGSS is coordination. For example, the users of a DGSS called Zero-Based Budgeting System worked under conditions of reciprocal coordination in which the mutuality of individual steps taken in the deliberation process mattered (for example, results of ranking procedures of one member would influence steps of another person, that would, in turn, have an influence on the first person's thinking). Group members could also work by taking turns sequentially, thus having downstream activities fully dependent on upstream activities. The authors added another coordination mode they called pooled. It is similar to the parallel mode, except that some common standard is used for formulating group standard (e.g., voting). DGSS also has to be able to accommodate for different truth inquiries that distributed groups may deploy. Table 4 lists five inquiries. This dimension can be understood in terms of the validation norms or ideology used to assess data used in problem solving/decision making, the path to truth seeking, and the character of the group's solution/decision. For example EMISARI users followed the inductive inquiry, and the users of the Zero-Based Budgeting System used conflicting inquiry.

In summary, distributed groups reiterate some of traditional challenges of teamwork and create new ones. Table 5 summarizes the discussion above. The first item is less explicit in the literature but nonetheless important. Since a distribute team (as any other) exists in order to perform and deliver on a particular task, it the composition of work (business) processes. This composition has to be creative, given the character of task and team characteristics. Process composition directly involves the management of communication within the team, and needs to account for other characteristics listed by the top of the table—opportunistic interactions, coordination, time management, awareness, and decision making. Other challenges refer to group memory, trust, and individual skills/traits. The last item closes

the loop—appropriate GSS. Design of the GSS would ideally support the work process along with other requirements.

MOBILE ENTERPRISE STRATEGY

Mobile technologies represent a metamorphosis of communication systems and GSS. So, they are the old wine in a new bottle. Email, chat, video conferencing, and GSS continue life on mobile hardware, such as the smart phone and tablets ranging from a thin to fat versions that replicate the laptop computer. This metamorphosis paves the way to a mobile enterprise discussed in this section.

A mobile enterprise is a highly spatially dispersed organization whose key business processes are distributed based on mobile information technologies and systems. This definition was essentially introduced in the first edition of this book (Travica, 2014); here it is slightly adjusted by emphasizing the distributed process character. The original model of mobile enterprise also featured a performance deferential implying that a mobile organization could accomplish more than an immobile organization. The argument provided also differentiated between a firm that merely uses mobile technologies and a firm that is *being* mobile with help of such technologies and illustrated with an example from the health sector. A hospital using cell phones for informing the staff about changes in patient history was contrasted with a community health care service deploying mobile physicians and nurses and coordinating them via mobile systems. Only the latter qualifies as a mobile enterprise because its key business process (health service delivery) has a distributed character. Likewise, process workers are distributed. The last point in the 2014 conceptualization pointed out that the mobile enterprise questioned the traditional concept of organization.

Table 5. Challenges of distributed group work

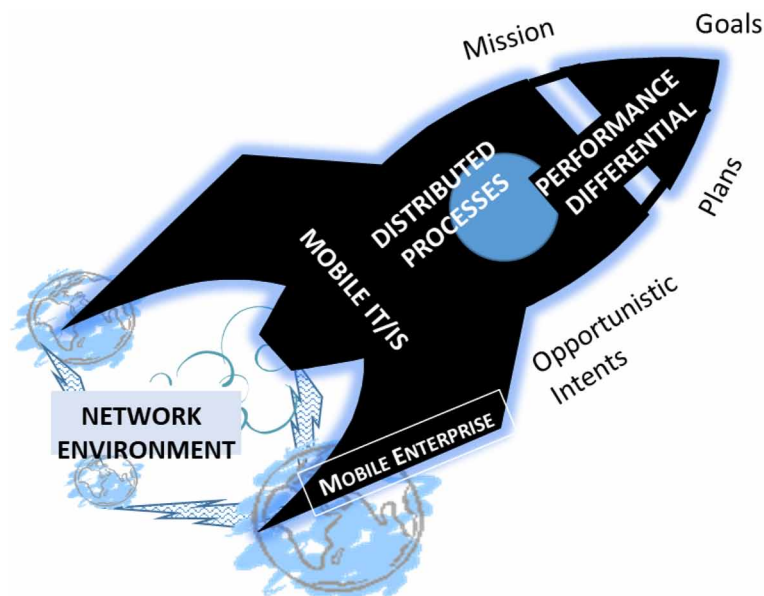
Challenging Characteristic	Explanation
Appropriate GSS	GSS fitting team production and socialization processes
Production Process Composition	Creative organization of work; Management of work-related communication
Opportunistic interactions	Informal, on the fly communication
Coordination Optimization	Supporting different modes of interdependence; Coordinating work vs. coordinating data flows and knowledge deployment
Time Management	Differences in time zones
Awareness Maintenance	Continuously understanding others' activities, competences, roles, etc.
Decision Making Modes	Various situations and different concepts of truth
Team Development	Time for meeting in person; Adjustment of GSS to team phases
Group Memory and Collective Mind	Provisions for developing transactive memory; GSS supporting group cognition
Maintaining Accountability and Trust	Need to be part of team culture (as in collocated teams)
IT Competence	Higher threshold and need for quick learning
Team Player Skills	Flexibility and tolerance for differences and seams; Trustfulness; Quick adjustment;

In this section, the concept of mobile enterprise is coupled with strategy concepts in order to propose a concept of Mobile Enterprise Strategy (MES). MES refers to the mission, goals, plans and opportunistic intents of developing a mobile enterprise (Figure 2).

There is a void in the literature that could help to advance theorizing the mobile enterprise and its strategy. The practitioner literature and educational cases typically associate these concepts with the deployment of mobile technologies, particular business function (mobile marketing), or a firm's front-end turned toward customers (e.g., mobile banking). However, organizations based on distributed processes do exist (retailers, consultants, transportation, health services) and other organizations can become mobile via distributed project teams and individual workers. Technology certainly makes such a transformation possible.

It was argued that the contemporary IT and IS for communication and group support covered in this Chapters allow for breaking free of space and time limitations. Organization members play out their roles regardless of the location they currently occupy or time frame (a period or a time zone designation). This has always been possible in arts (fiction literature, film) that plays with arbitrary mixing of both time and space segments. In this regard, technology elevates organization into a postmodern, esthetic sphere. Recall telecommuting that has been practiced since the 1970s. It unleashed the when-and-where work freedom. Where it was deployed as a telecommuting strategy, this practice punctured time and space boundaries by allowing professionals to work from home and conveniently located, interim offices ("virtual office"). Networking technology allowed for accessing remote, corporate systems located at headquarters. Today, the technological context features advanced computer networks (private and the public Internet), mobile/cell phone networks, powerful end-user technologies (smart phone, tablet computer, tablet readers), Cloud computing, and advances in automation via IoT. At the same time, the business context is globalized with a growing population of mobile professionals and managers. These

Figure 2. Mobile enterprise strategy



conditions imply that the office and business space extends to any location of choice. Therefore, the topic of MES appears less futuristic.

Looking more closely at relevant technology, one should note that the systems part of MES is Internet-centric. It includes various communication systems running on the Internet, which can be stand-alone or embedded in social media. GSS for distributed teams' file and application sharing as well as social media, and virtual desktop/workplace belong to the selection. Entire IS from accounting to HR and CRM as well as complex systems like online stores are offered via Cloud computing services, thus providing extensive support to MES. In addition, Cloud vendors supply novel analytics services, some of which are automated and belong to artificial intelligence (AI). Moreover, IoT technologies complete the systems architecture when the input side is automated via sensors and measuring devices.

On the firms' side, a general mobile strategy increasingly involves tolerance for the users' selection of technology, a strategic policy that is sometimes called "bring your own device" (BYOD). Catering to users' choices complies with their preferences in the growing mobile landscape. According to one survey, users spend about a half of work time on the smart phone, tablet, and laptop computer, where the frequency of use follows this order while the length of use is in reversed order (Willis, 2013). One can also see BYOD as a way of increasing IS utilization and taking advantage of mobile technologies.

Outside of firms, MES can engage Cloud computing services. The Cloud has evolved to three forms—public (shared by a number of companies and using pay-per-use pricing), private (exclusive to a single company that covers most of the costs), and hybrid (a combination of the two). Since 2014, Cloud services have been growing at about 10% annually to reach a \$325 billion market in 2018. North America makes a half of the market, followed by Western Europe and Asia-Pacific, and SaaS services take the largest share. (MarketWatch, 2019)

As Cloud clients connect to the Cloud via the public Internet or a private network, network technology is an essential part of systems architecture for MES. There have been advances in network protocols taking advantage of and improving over the familiar network types (TCP/IP, Asynchronous Transfer Mode, Frame Relay, etc.). The improvements include the traffic speed, reliability, security, decoupling of network software from hardware, and prioritization control. Connectivity between computer and mobile (cell phone) networks is also taken care since major providers of corporate networking also run cell phone networks. In addition to Cloud connectivity, development efforts focus IoT and the 5G mobile phone networks. Advances in network technologies have coupled with security improvements. For example, systems access became more secure via biometric techniques and new Identity as a Service (IdAaaS) support.

The automotive transportation presents an apparent case for MES. Its core process is apparently distributed, being greased by communication and other technologies. While playing a vital role in today's globalized supply chains, the truck transportation is a highly competitive industry that copes with significant variable costs and small profit margins. Fuel expenses vary due to several reasons, such as the price of oil, route selection, and ad hoc demand. Drivers might use trucks for private rides, and in some countries they can commit fuel theft. All the while, customers expect timely pickups and deliveries according to the price contracted. This puts a pressure on the driver as well as the trucking employer, who also struggles to keep drivers satisfied and reduce their defection. Mobile technologies provide help in this perplexing context. For instance, cell phones replace classical radio communications and add a visual channel and document transfer. In addition, the IoT technology supplies various devices for monitoring truck routing, timing, and workings, that is, the cost drivers.

Another example from the transportation industry refers to the segment of urban passenger featuring Uber. Founded in 2009 in San Francisco, the company first offered a black car service (special event transport) without owning cars or hiring specially trained drivers. The last property made Uber an entrant into the sharing economy. Uber has increased the range of transport services (ride sharing and ride hailing), spread internationally to hundreds of cities, established numerous foreign subsidiaries, and has been continually fighting against legal boundaries and competitors in traditional taxi business and the growing sharing economy-based transport. (O’Keefe and Jones, 2015; Wikipedia, 2019).

Uber developed a transportation management IS that sits at nexus of the organization. Drivers and passengers run mobile application software on their smartphones. The system relies on GPS and maps a passenger seeking a ride and drivers in the geographical space to determine their proximity. The ride booking step follows up initiated by the passenger and accepted by the driver. In the system’s stationary segment, the ride is recorded in a database for accounting purposes. Automatic charging of the passenger’s credit card is supported. A module for real-time analytics has also been deployed in order to provide dynamic pricing based on current traffic conditions (Newcomer, 2017).

Uber does not own cars and acts as a middleman between drivers-owners and passengers. Key business processes are dispatching and accounting. Both are spatially distributed (input-output points determined by drivers’ and passengers’ locations, plus connectivity with the central processing modules). These processes are actually infoprocesses since they consist of data management steps. Another important takeaway from the Uber case is the close partnering between business and IS strategy. Put another way, Uber’s corporate strategy is grounded in a unity between the business and technology mission and goals. In Uber’s words: “We ignite opportunity by setting the world in motion”, enabling people to move to “all kinds of places in all kinds of ways with the help of our technology” (Uber, 2019). These motives imply an expansion into the areas of health care, freight, and commuting as well as new transportation technologies, such as a driverless car and airplanes.

SUMMARY

This chapter discussed IVO’s concept of group informatics—groupomatics perspective. An attempt of balancing technological and cognitive issues was made, building on the idea that the IS field and small group theory, which has developed within psychology and sociology, can benefit from cross-pollinating their perspectives. One running theme was the emphasis on cognitive aspects of work groups. The emphasis comes from a metaphor of intelligence applied to organization and, consequently, to its building block—the work group. Experimental research on GDSS has initiated this focus with study of problem solving/decision making in the 1980s, while early conceptions of group intelligence are much older (Lewin, 1948). Many topics still await research in order to make more sense of the cycle of cognitive processes involving perception, learning, memorizing/retrieving memory, thinking, and knowledge/wisdom development.

Another running theme in this chapter was communication. Communication capabilities are always part of GSS functionality, although they can be analytically separated. A need for a deeper engagement of communication theory was argued, including understanding communication beyond the convenient but simplistic conduit metaphor. The chapter also addressed the theme of uncertainty and ambiguity plaguing the deployment of teamwork and GSS. Interactions between group, technology and the social context complicate the understanding and management of GSS. Ample evidence indicates unexpected

outcomes arising in the context of GSS adoption and use. Sometimes GDSS saves group perception from groupthink biases, but at other times it does not. The same applies to the quality of the generated brainstorming output. Sometimes GDSS can help manage conflict-ridden problem solving, while at other times groups use technology so that no productive outcome follows.

Distributed (virtual) teams and DGSS created new issues and challenges. Trust among dispersed teammates may or may not appear at random, classical management controls may bring surprising results, DGSS may be appropriated in an opportunistic rather than utilitarian fashion, and the group capabilities may compensate for shortcoming of communication technologies. Significant challenges of distributed teams produce a host of requirements for DGSS.

The chapter also introduced a concept of mobile enterprise strategy and discussed the case of company Uber Technologies.

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ENDNOTES

- ¹ In some languages computer is named after the term “order.” In Spanish, computer is called “ordenador,” in French “ordinateur.” Following this semantic path, computer is a technology for getting data and corresponding business in order. The way Poole and associates (1991) termed their finding conjures up this meaning.
- ² Much of GDSS research has been based on experimental design. In general, experimental design was rather a peculiar research methodology in the IS field before GDSS research brought it in through the front door. On the upside, IS research was put on the track of formal science research, which is common, say, in group psychology. On the other side, the novelty of the laboratory context set limitations to the scope and implications of research.
- ³ Bell Atlantic developed a methodology approach called Compendium™ to support collocated and distributed teams engaged in systems analysis, business process reengineering and other kinds of projects (Selvin & Sierhuis, 1999). Compendium knitted together off-the-shelf technology and documents, and supported converting the elements of various types of documents (email, word processing, spreadsheets, etc.) into nodes and links in a hypertext concept-mapping tool. Users could also create associations between these elements, and export this in new documents. In addition, Project Compendium prescribed a set of techniques that could be used within the off-the-shelf technology to add keyword coding and labeling schemas in performing the cross-referencing of ideas.

The conversion capabilities of Compendium made it possible for people from different parts of the organization to make sense of project issues and to collaborate on less structured projects and under time pressure. An example was the project Year 2000 Contingency Planning (Y2KCP) at Bell Atlantic. The project aimed at identifying the resources in Bell Atlantic’s core business processes that would cause the highest degree of risk if they were to fail due to the Year 2000 problem (the famed “millennium bug”). Five teams of 8-20 people were engaged in creating process maps of the business processes (e.g., call completion, maintenance and repair, emergency calls, and billing). For each step in the business processes, the participants identified which resources (people, systems, equipment, locations, etc.) were used. Then, the resources were rated in terms of the competitive, legal, and operational risk to the corresponding step if the resource was to fail. The sponsors of the Y2KCP project required that the output be presented to different audiences in requested forms (maps, diagrams, text, etc.). Teams communicated and worked both face-to-face (60% of the time) and in the distributed mode (40%), running NetMeeting and audio conferencing over the Bell Atlantic network.

Chapter 4

Infostructure, Technology, and Organization

ABSTRACT

The chapter discusses informing structure (infostructure)—the formal and stable patterns of relationships between data segments and in information technology (IT) arrangements. Infostructure parallels and complements the formal social structure of organization. The discussion covers infostructure dimensions and their role in changing organizational structure. The infostructure of big data is explained. Informal organizational structure is, then, discussed in the context of computer mediated communication (CMC) and social media. Social media are framed as a type of business, and a new concept of social media is proposed. The chapter also discusses technology and IT from the perspectives of organization theory and IS. Various ontologies of IT and information systems are reviewed, including currently popular sociomateriality and critical realism. A new model based on the emergent process ontology is described, and the potential of human agency is argued.

INTRODUCTION

Understanding organizations as social structures—that is, as stable patterns of social relationships—has been for long one of the most influential paradigms. For many, organizations still are mainly or even exclusively social structures. That is to say, they are social entities that embody different patterns of differentiating and integrating work. The concept of social structure was introduced in the early 20th century by the German sociologist Max Weber (1946), and later expanded and enriched with contributions of the British Aston group (see Pugh & Hickson, 1989) and others (e.g., Blau & Schoenherr, 1971). This is usually called *theory of formal organizational structure*. Formal social structure of organizations includes *stable patterns* of both horizontal division of labor (specialized organizational units such as departments and teams) and vertical division of labor (hierarchy), of work design (specialization), of reinforcement (formal rules and regulations, span of management control, and again managerial hierarchy), and so on. This approach paints a static (conservative) picture of organization. A humorous remark characterizes memorably this approach by the motto that organizations change as often as graveyards.

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Another important segment of organizational structure concerns those social relationships that emerge spontaneously and acquire stability even if they stay permanently non-regulated. This segment is informal social structure, which builds on different notions, such as the grapevine, informal ties, and networking. This view of social structure brings in dynamism because exchange, interaction, and communication are the central concepts. A network with no interactions and communicative exchanges is no-network. The concept of informal structure borders with the notion of action, since the social network is enacted through interactions of members. Thus, the distance between the antipodes of action and structure is shortened.

Action has been brought even more closely to structure in more recent research. The challenge has been to explain how structure changes, given that structure channels action and that arbitrary, random action deviating from structure is not a standard in organized society (or in the organizational context, for that matter). British sociologist Anthony Giddens (1984) has worked on this problem, developing a theory of structuration. According to this theory, social structure exists in the memory of organization members, for example, as the understood/adopted order of meaning and of power; this structure is invoked through communicative action and power relationships. For example, data is interpreted based on the organizational repertory of meaning via an act of communicating, which may engage power relationships. Ideas from structuration theory have influenced IS research (e.g., Orlikowski, 1992; Walsham, 2002). Structuration ideas also influenced adaptive structuration theory within group systems research (Poole et al., 1991; DeSanctis & Poole, 1994). Structuration approach has received criticism as well (Hanseth et al., 2004; Jones, 1999).

Informal and formal *social structures* (or just *structure*) are different from the *physical structure* of an organization (the shape and exteriors of building and external space, and the layout and purposes of internal space). But the two can be related. For example, offices designed as roofless cubicles (physical structure) can be introduced to complement a flatter social structure. Still, jumping to quick associations can be misleading: members of a Dean's office can share a bathroom with students, and yet staunchly maintain a rigid hierarchy. At the Microsoft "campus," the company's research powerhouse, all but two offices are of the same size and layout, thus conveying a sort of egalitarian spirit. Still, this does not mean that hierarchy is wiped out as part of organizational design.

This chapter introduces the concept of informing structure—*infostructure*. In accord with the intention of broadening the bridge between IS theory and organization theory, IVO builds on the latter in a substantial way. Infostructure is the first of "reconstructions" of traditional organizational views that IVO draws on. A concept of infostructure will be discussed as well as its relationships with formal and informal organizational structure. The second part of the chapter is about IT and technology in general, organizational structure, and action. As a thread to the discussion, structuration theory will be put in a certain perspective. Finally, the concept of IT that is used in IVO will be discussed and a comprehensive ontology of IT represented.

CONCEPT OF INFOSTRUCTURE

Max Weber posited that a "bureau" for safekeeping of all written records and files was an important part of contemporary organizations (Pugh & Hickson, 1989: 14). These records were supposed to be managed by officers according to certain rules and regulations that included hierarchically ordained authority for creation, transfer, and use of the records. The paper form of the records had a particular salience in Weber's theory (Nohria & Berkley, 1994). Modalities of records flows and management as

well as capabilities and limitations of spatial dispersion of organization and its physical structure were related to properties of the paper technology.

These ideas point to a connection between organizational structure, on the one side, and data and IT for storage and transfer, on the other. One can draw a parallel with today's organizations in order to grasp the validity of these assumptions. Being in the business of procuring and circulating publications, the library as an organization represents a good subject of examination. The modern library is indeed grounded in the organization of publications it manages. In a large university library in North America, there are branch libraries serving specific departments (product differentiation based on kinds of publications being maintained and served); in a main library, there are units differentiated on the basis of publications formats – monographs, serials, maps, microfiche and microfilm, and online services (departmentalization). Specialization of library staff follows this differentiation. Other specialties and units are based on deeper adherence to differentiation based on the publications content (e.g., English literature, Slavic literature, etc.).

Another basis for departmentation and job specialization refers to tasks of managing publications. There are units for circulation, cataloguing, reference advice, preservation, and IT services, among others. As in the case of bureaucracy Weber wrote about, the storage medium apparently affects organizational structure: paper materials vs. microfilm/microfiche vs. maps vs. videotapes vs. CDs. These formats of data storage serve as the basis of specialization and departmentation. It is also apparent that the physical structure of library is affected as well, featuring long lines of shelves (which quickly get cramped, to the despair of librarians constantly fighting for space). The dimension of physical space, therefore, correlates with the size of a library's collection, which further correlates with the organizational dimension of size measured as the volume of operations and the number of staff.

The 1990s ushered in a new form of library, which was unknown in Weber's time—the virtual library. In a simple definition of practitioners, a virtual library is a part of a library that is based on electronic media and the Internet, or just a set of hypertext links that point to online sources paid for on a regular basis (Travica, 1999). The part of a collection based on CDs certainly saves space, while hypertext links to external sources are even less demanding. Computers in the library are still needed, but access to links is being increasingly moved to users' computers in offices, dorms, and homes. In fact, the virtual library is wherever the Internet reaches and allows library users to access a library Web site in order to search online materials, download, print them, or order physical delivery of materials. The virtual library breaks with many structural characteristics of the paper-based library. Although area specialization is still needed, there is no more need for circulation, preservation, and classical elaborate cataloguing. Instead, IT services become more important. And so does the specialization of librarians in retrieving Internet publications and evaluating these. The connection between physical structure and organization size weakens, because a virtual library can be located in a small building while having access to a limitless collection of online serials and digitized books. The transition from paper to electronic materials demonstrates again that informing agents influence the structure of the library organization.

Bressand and Distler (1995) used the term *infostructure* to signify formal rules that govern the exchange between the actors present on the social network. Infostructure embodies a schematic representation of an organization and its activities. It is expressed in access privileges and in methods of organizing operational business data and knowledge representations. Another role of infostructure has to do with the structuring of cognitive resources—metaphors, common language, idiosyncrasies, and syntax. These cognitive resources help network members make sense of events within the network. (Cited in Ciborra and Patriotta, 1996: 122). Certain elements in Bressand and Distler's conceptualization are useful for

the concept of infostructure in IVO. One element is the emphasis on rules of interaction for network members—rules that resemble formalization of data and knowledge representations. Access to data is also regulated (formalized) and differentiated on privileges or hierarchy. Authors posit that infostructure influences metaphors, common language, idiosyncrasies, and syntax. However, these phenomena are more cultural in character, and they should actually go into the rubric of infoculture. The concept of infostructure in IVO is broader since it (a) applies to the entire organizational context rather than merely to social networks, (b) incorporates IT, and (c) incorporates other structural aspects (departmentalization, specialization, spatial dispersion, and centralization as discussed below).

Ciborra & Patriotta (1996) used Bressand and Distler's (1995) concept of infostructure as a point of departure in their study of the product development process and the related IS at Unilever, a manufacturer of consumer goods and specialty chemicals. For these authors infostructure is "the extent to which the system is able to provide a language structure and cognitive resources whereby people make sense of events within the network" (Ciborra & Patriotta, 1996: 139). The authors studied the process of innovation and Innovation Process Management system (IPM). These were based on an "Innovation Funnel" framework. The main idea behind this framework is to design processes for capturing innovative ideas and then filtering them through review cycles, which resemble a funnel-like path, until a relevant innovation idea is defined. At Unilever's Innovation Funnel, top management made a go/no go decision at the end of each stage. The process created specific documents. One was a "charter" that would briefly describe the product, consumers, new business resulting from the product, and the global technical, marketing, and project characteristics. Another important document was a "launch proposal," which detailed project components and results of surveying the target market (Ciborra & Patriotta, 1996: 128).

The IPM system was implemented using Notes™ software. Its main purpose was to inform Unilever's staff globally on the progress of innovative projects. In turn, this would eliminate duplication of effort and facilitate sharing of knowledge. The initial implementation of the IPM did not always deliver expected outcomes. Some teams began showing signs of revolt when they discovered that managers had online access to their project documentation. Teams took this as a violation of their autonomy and resisted. One consequence was that teams started bypassing some of IPM's functions. The conflict was resolved by classifying the team-generated documentation and records into above-the-line and below-the-line segments. The former was public, describing the project characteristics, stage, and team profile. Teams owned below-the-line documents, which reflected work in progress, daily communications, and other items not to be published yet or at all. Managers could access only above-the-line documents. Team workers had full access to below-the-line documents (reading and writing) and read-only privileges for above-the-line documentation. Team leaders had full access to all documents. From the IVO perspective, these solutions amount to changing infostructure in terms of its vertical distribution (*infohierarchy*; see below).

Weick (1990) discussed "new technology"—complex computer-driven production systems. He touched on certain characteristics of data associated with this technology. For example, the user of new technology is exposed to numerous, automatically generated readings of production process parameters. These pieces need to be put together into mental models that attempt to capture what is going on inside the technology, failures including. This sort of data organization can be understood in terms of *infofragmentation*, as the further discussion will demonstrate.

Summary

Indications of the relationships between organizational structure and organizational informing agents are apparent in the library organization. In fact, these relationships exist in any organization, if one approaches organization in the manner that IVO suggests. Both in classical organization theory of Max Weber and in more recent research on GSS one can discern structuring of informing agents that complements organizational structure. New organizational designs, such as the virtual organization violate some of the principles of organizational structure, while reaffirming the relationship between organizational structure and infostructure.

Defining Infostructure

Infostructure refers to stable patterns of relationships between data segments and in IT arrangements. It is the structure of informing agents. Data can be thought of in terms of organizational records (e.g., database records, or looser structures, such as email) and documentation (higher levels of data organization as in management reports, patents, or documents representing organizational knowledge). Infostructure complements organizational structure. Taking the perspective of resource based view organization, informing agents can be thought of resources that underlie, complement, and extend social structure. This complementing is instantiated in specific dimensions that make the coverage of infostructure and are summarized in Table 1.

Infohierarchy

Infohierarchy refers to the extent to which data and IT are vertically distributed. We have already come across this dimension in discussing the study of Ciborra and Patriotta (1996). The IS field is familiar with images of hierarchy as much as is organization theory. In older database systems, there used to be a “parent” segment of data representing some item of business that pointed to other logically related data—the “children” records. The children were parents to descending children records, extending into a

Table 1. Dimensions of infostructure

Dimension	Definition	Example
Infohierarchy	The extent to which data and IT are vertically distributed.	Higher management levels have access to data with larger breadth and depth.
Infocentralization	The extent to which data and access to IT are concentrated.	The number of locations at which data for making certain decisions are regularly allocated.
Infoformalization	The extent to which written rules, procedures and instructions on handling data and IT are extant.	Paper and electronic manuals of handling data and IT, which are readily available.
Infofragmentation	The extent and modes of dividing data and IT on the department, job, task, and process basis.	Data are grouped in organizational units; jobs are supplemented with special data and IT; etc.
Infodispersion	The extent to which data and IT are dispersed in space.	The number of locations at which organizational IT and data are stored for operational use.

pyramid. In any database system, there is a master record that serves as the senior authority for updating related records, recovering the database after the system malfunctions, validating the accuracy of data, etc. In object oriented IS, a super-class provides data structures and transformation procedures to be inherited by subclasses. Subclasses are dependent on superclasses in this respect. Similar senior-junior dependence exists within the XML markup language: there is a segment called document type definition (DTD), which defines the content in the associated document. In the domain of computer hardware, an oft-used relationship is that of master and slave (e.g., “dumb terminals” are fully dependent on a central processing unit). Computer network architectures can use the principle of hierarchy in various ways, and so on.

An example of infohierarchy and its dynamics is in Hammer & Champy’s (1993) description of management changes at Taco Bell in the early 1980s. After realizing that its command-and-control organization was making it slow in doing and thinking, the company redesigned management hierarchy. Specifically, restaurant managers were put in charge of all operational and performance issues in their restaurants. They were taken out of the linking role in the chain of command and put in the role of problem solvers. In addition, the old supervisory position was abandoned and a new position of market manager was introduced. This manager had a broader span of control than the old supervisor, and was expected to relax command-and-control methods, empower restaurant managers, support innovation, and make decisions by using diverse outputs delivered by newly implemented IS in restaurants. The changes at Taco Bell could also be understood so that the vertical distribution of data was reshaped. A segment of the data was pushed down from the abandoned supervisory rank to the restaurant manager, and another segment was pushed up to the new market manager position. Therefore, the vertical distribution of both data and IT—infohierarchy—was changed. The change in infohierarchy was part of, or a necessary condition for changing management hierarchy.

Higher management levels typically have access to reports with larger breadth and depth. In a traditional hierarchical organization, executives are expected to be able to interpret such reports because they are more knowledgeable than others of crucial organizational goals, strategies, and essential workings of an organization. Learning from new data advances knowledge of executives. Consequently, the vertical distribution of reports and documentation correlates directly with the vertical distribution of authority. Patterns can be different in the matrix or team-based organizations. Consider again the study of innovation teamwork at Unilever cited above (Ciborra & Patriotta, 1996). Although functional managers maintained a higher position *vis a vis* team members, the former were allowed to access only the above-the-line project documents. It follows that infohierarchy in this organization was of a lower degree than in a traditional hierarchy. (See also the discussion on team infoculture in the corresponding chapter.)

The concept of infohierarchy implies that access to IT can also be organized on a hierarchical pattern. Such a pattern can easily be recognized in the traditional typology of IS (almost any textbook on information systems uses it, echoing Anthony’s (1965) management framework). At the bottom of the hierarchy lie the transaction processing systems (TPS) that track every atomic event important for workings of an organization (single instances of purchasing, sales, employee hiring, payments, etc.) and are used by supervisory management. TPS feed data into management information systems (MIS), which generate reports for the middle management. The content in reports can be merged with other data in decision support systems (DSS), which serve upper management in planning and decision making. Executive support systems (ESS/EIS) usually top the management/system hierarchy. Data in these systems comes from the organizational environment as well as from DSS. It is apparent from this description that access to IT is stratified, since these IS types use different kinds of IT; for example, TPS uses transactional

databases, DSS uses software in which different models of problem presentation and choice making are coded, and ESS possess “drill-down” technology that allows for exploring the background of aggregated data that executives typically get.

Although this topology has been used repeatedly and may contain additional items (e.g., office automation systems and system supporting professionals), it is not perfect. New kinds of IT and corresponding IS have vexed the neat hierarchy. Take the already discussed GSS in the Ciborra & Patriotta (1996) study: the PIM system is allocated to serve team members exclusively, and no drill-down technology is available for upper management echelons. Surely, there was a deliberate decision to use technologies built into PIM this way, while it could have been accessible to upper management as well (as it was in the beginning). But this is precisely where the issue of these new, open-ended technologies lies. They can be molded in various ways, catering to different hierarchical levels. Or take communication technology as another example. It may be placed in office automation systems. However, the fact is that email serves secretaries (office workers) as well as managers, while video conferencing serves professionals rather than office workers. Therefore, the extent of vertically distributing IT could not have as strong a correlation with organizational hierarchy as the distribution of data has. Still, data is the heart of IS, and understanding how access to them is distributed is always a reliable lead in understanding organizational hierarchy.

It is useful to make a distinction between accessing/possessing data and using them. Access rather than actual use is the valid indication of infohierarchy. The sheer fact of publicly displaying business reports can be an indication of a hierarchically higher position. This is exactly what Feldman and March (1987) found by studying organizational paper flows: mid-level managers would pile up reports in their offices in spite of lacking enthusiasm to read them. The authors contended that the intention behind this behavior could be to flag one's place in the hierarchy. In turn, the rationale of such a signaling could be in keeping with cultural norms of rationality that organizations adopt due to institutional of the organizational environment. Rational decision making implies using reports (the intelligence step). This stipulation is consistent with the concept of infohierarchy.

Infocentralization

Infocentralization refers to the extent to which data and access to IT are concentrated. This dimension complements the centralization aspect of organizational structure. In other words, IVO assumes that the concentration of data and of access to IT is the necessary condition and antecedent to organizational centralization. This concentration serves as the basis of different kinds of social power—primarily of expert power, and also partly of legitimate and referent power.

Zuboff's (1988) study is instructive for understanding infocentralization. She studied a cost management system in a paper mill. Before the technological change, operators had access just to data on the state of the machinery. This was passed on to managers who would make all cost decisions. After the implementation of the new system, production parameters were automatically passed between shifts. Operators had immediate access to comprehensive, objective data and acquired responsibility for cost management, process stability, and troubleshooting. They became capable of making decisions that were previously outside of their reach. These changes can be viewed from the infostructure perspective. The redistribution of production data amounted to a decrease in infocentralization. Zuboff (*ibid.*, p. 257) noted that the quality of the product increased, as the operators could correct malfunctioning processes

immediately. In addition, financial performance improved. Therefore, a decrease in infocentralization led to an increase in organizational performance.

Infocentralization has to do with any model of decision making that uses data in different states of organization. Decision making is a prerogative of power. It clearly is so in the case of paper mill discussed above. Among professionals, however, taking responsibility for making choices could also be a way of doing meaningful professional work. This phenomenon is indicated in Orlikowski's (1996) study of the customer support desk at a software company. When the new groupware for the support desk was implemented, a new division of labor was also introduced, involving the front-line and back-line specialists (see the chapter on group informatics). The decision making authority was supposed to be divided among them; upon receiving a customer request and making the first attempt at solving it, a front-line specialist was supposed to engage a back-line partner. This organization did not work because the front line rarely engaged the back-line. The front-liners commented that foregoing decision making would have meant losing the opportunity to learn and grow professionally. This case illustrates tensions between centralization and decentralization of data needed for decision making. The front-line's move toward concentrating data violated the intended sharing of decision making authority or making decisions in a more decentralized fashion.

Infoformalization

Infoformalization refers to the extent to which written rules, procedures and instructions on handling data and IT are extant. Regulating access to data, patents (a form of organizational knowledge), and IT make a part of overall formalization in an organization. How IT is supposed to be used (user how-to manuals) is also a source of generating rules in today's organizations. To produce, say, financial figures using spreadsheet software, a worker has to run data transformation procedures that are embedded in software. Software-use procedures thereby become work procedures. Likewise, the manipulation of data demands a regulatory backing. Examples include the following: data input, output, and transformation procedures; the organization of data; storage and retrieval techniques; use, maintenance, and discarding data. Also formalized are techniques of safeguarding data (the security, backup, physical protection, etc.). In fact, informing agents are powerful generators of formalization in organizations.

The term "codification" has similarities with the concept of infoformalization. Boisot (1987) defined codification as representing knowledge in some formalized manner, compressed, and classified (see the chapter on infoculture). Davenport and Prusak (1998) viewed codification in terms of putting knowledge into a "form that makes it accessible to those who need it;" codification "literally turns knowledge into a code (...) to make it as organized, explicit portable and easy to understand as possible" (p. 68). However, there are differences between codification and infoformalization. Codification applies to knowledge representations, while infoformalization applies to any data. Codification includes a transformation of cognitive content (possibly including even a visceral content) into common symbols appropriate for communication purposes, manipulating the quantity of data ("compression"), and organizing data ("classification"). In contrast, infoformalization refers to the rules, procedures and instructions involved in these operations.

Rules and regulations pertaining to handling organizational documentation, records and IT are usually clearly spelled out. This is particularly apparent in domains that are based on process thinking. Drawing on general systems theory, a process can be defined in terms of a purposeful set of steps leading to an outcome; the order of steps is usually sequential, sometimes with loops included. The IS departments and

professionals constitute a paramount example of process thinking. A computer program is a process-like structure: the manipulation of computer hardware and the execution of computer code flow in a process manner. System development adheres to process logic overall, regardless methodological innovations that introduce iterations and other methods. All this increases the likelihood of a higher infoformalization in IS departments and the IS profession. To be sure, one can also find a high infoformalization in other departments or professions, such as accounting, banking, and insurance.

Rules and regulations pertaining to informing agents may not be explicated but rather embedded in software. This is what happened with “software tools” in Orlikowski’s (1992) case: from being visible or obtrusive, rules became invisible or less obtrusive. Another example is ERP software packages, which have “best practice” designs of work procedures embedded in them. Also, user manuals may not be in print form, which would allow for counting the number or length of regulatory documents in order to assess infoformalization. Instead, online documentation is increasingly used. These facts could explain, in part, why the professionals using IT extensively may perceive formalization as being lower. For example, in a study of the public accounting industry, Travica (1999) found that a higher usage of IT is associated with a lower formalization, as perceived by the professionals. Although professionals had to run audit, tax, and other procedures in a formalized fashion, they did not feel as being driven by rules. This could be due to the fact that rules and regulations were embedded in application software. Another explanation could be evolutionary in character. As Huber (1990) suggested, the formalization associated with IT could be more salient in early stages of IT adoption than in later stages. Once users become familiar with IT, they stop thinking of rules driving its use. Once the rules get under the skin, one stops feeling their pressure. The corollary is that perceived infoformalization should be taken as a proxy construct.

When overdeveloped, infoformalization can jam the nervous system of an organization that in turn can affect organizational performance. Consider this account of Taco Bell’s CEO portraying the organization of this firm in the early 1980s.

...[We had] operational handbooks for everything – including, literally, handbooks to interpret other handbooks. (...) If something was simple, we made it complex. If it was hard, we figure out a way to make it impossible. We operated this way, because with all our layers of management, we needed to make things difficult so we could keep everybody busy. The more commands and control we had in the system, the more the system justified its own existence. (Hammer & Champy, 1993: 172).

The “old regime” at Taco Bell exemplified a high degree of infoformalization that is typical, say, of the military organization. The company created so many rules that it had to introduce a manual for guiding the interpretation of these manuals. Thus, old Taco Bell formalized even the process of creating meaning—one aspect of infoformalization. This is a good example of how high infoformalization can impair organizational performance.

Infotragmentation

Infotragmentation refers to the extent to which data and IT are divided along departments, jobs, tasks, and processes. Corresponding dimensions of organizational structure are departmentation (divisionalization) and job specialization, both representing horizontal differentiation of organization. IVO prefers putting these different bases of differentiation under the same umbrella because the classical boundaries

between the bases are becoming softer as a consequence of implementing new organizational designs and process-centered organization.

Examples of infofragmentation are abundant. An accounting department operates with accounting data (financial figures and records, meaning of financial figures, knowledge of accounting procedures); a marketing department operates with customer data and other market phenomena; and so on. As departments (divisions) in a functional organization are differentiated on the basis of related work they perform, these departments are characterized by distinct data content. In organizations departmentalized on the product basis, each unit must have all or nearly all departments participating in the production of the particular product (a good or service). Clearly, specific product-related data are what makes a difference in this structure.

Classification, categorization, indexing, abstracting, and similar methods of organizing data have to do with infofragmentation. The documented corporate knowledge can be categorized by professional areas and further classified. Libraries perform a similar organization of their materials based on areas of research/study, leisure, age, etc. (see the discussion above). The effect in either case is that the body of data is somehow fragmented. In this aspect of organizing data, infofragmentation has some overlap with the concepts of knowledge codification mentioned above (Boisot, 1987; Davenport & Prusak, 1998).

Infofragmentation in process-centered organizations paints a different picture (more details on this organization are in the chapter on infoprocesses). Hammer (1996) emphasized a need for big picture and systems thinking. An organizational process can integrate many separate tasks into a complex IT-supported workflow, which delivers a product to a customer (internal or external to an organization). Consequently, process-centered organization strays from the silo model of infofragmentation in functional organization. Data are integrated across functions or centralized in the hands of process workers. An example is the transformation of the credit approval process at IBM Credit Corporation (Hammer & Champy, 1993: 36-39). Initially, the process of approving customers' requests for their purchasing of IBM products took four specialists from different units, working on different IS to check credit history, set loan terms, determine interest rate, and create quotes in six days. A new process rested on a database system was introduced, integrating all activities from start to end. A single person ran the process in a much shorter time. Looking from the stance of infofragmentation, one can see that the organization dramatically reduced divisions in data and IT.

Applied to knowledge representations, infofragmentation overlaps with knowledge codification (extensively discussed in the chapter on infoculture). In turn, knowledge depends on job specialization. To take IS jobs as an example. There are network and database specialists. Network specialists can further specialize for local and wide area networks. Both WAN and LAN specialists can specialize in different network architectures. Database specialists, on their part, can be data analysts, system analysts, system developers (programmers), or database administrators. The last two can further specialize in different database products and technologies (relational vs. object-oriented, Web service solutions, N-tiered architectures, etc.). Each of these areas of specialization operates with appropriate knowledge frameworks and perhaps nurtures a distinct wisdom. This leads to different methods of codifying knowledge, the bigger the differences, the bigger the likelihood of problems in mutual understanding needed to perform in joint projects. From the management perspective, infofragmentation deserves continuous attention since it can insert roadblocks to collaboration.

Infodispersion

Infodispersion refers to the extent to which data, knowledge, and IS are dispersed in space. In the example of academic library organization above, library branches located in schools and departments represent an example of spatial dispersion: the more branches there are, the more dispersed data are, and vice versa. The allocation of library materials to different physical places indicates infodispersion. Infodispersion and organizational dispersion go hand in hand in traditional organizations. Recall, however, the discussion on the virtual library above. A physical library can be in one place, while the online sources of materials can be dispersed in a huge global space. Even when the spatial dispersion of an organization equals one, infodispersion can be large. Therefore, infodispersion can be indeterminate of organizational dispersion in the virtual organization. Put another way, infodispersion extends organizational dispersion.

The macro-societal perspective shows a historical trend of increasing infodispersion. In old times, informing resources (books, drawings, maps) were located in a small number of schools, monasteries, and homes of the rich. Early books were handwritten and published singularly. Chained to a study desk, a book could be read just by one-two persons at a time. A similar situation marked the advent of news forms (e.g., notices on the movement of ships carrying merchandise). The press technology gradually increased the volume of publications. Still, due to transportation costs and variable purchasing power of customer segments, infodispersion of paper publications is not universally accessible even nowadays. However, electronic data format and computer and mobile phone networks have unleashed historically unprecedented increases in infodispersion. If the Internet is a chief enabler of this trend, the question now is: how to overcome the digital divide arising from uneven Internet access?

At the organizational level, the challenge is to ensure funding for infodispersion that highly correlates with dispersion of operations. Infodispersion is a dynamic aspect, implying that data are in motion where they are needed. That is where one difference between infodispersion and infofragmentation lies. Technological barriers to achieving higher infodispersion continually decrease over time, which does not necessarily apply to infofragmentation. To further differentiate between infodispersion and infofragmentation, note that the latter poses bigger challenges due to different data types and the content inconsistency. For example, mobile marketers can be well-served by a shared pool of product data of the textual type, which are pulled from spatially distributed servers. In contrast, the same marketers experience a challenge if a customer asks precise technical questions that only engineering drawings can help answering. The drawing data type can be challenging to understand. In a word, the difference between infodispersion and infofragmentation is a difference of similar data (type, content) vs. dissimilar data.

The literature makes a connection between organizational development and ideas behind the concept of infodispersion. Morgan (1986) argued that organizations have been evolving into information systems as IT is built into their spatially distributed design. Quinn (1992) proposed a concept of intelligent corporation that has to do with ideas of dispersing data and IS. Studying Arthur Anderson, a large, global consulting firm, which went through several technological solutions in recording and sharing practitioner experience (e.g., CD-ROM, electronic bulletin boards running on a high speed computer network, and a central database), the author noted that these methods enabled the company to function in a highly decentralized mode. This conclusion confirms the inverse relationship between infodispersion and centralization as a structural dimension.

Summary

In summary, infostructure was defined in terms of stable patterns of relationships between data segments and in IT arrangements, or as the structure of informing agents. Dimension of infostructure parallel organizational structure and they are infohierarchy, infocentralization, infoformalization, infodispersion, and infofragmentation. Each dimension was defined, its examples furnished, and its relationship with social structure discussed. From the perspective of resource based view organization, infostructure complements organizational structure. Infoformalization and infohierarchy overlap, i.e., explain in part the structural dimensions of formalization and hierarchy, respectively. Infohierarchy as well as infocentralization are necessary conditions for the symmetric dimensions of hierarchy and centralization, respectively. Infofragmentation can indicate ruptures in organizational structure. Table 2 summarizes these relationships.

Infostructure of Big Data

An important application of the infostructure concept involves Big Data. In comparison to “small data” (structured records of alphanumeric data according to the relational database model or some older model), Big Data appears very different.

Infohierarchy is low (Table 3) because master data of relational databases and primary and foreign keys are not as important. There can be multiple keys in Big Data databases, new columns can be added to tables as needed. In addition, infohierarchy is dynamic, influenced by new data segments and sources that can emerge.

Infocentralization is also low, because Big Data technologies allow a flat structure. This is so in principle, while practically infocentralization is flexible. Furthermore, infoformalization is low since rules and regulations are just emerging as companies learn about rapidly evolving business environments.

Big Data are high on both infodispersion and infofragmentation. Design issues of high infodispersion are being resolved via technological advances, such as increased connectivity, Hadoop, and MapReduce. However, the infofragmentation of Big Data is a more problematic issue because various data types and contents need integration. Data that is not connected with a major data pool can be sitting in data lakes that actually become waste lakes (sometimes called dark data). This problem can only become more salient in the future.

The Big Data infostructure discussed above can serve as a guide for firms moving from “small data” to Big Data.

Table 2. Infostructure and organizational structure

Infostructure	Relation with Organizational Structure
Infoformalization	Explains partly Formalization
Infohierarchy	Explains partly and is necessary condition for Hierarchy
Infocentralization	Necessary condition for Centralization
Infodispersion	Extends Spatial Dispersion
Infofragmentation	Indicates significant structural division

Table 3. Infostructure of big data content and technologies

Dimension	Definition	Big Data
Infohierarchy	The extent to which data and IT are vertically distributed.	Low
Infocentralization	The extent to which data and access to IT are concentrated.	Low
Infoformalization	The extent to which written rules, procedures and instructions on handling data and IT are extant.	Low
Infofragmentation	The extent and modes of dividing data and IT on the department, job, task, and process basis.	High
Infodispersion	The extent to which data and IT are dispersed in space.	High

INFORMAL STRUCTURE OR SOCIAL NETWORKS

Organizational members build and participate both in formal and informal relationships. In other words, they create and are subject to both formal and informal organizational structure. One can study informal social structure by the means of network analysis, which can be traced back to Moreno's study in sociometry in the 1930s (Moreno, 1953). Theories of informal and formal structure have never been brought into a harmonious relationship, but rather existed in their separate turfs without cross-pollination. Interest in network analysis resurged in the era of computer mediated communication (CMC), which commenced in the 1980s and continued with the rise of social media by the end of the past millennium.

An informal social network is based on exchanges of some "currency." This can be material entities (e.g., physical and monetary presents) or immaterial entities (e.g., answers and advice). Actors involved in exchange are usually called nodes, and their exchange-based relationships are called links or ties (the terms are used interchangeably, the first being more general and the latter referring to Grenovetter's (1973) work). The same terms are used in concepts of network used in technical disciplines, including computer engineering. Therefore, a computer network also consists of nodes and links. For this discussion, immaterial exchanges in a social network are of interest, while computer networks matter as part of communication systems supporting the social links.

Communication is a substance of links in a social network. Put another way, social relationships are maintained via communication, or communication is part of social relationships. In organizations, communicated are opinions, advice, professional questions and answers, facts and fiction (rumors) alike, and the like. The term "grapevine" is sometimes used to mark this communication. In contrast, announcements, orders, reports and the like content make formal communication that, in turn, partakes in formal organizational structure.

For a social network to exist, it is important that network members value the "currency" and maintain its exchanges in a continuous manner. If performed face-to-face (in person), a social network is obviously confined to a limited space. Modern communication systems, extend capabilities of the landline telephone and pre-electronic technologies and reduce the space limits.

Social network theory operates with an elaborate framework. Some of the concept relevant for this discussion is:

- *clique member* – an individual involved in intense exchanges, i.e., communication, thus creating a close-knit part of a social network called clique;

- *communication star* – an individual with dense communication links);
- *isolate* – an individual outside a clique;
- *bridge* or *liaison* – an individual that connects cliques;
- *boundary spanner* – an individual who connects a social network with its environment.

Social network analysis is interested in links/ties. Understanding these leads to understanding the network itself. (Grenovetter, 1973; Monge & Eisenberg, 1987)

Ties/links may or may not exist within a group of organization members. The measure of *network density* reflects the proportion of existing and possible links. Links between two members can be in one or both directions, and the measure of *network reciprocity* captures this idea. Links can be stronger (carrying more frequent exchanges) and weaker (less frequent exchanges). These notions also underlie Grenovetter's (1973) concepts of *strong and weak ties*.

A denser network with strong ties can be a supportive social structure, and it may be a necessary condition for adopting communication technologies (Fulk et al., 1990). However, this more structured social fabric may put pressure on members to adopt norms and values, and it could become more conservative and less risk-taking. In contrast, a less dense/more loose network may be more agile in adapting to external changes.

Links can take on various configurations, thus creating different types of networks. A sequential link pattern defines the *bus* type, closed loop defines the *ring* (or wheel), a pattern with central node makes the *star* type, a pyramidal pattern makes the *tree* type, and a random pattern of links to any node defines a flat network called *mesh* or *all-to-all* network. Network members differ on the number of links going to and from them. The measure of *network centrality* is supposed to make this differentiation. This aspect can help us understand who works in the shadow of the official distribution of formal authority or who is who in a network created with a support of a social medium. Newer social network theory reaches beyond the quantitative aspects of links and takes interest in their content. A community of interest can be accessed via network analysis and characterized as a social network. Some networks evolve around singular topics, others about several. If each topic is considered a separate link (a channel of communication), then the networks with multiple topics make a *multiplex*. A multiplex is more stable than a *uniplex* (single topic-networks). (Putnam et al., 1996)

CMC can impact on creating informal structures (Fulk & Steinfeld, 1990; Sproull & Kiesler, 1991). It would take little effort to maintain a clique via a private electronic bulletin board system or to utilize email in order to serve as a bridge between two departments in an organization in the 1980s. Other network roles have also been impacted by advances in communication technologies. Networks can be easily tuned to different configurations. For example, use privileges can be managed so that centralization and hierarchy are instilled into the network; or distribution lists and the forwarding function can be deployed to purport a flat structure.

Social networking via specialized systems and CMC have historical precedents. In 18th century England, Francis Bacon, the well-known intellectual of the time, used the term “invisible college” for people who carried out the intellectual and political discussion by writing letters to each other (Hiltz & Turoff, 1978). A college would live invisible to bystanders. In the last two decades of the 20th century, invisible colleges of academics, professionals, politically like-minded people, and many other groups mushroomed via CMC. While the characteristics of distance and invisibility of network actors were similar to the historical precedent, modern electronic technologies have brought a whole world of difference in comparison to the horse-and-carriage based mail.

This rich social network framework has regained importance in the era of social media. The term social media is used interchangeably with “social networking (or network) sites” to refer to a range of specialized web sites and other system assemblages with CMC, file sharing, and creating between users-connectivity as the core functionality. Social media can be Web sites (e.g., Facebook, LinkedIn, YouTube and other Google business, and sites for blogging) or cell phone systems (e.g., Twitter). The core functionality underlines design of various IS that a social medium consists of, such as electronic bulletin boards, chat systems, photo albums, video database system with automated indexing and retrieval functions, short messaging service, blogs posting and retrieval facilities, and connectivity modules (exemplar functions are those of liking and friending on Facebook and of following and trending on Twitter). Most of the content on a social medium is created by Internet and cell phone users, while social media companies supply a part of the connectivity content.

Since a social medium technically is an agglomeration of IS, to a user it appears as a single package of services. A user of a social medium thus can be in a simplex or a complex role. In other words, one can use less or more of the services and underlying IS. The incipient research on social media has suggested that staying in touch with acquaintances or *connectedness* play a motivating role for users of social media (van Dijck, 2013). Psychological needs and social capital incentives may be involved.

Social media originated in the public domain of informal two-way social communication. The origin justifies their name and sets them apart from the classical mass media based on one-way mass communication (TV, radio, press). Social media have gradually been moving into the organizational context, as marketers and other parties have realized their business potentials. Social media may be the technological platform facilitating maintenance of social organizations (e.g., existing groups) or creating of new organization, such as social network. However, the starting assumption should be that a social network does not exist around a social medium until it is identified via a social network analysis. The hype that traditional mass media have created around social media could fog lenses even if they belong to a social researcher.

Infostructure and Social Network

The perspective of infostructure can help in social network analysis. Data and IT bundled in various IS are the resources that can take on different patterns of access and use. The perspective of infostructure can illuminate these patterns. Specifically, infocentralization complements the concept of network centrality. Both infocentralization and infohierarchy can illuminate vertical structuring of social networks emerging around social media, which at the surface may appear flat. CMC may make actors feel less constrained due to a lack of social cues and semblance of anonymity, leading to the assumption of equalizing effects (Kiesler et al., 1984; Kiesler & Sproull, 1992; Sproull & Kiesler, 1991). Although historical, such a lesson may repeat with similar new systems, such as communication systems incorporated in social media. However, vertical differentiation remains a possibility, as some CMC researchers suggested (Spears & Lea, 1994). The perspective of infocentralization and infohierarchy can assist in revealing the differentiation.

Infoformalization can bring to surface constraints applying to data properties in a particular social network. It can also detect the impact that a social medium makes on the data exchanged. Depending on the requirements of a social network (be it extant or in creation), the degree of constraints imposed may have a differential impact on the network, ranging from supportive to stifling. Finally, infodispersion taps into the locations of social network data both within a social medium and beyond it. In selecting a host social medium, a social network could compare its infodispersion requirements with corresponding

capabilities of social media. A quality option should be able to provide smooth connections, including data conversions across required locations.

Summary

In summary, informal social structure can be identified by the means of network theory and analysis. This elaborate framework with a long tradition identifies social network as a set of nodes and roles, and defines network types. Analysis focuses on the properties and configurations of network links. This framework has regained importance with the advent of CMC and social media. The perspective of infostructure can help in social network analysis. Table 4 summarizes relationships between infostructure and social network.

SOCIAL MEDIA AS BUSINESS

The discussion in this section will explore social media. It will extend the topics of social media and infostructure, while charting a path toward the discussion on the philosophy of technology and human agency, which is addressed further down in the chapter. Social media will be approached as a business rather than a marketing channel or just the end-users' context, which is more typical to IS research. Another premise will be that social media are part of the mass media industry, thus complementing older media, such as TV, radio, press, and film. This premise will be a springboard for defining social media in contrast to the old media and labeling the former as "new media."

Classical communication theory defines old media by a purpose of *mass communication* in the macro-societal context (McQuail, 1983). This communication is one-way, from the professional journalists that produce the media content downward to mass audience. One aspect of this communication is informing, for example for political purposes. Therefore, TV, radio and film can also be viewed as media of mass informing. These media operate upon the familiar sender-receiver model, where the possibility of the receiver's taking on the sender role is extremely limited. The receiver is placed in a passive consumer role. Contrast these characteristics with social media. Members of, say, Facebook create the content by themselves for themselves. There is no professional staff or limits to what is written or submitted as photos or videos. Communication is two-way and potentially all-to-all. Blogging may replicate the one-to-many mode of old media or be more interactive. Still, both social media Websites and blogs match old media with regard to the broadcasting, mass communication property.

Mass media communication relies on techno-social *connectivity*. For example, a TV company routes the signal via cabled links hooked into a viewer's TV set. This creates a technical network that is of a

Table 4. Infostructure and social network

Infostructure	Relation with Social Network
Infohierarchy	Explains vertical structuring of network
Infocentralization	Explains vertical structuring of network
Infoformalization	Explains constraints in network
Infodispersion	Extends network requirements

centralized, one-to-many, and push type. The number of links is fixed and equals $N-1$, where N is the size of audience plus the broadcaster node. The technical network has a social complement in a gathering of viewers. If the creation of a social network depends on the frequency and member-attributed importance of social links — “ties” (Grenovetter, 1973) — then social density never matches the technical density. Also, horizontal ties between viewers are random, thus uncertain. Castells (1996) explored relations between social connectivity and growing computer networking in the macro-societal context of the late 20th century. Social media based on multifunctional Websites like Facebook, belong to the type of pull technical network. Users join in and arbitrarily initiate links with others (e.g., interest groups and “friends”). The theoretical maximum of links is $N(N-1)/2$, where N is the number of users. These links support social ties that, in turn, may produce social networks. These may overlap since one user can be part of many networks. Social network properties (the number, size and density) are indeterminate and potentially large.

Beside social functions they perform, old media represent the means of intellectual *expression* of media professionals. McLuhan saw media also as an art form, which is obvious in the case of film and TV. This individual creative expression aspect is again emphasized with new media. Manovich (2013) argued convincingly that electronic technologies, software in his words, has become the major medium because all classical media are transformed into digital form. Therefore, software appears a medium of creative expression. Network and application software is certainly behind social media like YouTube, blogs and wikis that enable an expression of members. These users are both amateurs and professionals. By provisioning a free domain of creative expression for untrained thinkers and artists, social media expand expression potentials of the media universe.

Media play a proactive role rather than just reflecting on some objective reality. McLuhan (1964) contended that a medium is a message and that TV has created a global village. Various theories of mass media as gate keepers, agenda-setters and partner/interlocutor do concur that old media, at the minimum, play an active role toward the content broadcasted rather than merely publishing “facts.” On a more critical wing, theorists see the media as the propaganda tool, amplifier of dominant social positions, or shaper of reality in an ideological fashion. Examples of the first two are government-controlled media (propaganda) versus corporate media (amplifier). The notion of ideological shaping posits that media intervene in mass perception, understanding and preferences, and thereby obtain cultural legitimacy for what is actually partial descriptions of the world. By creating interpretative frames that coincide with ruling values and symbolic order, media establish what is real, true, factual, common interest, and other universal things. (See Milivojevic, 2015) This reasoning portrays old media as a *reality creator*. This capability is brought to extreme with reality TV that clones the film medium and constrains the interpretation of options to televised reality.

Are new media any different regarding reality creation? If anything, new media match its counterpart as *reality creator*. As social media feature a scaled up connectivity, self-initiated mass communication, and expression commons, reality is constructed in an inter-subjective fashion by the crowd and for the crowd. Such reality is spawned haphazardly, temporarily and swiftly, as indicated by the term “viral video.” But as long as it lasts, it is not lacking in persuasive power. Moreover, parties advocating special interest can use new media as a propaganda tool as with old media. The capacity of spinning is scaled up as the social media content can be playful, exciting, shocking, engaging, and it is pushed pervasively down to mobile technologies. The content is also discrete rather than story-like with old media, thus allowing today’s impatient user to arbitrarily plug in and out. Nevertheless, users can fall victim of what a spin-doctor mediates as reality.

The characteristics of old media discussed so far helped in differentiating new media within the media universe. The last property of *sharing* multimedia format is a differentiator exclusive to new media. Social media can support functionality of uploading and downloading digital objects, such as photos, videos, and audio files. This applies to multifunctional Websites (e.g., Facebook and Chinese QQ) as well as specialized sites (e.g., YouTube and Instagram). Again, the user is in charge and exchanges are massive. Being enabled by connectivity, *sharing* stimulates communication and impacts *reality creation*.

Based on these characteristics, social media can be defined as Internet-centric organizations for user-driven mass communication, exchange of digital objects, and creative expression. Compared with old media, new media are higher on connectivity and communication, enable sharing of digital objects, and have a high potential for creative expression and reality creation. They exhibit a lower infostructure with regard to formalization, hierarchy, centralization, and dispersion. This is summarized in Table 5. Note the differing character of the users/audience. While the old media presumes a passive consumer of its programming (the reified information discussed in Chapter 1), social media promote active user who is unconstrained in creating and possibly interpreting the content. Still, when social media are used by special interest for manipulative purposes, this difference withers. The defining dimensions of social media are represented in the model appearing in Figure 1. Interested researchers may want to operationalize the dimensions and test the model.

Implications of this exploration concern both the social media and the old media organizations. The former may consider pushing further the differentiation in order to starve old media from advertising, the lifeblood for both competitors. On its part, old media may consider continuing in the direction of replicating some capabilities of its counterpart. This has already been going on through setting up online newspapers, radio and TV stations, and adding interactive functions. For example, some online outlets of TV stations added open blogs for the audience's comments. Some also added droboxes for uploading photos and videos, and so they tried to replicate the sharing capability of social media.

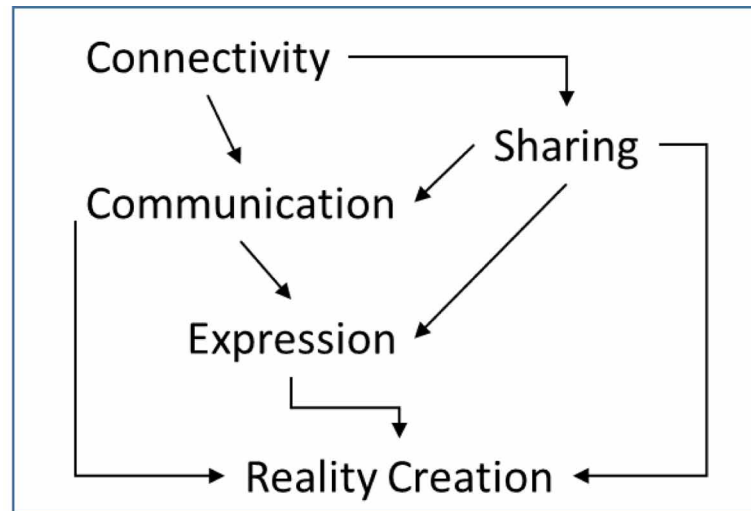
TECHNOLOGY AND ORGANIZATION

The relationship between technology and organizational structure has been studied for decades. A fundamental assumption has been that technology is a social concept accounting for production and management methods that deliver a good or service by transforming material and immaterial entities.

Table 5. Comparison between old media and new media

	Old Media	New/Social Media
Communication	Moderate; One-way, top-down	High; Two-way, all-to-all
Connectivity	Moderate, weaker one-way links	High potential, strong horizontal links
Creative Expression	Moderate-High; Professional training	High potential; Amateurs, some professional
Reality Creation	High; Push/audience spin	High; Pull, inter-subjective, and special interest spin
Sharing	Negligible sharing of audience-generate content	High, genuine capability
Infostructure	Lower infoformalization, infohierarchy, infocentralization, and infodispersion	Higher on all dimensions

Figure 1. Model of social media



Physical manifestations of organizational technology have been out of the research scope. IT has been left out as well, with rare exceptions in the case of high technology (hi-tech).

In the IS field, scholars are focused exclusively on IT irrespective of other technologies. A majority of IS scholars think of IT in reference to electronic machines and devices, or computer software and hardware taking on various configurations (a minority accounts also for pre-electronic devices). Theorizing beyond the material to involve the social is visible. In some works, the social even takes precedence over the material, thus overlapping with the treatment of technology in organization theory. There are also attempts of ontological integration.

Technology as Transformational Function

Organization theory takes a specific approach to technology, which does not differentiate between material, social, and cognitive aspects of organization. Technology is usually “a means to some end” (Hatch, 1997: 129) or a transformational function of organizational input into outputs. This highly abstract approach is not interested in particular material technologies, including IT. Students of technology usually equate “technology” with the term “technical,” which has the root in Greek “tekhné” meaning “art” or “method.” Also, “technical” is sometimes moderated with other terms (e.g., technical system, and technical process). Technology thus includes work procedures and associated tools, knowledge of these procedures, and management methods involved in transforming organizational inputs into outputs (cf. Hatch, 1997; Roberts & Grabowski, 1996; Scott, 1992).

This highly abstract view blends the material side of technology into social aspects. This implies neglecting specific kinds of technology with regard to source of energy or technical principles applied. Consequently, IT is not differentiated from, say, electro-mechanical machinery. An exception is research on high-tech (Barley 1986, 1990; Weick 1990). Technology is typically studied in conjunction with organizational structure, which results in taxonomies (categorizations, typologies) of organizational forms. Several representative concepts of technology are discussed below and summarized in Table 5.

Scott (1992) defined technology in terms of hardware, skills, knowledge, and characteristics of objects of work. Hulin & Roznowski (1985) defined technology in terms of a transformation process that contains both physical and knowledge aspects. Berniker (1987) restricted the concept to technology to knowledge about cause and effect relationships between actions (cited in Roberts & Grabowski, 1996: 410). Woodward (1965) created an influential taxonomy of technology, inspiring taxonomy research to come. She studied certain aspects of formal structure in relation to organizational performance in smaller manufacturing companies. Woodward found that the performance can be explained when structural variation is combined with types of what she called technical complexity or the degree of mechanization (the extent of deploying machines in production).

Woodward defined four organization-technology forms—unit, batch, continuous, and mass production (Table 5). The first three were lower on several dimensions of formal structure (e.g., formalization, centralization, and span of control) than the fourth, in companies with a higher performance. (Curiously, the hierarchy was steepest in the continuous design; e.g., oil refinery.) In later theory, this conclusion has been interpreted as the impact of technology on organization. Subsequent research on organizational structure determined that organizational size mediate the impact of technology on organizational structure and/or shapes structure (Pugh et. al, 1968). It has been commonly accepted that technology effects are more pronounced in the context of smaller organizational size (Aldrich, 1972; Travica, 1999).

Approaching organization from a general systems perspective and process approach, Thompson (1967) proposed an organization-technology typology based on dimensions of standardization of input/output and of transformation processes. He also researched kinds of dependence between parties involved in the transformation processes. Thompson determined intensive, mediating, and long-linked technology. Hospitals host intensive technology, where inputs (patients' health problems) are unique and non-standard, and therefore medical services (transformation process) may vary. As a team of experts performs an operation, members depend on each other in a reciprocal way. Mediating technology is in organizations furnishing an interface for other parties; banks make an interface between borrowers and investors. Inputs/outputs are less standardized, the transformation process is standardized. Bank units are loosely coupled, thus creating the pooled interdependence. Long-linked technology is characterized by high standardization on both dimensions, and the interdependence is sequential. This resembles Woodward's mass production, and the typical example is manufacturing deploying mechanized assembly lines.

Perrow (1967) was concentrated on the nature of tasks, while excluding material technology (tools) from his model. His typifying dimensions are (a) Task Variability (exceptions to a standard way of working), and (b) Task Analyzability (the availability of methods for dealing with exceptions). These define a four-item typology. Routine technology is where tasks are both analyzable and constant, as in clerical units. In contrast, non-routine technology is where tasks are neither constant nor analyzable, as in R&D units. (This is similar to Woodward's small batch technology and Thompson's intensive technology). Lower variability but also lower task analyzability is where procedures are standardized, but exceptions in production require creative problem solving (e.g., crafts and civil construction). High variability and analyzability is where there can be many exceptions in tasks, but specialized training in problem solving makes the tasks analyzable (e.g., engineering and accounting work).

Galbraith (1973, 1974,) introduced the notion of "information processing" in understanding organizational designs. (Note that "information" refers to what IVO treats as data.) Galbraith posited that production complexity correlates with uncertainty, which, to be resolved, requires more intensive "information processing and communication." In complex organizations, IS can help monitor organizational

activities and automate control so that a need for hierarchical supervision (vertical communication) is reduced. Lateral relations and communication can also help in this respect, shifting information processing to teams and to Galbraith's matrix design (a project organization with a horizontal line of reporting to a project manager in addition to the classical hierarchical reporting to department management). All these are apparently moves pull organization toward more organic designs. In contrast, less complexity in the production process implies a smaller uncertainty and simpler processing and communication patterns. Mechanistic designs may suit these conditions. In this framework, technology is embedded in organizational structure, and it has to do with different methods of solving the different information processing and communication needs.

High Technology as Cognitive Equivoque

Weick (1990) concludes this selection of conceptualizations of technology summarized in Table 5. His conception includes IT in a corpus of high technology—"complex production systems that use computers" (that is, high automation, or software intensive systems). Weick ventures into the less explored area of user cognition. His start premise is that these technologies pose unusual problems. One refers to failures, which can be incomprehensible. In Weick's (1990) words, "people must assume the role of failure managers who are heavily dependent on their mental models of what might have happened, although they can never be sure because so much is concealed" (ibid., p. 1). In addition, there is a continuous intervention, improvement, and redesign. The systems development, therefore, never stops, and organizational structure is affected in new ways, posits the author. Weick argues that some established concepts of technology may not help in this situation. For example, asking about task exceptions and analyzability (Perrow, 1967; see above) makes little sense when technology operators do not even know that a problem occurred. Accidents of catastrophic proportions may occur randomly in spite of all control methods, as explained in Perrow's (1984) later study.

Weick (1990) introduces three characteristics that can explain new technology—stochastic, continuous, and abstract events. *Stochastic events* mean that new technology is indeterminable. One cannot predict exact paths of functioning, exceptions, and errors. Classical cause-effect reasoning fails to capture understanding of the relationships between human action and the functioning of the machinery and between parts of the machinery. And this uncertainty is permanent, in contrast to older technologies where uncertainty was transient. Part of the problem is "a continuous revision of the design of organizational processes and the fact that implementation often is the means by which the technology itself is designed," argues Weick (ibid., p. 8). (One can recall here the example of e-commerce systems based on N-tier architectures, where tiers can be slotted in and out of a distributed system, as the cost and market dynamics dictate, affecting downstream organizational processes.) Furthermore, stochastic events can occur one or more times, and may or may not be understood. Failing to understand is stressful, and chances for learning are usually limited. Users of new technology must be very skillful and capable when operating in a standby mode to prevent faults or to remove these when they occur. They have the discretion to make decisions, which are hard because the problems are unstructured. This keeps the users in a state of arousal, which can further impede their inability to learn.

The characteristic of *continuous events* means that new technology draws on longer workflows (as Woodward's (1965) continuous process cited above) and that it exhibits a high level of automation. The main related issue is that of reliability for keeping organizational processes doing what they are supposed to do. This issue marks the ongoing postindustrial era and replaces the efficiency imperative, which marked

the industrial era technology (Weick, *ibid.*, p. 11). Automated processes span into the area of data- and communication- intensive work. Examples include the work of bank tellers, airline ticket reservation systems, ATMs, and POS payment processing. Unlike the previous continuous process technologies, new continuous technologies “use communication technology and construct organization without location” (*ibid.*, p. 12). These technologies “knit separate actors, transactions, and locations together into a continuous process” (*ibid.*). Thus, significant implications for organizational structures are at stake. (It may be noted here that a good example of “organization without location” is the virtual organization, which can be created through electronic interaction of different physical organizations (Travica, 1999a, 2005). From the user perspective, continuous events require a high attention to work processes, and rapid response in emergencies, among other qualities. The continuous and stochastic events combine, thus scaling up the frequency of unexpected outcomes—whether failures or such outcomes that present occasions for innovation and learning (*ibid.*, p. 14).

Abstract events means that more of the work associated with new technologies “has disappeared into machines.” This imposes increased cognitive demands on users in terms of inference, imagination, integration, problem solving, and mental maps to monitor and understand what is going on out of sight (Weick, *ibid.*: p. 14). At least four components need to be understood: (1) the process—layout, sequences, interdependencies; (2) the product; (3) the equipment—functions, capabilities, and limitations; and (4) the controls—functions capabilities, limitations, and effects of control actions on performance. Technology is partially self-controlled, and so users need to understand the whole picture in case self-control malfunctions. Moreover, the users are more likely to make mistakes than errors (straying from a prescribed procedure). Mistakes come from misconceptions and misunderstanding of what is going on.

The complexity of technology and the processes it carries evades understanding of what may be really going on. Users collect and process sensor-collected data on the process state, but these readings do not convey a direct picture of cause-effect, goals-means, or physical relationships. In coping with this situation, the users try to imagine what the physical process is. In doing so, they can drift far apart. The result is that there are two technologies – one physical, and one mental. New technology is, therefore, a “parallel technology” or a “dual technology” (*ibid.*, p. 17). Contrasting the technology on the floor with the technology in the users’ head, Weick finds that each of these is self-contained, has a sizable effect on the other and a mystery due to the invisibility, corrects the other discontinuously, and is coordinated with the other intermittently.

All these properties lead Weick to characterize modern IT as an *equivoque*. One needs to pause here, because Weick shifts the concept of IT into a domain of cognition. He makes this shift clear by stating that cognition is the key, along with micro level processes, to understanding the organizational impact of new technologies.

Follows a summary of main points from Weick’s conceptualization of technology and users. The vocabulary of IS is introduced to ease reading for he readers coming from the IS perspective:

- IS are complex with advanced capabilities of automating organizational processes at the micro and higher levels;
- IS are continuously redesigned in the implementation stage;
- The workings of IS are hard to comprehend. To compensate users make assumptions that can deviate from facts. This leads to one aspect of the technology equivoque—IS on the floor vs. its image as in the user’s mind;

- IS functioning is not fully predictable as it is susceptible to random (stochastic) events. This is another aspect of the equivocal. It is dramatically demonstrated in failures, although unpredictable outcomes can create felicitous conditions for learning and innovation;
- IS users cope with increased cognitive demands (attention, inference, imagination, integration, problem solving/decision making, mental maps, holistic thinking);
- Failing to understand random events creates stress, which further impairs comprehension; and
- Users' mistakes are inevitable.

Below are Weick's relevant points concerning specifically cognitive informing agents:

- Readings of production process parameters are the pieces of data that do not reflect cause-effect, goals-means and physical relationships.
- Mental models of work processes, product, equipment, controls, problems causes and failures are crucial in using IS. These bear a subjective stamp;
- The mental models may contain mistakes (misunderstanding);
- IT/IS are a cognitive concept as well as physical;
- Users' cognition and micro-level processes are the key level of analysis for understanding high technology.

The concept of technology-equivocal has been advanced in research on mindfulness and high reliability organization (Weick et al., 1999). Developed in part antithetically to normal accidents theory (Perrow, 1984), which predicts that failures of high technology are inevitable, the concept of mindful organization puts the perils of complex technology under check of human factor. Weick and colleagues (1999) argue that "mindfulness both increases the comprehension of complexity and loosens tight coupling" (p. 51). Moderating impacts on these two main causes of disasters (complexity and tight coupling) is carried out by five cognitive processes leading to mindfulness.

The first process of mindfulness is *preoccupation with failure*; it helps to comprehend more of the potential complex interactions and create task alternatives that loosen up couplings. *Reluctance to simplify interpretation* of situation/problems enables people to pay close attention to details of complexity and see more components that can be rearranged so that tight invariant sequences are avoided. *Sensitivity to operations* permits seeing more interconnections and comprehend more complexity so that adjustments can be made and time, resource and other dependencies loosened up. *Commitment to resilience* enables people to stay attuned to unfolding events for a longer time and thereby increases the likelihood that they will be able to grasp puzzling interaction. Finally, *underspecification of structures* means that decision making can be pushed down to competent people facing specific problem aspects and thus can detect anomalies early.

When complexity and tight coupling is attributed to technology and IT, it is apparent that mindful organization modifies the concept of technology-equivocal. As the authors argue:

We see technology less as an intractable technological imperative and more as a controllable option if it is engaged by effortful, continuous collective mindfulness enacted by smart, trusting, trustworthy, self-respecting (Campbell, 1990) people willing and able to negotiate the differences among their diverse views under intense time pressure. (Weick et al.: 51)

Obviously, this conceptualization portrays users as being abler to understand technological complexity and to control coupling of potentially dangerous events in technology. Mental mistakes and misunderstanding of technical processes are not inevitable. Another important characteristic of users is the salience of group dimension. Coping with complexity and tight coupling succeeds through group rather than individual effort. The concept of mindfulness, therefore, adds to the discussion on groupomatics. If wisdom is the capability of making right judgments in right moments, it can be said that mindful organization possesses wisdom arising from group collaboration in critical situations. In addition, the viewpoint of mindfulness helps in understanding the relationship between groupomatics and organizational performance and economics, inclusive of infoeconomics.

In summary, organization scholars think of technology in broad, abstract terms, blending it into a larger social frame of transformational function. Specific forms of technology are approached as determinants of different forms of production. In this abstract view, IT is not recognized as a particular entity, except in some studies of high-tech. Nevertheless, this theorizing yields valuable contributions for study of IT, which will be recalled further below in the chapter. The concept of technology as equivocal broadens the horizon for theorizing IT.

Information Technologies and Organization

IS scholars usually think of IT in reference to computers. For example, Huber (1984) referred IT to the digital computer and the capabilities of transmitting, manipulating, analyzing, and exploiting data, which were integral to communication and decision-making tasks. Zuboff (1988) defined IT in terms of combinations of microelectronics, computer systems, and telecommunications. She studied IT in a case manner and found that the same kinds of IT (or IS) reside in different organizational designs, which she labeled as “informed” and “automated.” The corollary is that the role of IT is socially mediated. This interpretation represents a bridge toward a social ontology of IT. In fact, social ontology underpins several methodologies, such as socio-technical systems, the institutional approach, and a structuration theory approach. Materialistic ontology marked early research (e.g., Huber, 1984) and has been perpetuated in approaches such as actor-network theory (Hanseth et al., 1994) and sociomateriality (Orlikowski, 2007). Still, conceptualizations and definitions of IT are curiously lacking in the IS literature.

More often than not, IS studies neither offer any definition of IT nor go into describing the “assumed IT” they investigate (Orlikowski & Iacono, 2001). Instead of looking at particular types of IT and IS in terms of their characteristics, capabilities, and limitations, the IS literature in general tends to operate with vague notions of IT (e.g., a decision system, the Internet, an email system, social networking site, mobile solution, etc.). The term “application” is also popular, leaving the reader to wonder what precisely is meant by this term imported from the lingo of software producers. Vague conceptualizations of IT have a complement in vague operationalizations drawing on surrogate measures (e.g. the level of IT investment, IT availability or access, and self-reported measures referencing IT).

Research rarely differentiates between IT and IS in terms of part and whole. It goes without saying that for a researcher of ERP systems the “IT” is ERP, for social media “IT” is the whole medium (even though a social medium consists of various IS and numerous kinds of IT), and so on. In addition to identifying IT with IS, it is rarely clear what parts and characteristics of a particular IS are under study. Depending on the research problem, one can differentiate between functionality and user interface, characteristics of data stored vs. quality of system outputs, and so on. Such differentiations are usually missing. The colloquial term “application” contributes to the confusion, as the authors may use it to

refer to a part of IS (e.g., user interface or a reporting module) or to an entire IS. The confusion increases when authors mix the terms “IT application,” “software application,” and “application software” (the only technically correct phrase).

This essentially black box approach to IT is apparent in quantitative IS research. It can also be detected in qualitative investigations that oversee particular features, capabilities, limitations and arrangements of IS under study. Consequences of the black box approach to IT are (a) a reductionism in understanding the relationship between IT/IS and organization, and (b) a concealment of different ontologies that may lead to confusing communication of research results both within and outside the IS field. Some aspects of the problematic black box approach have been noted in the IS field, resulting in a call for “theorizing IT artifact”.²

Information Technologies, Structure, and Action

In IS research, IT has been studied in relation to organizational structure. This resembles the approach taken in organization theory discussed above. Action ontology has also driven research. And attempts at bridging the two philosophies have been made. Structuration theory of British sociologist Anthony Giddens (1979, 1984) has served as a source of inspiration (Orlikowski, 1992; Orlikowski et al., 1995; DeSanctis & Poole 1994; Walsham, 2002). Structuration theory has been proclaimed a way of looking at the relationship between IT and structure that could replace the traditional structural approach (Weick, 1990; Roberts & Grabowski, 1996). Although the suitability of structuration theory for IS research has been questioned (Hanseth et al., 2004; Jones, 1999), some relevant insights have accrued.

The basic idea of structuration theory appears simple: bring together structural and action philosophies because none of these taken separately can explain the social context (in Giddens’s analysis this is a macro society). The structural approach alone explains social relationships that make an organization. It explains why people behave in a certain way. However, it is uncertain how structures are created and changed. The opposed action philosophy posits that human agency engages in action to create and change structure. But the action perspective falls short of explaining the contextual constraints on action.

Among students of organization, the structure-agency controversy has marked the line between the proponents of the classical structural view and various contingency approaches, on the one side, (e.g., Pugh et al., 1968; Thompson, 1967; Scott 1992), and ethnomethodologists and social psychologists, on the other (see Czarniawska-Joerges, 1992; Garfinkel, 1967; Weick, 1979). The former camp thinks of organization as an institutional entity, while the latter camp prefers thinking in terms of processes of organizing. Structuralists object that action is de-contextualized and that it cannot explain the macro-organizational context. Action theorists object that structuralists are trapped in a conservative view that cannot explain how organization is created and changed. This dispute leads to a *dualism* of structure and action in understanding organizations. Structuration theory strives to overcome the dualism and reconcile these opposed approaches by postulating that structure and action do not exist independently, but that action reproduces or evolves structure, while structure enables and shapes action.

Giddens’s (1984) structuration theory conceptualizes social structure in a particular manner. Structure is not detached from agent but rather exists as “memory traces” in agent as “virtual order.” Structure is reproduced via action (“social practices”) and instantiated in structural properties of social systems. Therefore, structure is both the medium (constraint) of action and the outcome of action. This two-fold character of structure Giddens termed *duality of structure* (p. 25). Furthermore, *structure* can analytically be decomposed into three dimensions: *signification, domination, and legitimation* (p. 29). Each

of these is reproduced via particular action: signification via *communication*, domination via *power*, and legitimation via *sanction*. Structuring of social relations across time and space in the manner of the duality of structure is *structuration* (p. 376). Therefore, structuring is realized via action by which agent “draws on” *modalities of structuration*. Power draws on *resources* to reproduce domination structure, communication draws on *interpretative schemes* to reproduce signification structure, and sanctioning draws on *norms* to reproduce legitimation structure. Giddens often uses a simplified vocabulary, in which the last two items are labeled as *rules*. Therefore, agent acts upon resources and rules in reproducing or changing the structural properties.

To illustrate these concepts by meta-analyzing Jones’s (1999) example of purchasing act. In grasping a price of an item from a price tag, the buyer engages in communication action and uses an interpretative scheme to understand the meaning of displayed symbols. The outcome is reproduction of the structure of signification. (Note that in IVO this act would be one of informing, which is a part of communication.) Furthermore, in exchanging money for the item, both the buyer and seller draw on their respective resources (the buyer on money, the seller on goods) thereby engaging in power action and reproducing the structure of domination. (Giddens views economic and political institutions as the paramount domains of domination structure.) Finally, the whole episode can be viewed as a reproduction of legitimation structure of the buyer-seller relationship via action that sanctions norms of the buyer-seller system.

However, the buyer can act differently and thereby reproduce different structural properties. The buyer can question the meaning of the price tag symbols, thus not reproducing the traditional structure of signification. The buyer can steal the product by using force, in which case the traditional domination structure would be undermined, and domination skewed toward the buyer side with aid of a new, coercive resource. This action would also invoke an illegitimate (criminal) structure. But it should be noted that structuration implies structural change as a latent possibility rather than as an extreme case because invoking resources in power action creates possibilities of declining from rules.

Although structuration theory lacks a fuller formulation at the organizational level of analysis (Hatch, 1997) as well as applications involving informing agents, it has been used in IS research and in cognate organization research (Barley, 1986, 1990; DeSanctis & Poole, 1994; Orlikowski, 1992; Orlikowski & Yates, 1994; DeSanctis & Poole, 1994; Walsham, 2002; Weick, 1990). For example, Barley (1986, 1990) found that the deployment of computed tomography scanners in a hospital was associated with action that changed organizational structure. The deployment of scanners coincided with changes in the organization of work and in a redistribution of power. Operators of the older radiology equipment lost power in favor of newly trained computed tomography technicians.

Barley (1986, 1990) concluded that the implementation of the new technology created “an occasion for structuring.” The interpretation schemes suitable to traditional radiology did not work because computer tomography delivered different outputs that required new reading. This undermined the traditional signification structure. Radiologists could not provide and approve these readings, and therefore they became unable to enact and reproduce traditional domination structures. Consequently, old legitimacies were not sanctioned through action. Rather, computed tomography technicians came to act, demonstrating in practice their competence. More collegial relationships between the two professional groups emerged as another effect. Overall, a new structure of legitimation coalesced, and new norms were established. (Cf. Weick, 1990.)

An attempt at structuration theory was experimental research in group decision support systems (GDSS) known as *adaptive structuration theory* (DeSanctis & Poole, 1994; see the chapter on groupomatics). However, outcomes of this research rather incline toward sociotechnical ontology. In addition,

Jones (1999) argued that a positivist slant in adaptive structuration theory had distanced it from Giddens's premises and did not overcome dualism of structure and action. Another significant attempt was Orlikowski's (1992) investigation of a software firm that was developing CASE software (computer-aided software engineering). The software purpose was to automate the development of user interface and, thus, increase programmers' efficiency. Senior management initiated the project, providing the resources and encouraging developers to make the CASE software compliant with the firm's systems-development methodology. From the perspective of structuration theory, developers of the CASE software were the human agency that was influenced by "institutional properties" of the firm. These were management strategy (the structure of domination), the structure of signification (the systems-development methodology as a part organizational knowledge), and the legitimation structure (the application of work practices that followed certain norms).

Users of the developed CASE system adopted it in either an expected manner (structure reproduction) or in an unexpected manner (structure change). In the former case, users enacted the institutional properties built into the software. The system development work driven by the CASE system was executed in a standardized, structured, and predictable manner. The management assumptions of compensating for the users' insufficient experience with CASE software were also reinforced. The organizational goals of increasing the productivity in systems development, which "built" into the CASE system, materialized via users practices as well. This way, the CASE system became a conduit of institutional (structural) properties and a constraint on human action. In other words, users' practices were determined by structure and reproduced structural aspects of legitimation (a proper way of doing work) and domination (the organizational and management goals).

In the case of unexpected adoption, however, the users would bypass or alter the system's functionality. In one episode, the users convinced managers that the software was too restrictive and succeeded in initiating a change. Therefore, users' action changed structure. But once a change was technologically implemented, it again became a constraining institutional force. It follows from this analysis that technology is simultaneously a medium of structure and action. Orlikowski labeled this as *duality of technology*, thus echoing Giddens's term *duality of structure*.

Orlikowski's (1992) invocation of structuration theory was motivated by the goals of avoiding both voluntarism behind strategic choice/human actor approaches (people shape IT) and technological determinism (IT shapes people and organizations). Also, it examined how the character of IT is formed in the design/development process rather than treating it as a given in the manner that adoption research had usually done. This application of structuration theory illuminated the background of IT as an extension of structure. IT is a part of "institutional properties" since "rules and procedures [are] structured into a machine" (p. 399).⁴ However, it can be argued that this strong emphasis on institutionalizing does overshadow the potential of agency to change structure. In effect, the framing of study's findings resembles an institutional approach. Another critique has addressed a deviation from Giddens's concept of duality of structure, which frames structure as "memory traces" in human mind: if it resides only in mind, structure cannot be externalized in IT (Jones, 1999). But it should be noted that Giddens (1984) framed technology as an *allocative resource* (p. 258). An allocative resource refers to a capability ("transformative capacity") of generating commands over material phenomena. A material object becomes a resource only when incorporated within processes of structuration (p. 33). Therefore, although IT as an allocative resource has a material existence, it can also feature as a "memory trace" in power action of knowledgeable agent.

Giddens's (1984) ideas, which directly address IT in contrast to other types of technology, can also be interesting for IS researchers. He argues about "information storage" as an extension of human memory

and a medium of historical and spatial expansion of social institutions. The notion of information storage indeed references a broader set of operations, such as representation, retrieval, and dissemination (p. 261), that is, IT as opposed to other types of technology. While in oral cultures human memory is the predominant “information storage,” newer technologies, such as books, films and audio tapes have overcome agent’s limitations. Giddens then ties the notion of “information storage” or IT to both allocative and authoritative resources (the capability or “transformative capacity” of generating commands over actors):

The storage of authoritative and allocative resources may be understood as involving the retention and control of information or knowledge whereby social relations are perpetuated across time-space. (p. 261).

Since resources are the medium of power action that reproduces structures of domination which constitute society, it follows that IT is directly involved in the constitution of society. Giddens notes that the city “develops in conjunction with the elaboration of new forms of information storage, above all writing;” the city is “the container or ‘crucible of power’ upon which the formation of class-divided societies depends” (p. 262). To the extent that city rests on economic, political and other organizations, these propositions on IT apply to the organizational level of analysis as well. They are interesting for IS research in general and for IVO research in particular (with some adjustments in terminology as the term data does not feature in Giddens’s vocabulary). In conjunction with theorizing on resources and power, Giddens’s concept of *duality of control* is also interesting. It plays a significant role in conceiving of infopower in Chapter 6.

Another interesting set of Giddens’s (1984) ideas refers to semiotics and semantics. The author argues that meaning cannot be reduced just to the communicative intent of an actor or to the structure of sign systems but that both aspects matter from the perspective of structuration (pp. 29-30). “Signs ‘exist’ only as the medium and outcome of communicative processes in interaction” (p. 31). In contrast, “structuralist conceptions of language [...] tend to take signs as the given properties of speaking and writing rather than examining their recursive grounding in the communication of meaning” (p. 31). In other words, signs are part of the signification structure that communication actors draw upon to construct meaning.

These propositions are relevant for IVO’s concepts of informing agents and informing. From the semiotic perspective, signs can be equated with the data that electronic and pre-electronic IT store, process and transfer, and that make the content of an IS (Travica, 2011). Data have no meaning by themselves but are given a meaning only by actors involved in a communication act (both the informer and the client, who keep switching the roles). In interpreting signs, the actors are bound to structures of signification (the learned relationships between signs and concepts). But communicative action has other aspects as well, and most notably power connotations. As Giddens (1984) stressed it, “structures of signification always have to be grasped in connection with domination and legitimation” (p. 31). These ideas are congruent with the IVO perspective. Informing is a complex process resulting with the inferring of meaning (information). Informing is part of communication, which in itself is a form of action. Giddens’s emphasis on a power dimension of communication (and thus informing) furnishes a sociologist critique of simplistic modeling of communication as information provision or transfer from a sender (informer) to a receiver (client). By communicating/informing, the informer wields power. Even if the informer’s action takes a form of ideal service to the client as presumed in early informing science (Cohen, 1999), power is exercised in the informer’s willingness to reduce the relative knowledge asymmetry and in the act of responding to the service request. Of course, perfect informing service is just hypothetical: the

informer always has a discretionary room for selecting and framing the content communicated, and the client's ignorance bounds the service request.

In sum, IT needs more precise defining in IS research. Ontologies of IT account for matter, action, cognition, and social structure. Attempts at uniting structural and action ontologies have been premised on Giddens's structuration theory. Although the results are mixed, structuration theory maintains an inspiring potential for IS research.

Summary

Organization scholars think of technology at an abstract level, as a transformational function turning organizational inputs into outputs. IT is typically not recognized as a particular entity in this approach, except in study of hi-tech, where it features even as an interesting cognitive entity. IS scholars usually think of IT in reference to computer technology, deploying materialistic and various social ontologies. Table 6 summarizes the concepts of technology discussed in the chapter.

The IVO Approach to Information Technologies

The above discussed organization theory supplies leads for students of IS. Woodward's focus on a role of technology in organization extends to IT. Thompson's concepts of interdependence apply to design of IS that enables more effective design of organizational processes. Perrow's concept of task analyzability matters in intellectual processes, such as less structured decision making and knowledge creation. Galbraith's model of organization reveals that data processing and communication underpin vital organizational capabilities. Weick's framework shifts the focus from technology as a social phenomenon to a cognitive view, which suits IT as a technology that directly interacts with cognition. Another contribution of organization theory is in postulating that social context (task, process) needs to be defined in study of technology. On its part, IS research has contributed by emphasizing material aspects of IT as well conceiving of IT in terms of action and structure.

All this theorizing contributes to grounding the IVO approach to IT. In IVO, *IT refers to tools, devices, and machines with the purpose of manipulating data*. This definition points to different technologies for performing infoprocesses of data creating, storing, organizing, transferring, retrieving, transforming, etc. The differentiation is premised on infoprocess capability or the extent of supplanting human labor. Tools represent the simplest kind of IT limited to the purposes of data creating and storing, and requiring substantial manual work (very small automation); examples are the pen, paper files, and rolodex. A device can store or transfer or transform data, and it can perform more than one infoprocess. It deploys some techniques replacing human labor; examples are a calculator, the classical telephone, pre-computer based facsimile, printer, and many components of computer networks. A machine can perform multiple infoprocesses for the most part autonomously. The typical example is computer, the major IT of the time. In this rubric belong also various machines based on the computer (smart telephone, tablets, WAN routers). The important part of an electronic machine is software instructions that control the hardware. But for analytical and management purposes the machine as a whole makes IT. IT as machine is synonymous with the term "technical system."

It is apparent that IVO accounts for both electronic and pre-electronic technologies. Rather than being eradicated, the proverbial "paper trail" is resilient and keeps co-existing with electronic technologies even in technologically advanced parts of the world. The list below compares paper and electronic data

Table 6. Conceptualizations of technology and information technology

Concept of Technology	Categorizing Dimensions; Technology-Organizational Form
Hardware, skills, knowledge, and characteristics of objects of work (Scott, 1992)	NA
Transformation process based on physical and knowledge resources. (Hulin & Roznowski, 1985)	NA
Knowledge about cause and effect relations of our actions. (Berniker, 1987)	NA
Technical aspects of organizing (Woodward, 1957, 1965)	Degree of Mechanization (Technical Complexity); Unit, Small Batch, Mass Production (manufacturing), and Continuous Process (oil refinery)
Core transformation process (Thompson, 1967)	Degree of standardization of input and transformation processes; Intensive (surgery, teamwork), Mediating (bank), and Long-Linked (assembly line)
Task nature (Perrow, 1967)	Task Routines (variability) and Task Analyzability; Routine/Analyzable (clerical), Variable/Less analyzable (R&D), Routine/Less analyzable (crafts), and Variable/Analyzable (engineering)
Communication and data processing methods of resolving uncertainty in production process (Galbraith, 1973, 1974)	Organic vs. Mechanistic organizational designs
Combinations of microelectronics, computer systems and telecommunications (Zuboff, 1988)	Automated vs. informed organization
Configurations of computer software and hardware embedding institutional background (Orlikowski, 1992)	NA
Equivocal—an ambiguously cognized stochastic entity (Weick, 1990); mindfulness improves cognizing and prevents accidents (Weick et al., 1999)	NA

based on characteristics that paper and electronic technologies respectively impart on them. Although advantages are mostly on the electronic side, the paper trail is not a total outsider. In any case, when system analysts investigate an IS, they usually encounter paper trail and have to deal with it either as an entity to be overcome or the one that still has to be tolerated.

Characteristics of data in the paper form start each point, and electronic data characteristics continue the point.

- Stable, hard to falsify - Less stable, falsification risk (solvable)
- Preserved on long run - Possible, but must migrate to new storage technologies
- Lockable in a single location - Same, but easy copy and hacking
- Readability & note making ease - Issues on both counts
- Time consuming creation, transfer - Faster on each count
- Errors uncontrolled - Automated control of errors
- No infoprocess automation - Infoprocess automation
- Space demanding - Takes little space
- Limited access and sharing - Broad access and sharing
- Fire and water risks - Same risks, plus hacking (solvable)

- Ecologically damaging - Saves trees, but disposal costs.

The preferable term “information technologies” (IT for short) implies that a business process usually uses more than one piece of IT. In fact, the optics of information systems (IS) allows for an insight that is truly useful from research and management perspectives. The term information system is used in the standard meaning it has in the area of systems analysis and design, to refer to a purposeful arrangement of IT, data, and procedures. IT and procedures can have the manual character in different degrees; highly manual procedures involve the user within a system boundary. The concept of IS overlaps with conceptualizations of technology in organization theory, as both involve work procedures and knowledge (know-how in the case of IS). But the level of analysis differs—micro (IS) vs. macro-organizational (technology in organization theory). The stance of IS rather than IT is more appropriate for investigating the relationship between organization and technology.

ONTOLOGY OF INFORMATION TECHNOLOGIES

The last aspect of the IVO approach to IT concerns ontological issues. The examined literature reveals different ontologies in the triangle comprised of organization, actors, and IS. The term “organization” is used in the sense of structure or institution as opposed to action, but is preferable to avoid confusion with the concept of organizational structure as used in organization theory and IVO. Also, in agreement with the discussed differentiation between IT and IS, the latter term features in the ontologies depicted in Figure 2. The diagrams represent technology imperative (Figure 2a), action/strategic choice (Figure 2b), institutional (Figure 2c), sociotechnical (Figure 2d), structuration ontology (Figure 2e), and cognitive ontology (Figure 2f). In recognition of unpredictable outcomes of coupling organization with certain kinds of IS, some authors also proposed an emergent process ontology (see Markus & Robey, 1988; Markus, 1994; Orlikowski, 1992). Emergent process can be understood in terms of combinations of the cited ontologies.

To read Figure 2, one should start from the initial sink of causality. In the *technology imperative view*, a form of materialistic ontology, causality starts with IS technical characteristics (e.g., Huber, 1984; Whisler, 1970; aspects of actor-network theory). The IS characteristics are the product of engineering, and they determine both users’ behavior and organization. Contrary, ontology of *action/strategic choice* presumes that causality starts with agency and that IS are decisively shaped by action (e.g., Zuboff, 1988). *Institutional ontology* attributes initial causality to organization. The IS designer essentially infuses structure in IS that, in turn, becomes a reinforcement of structure. The discussion on infostructure in this chapter contributes an analytical look to the institutional background of IS.

Sociotechnical ontology combines IS, actor, and organization in a mutual causality loop, where the last two items are viewed as a social system (e.g., Bostrom & Heinen, 1977; Kling, 2007; Mumford & Weir, 1979). The initial causality is not clearly postulated, although many sociotechnical studies start with a technical system as a given. If an IS initially affects actor and organization, these react and exert the influence back. Also, IS-affected organization influences actor that, in turn, acts back onto organization. But liberal grounding of sociotechnical ontology allows for different paths of causality, which poses research challenges. Sociotechnical ontology has been very influential in IS research, be it declared by an author or not. For example, results of research based on adaptive structuration theory bring it closer to sociotechnical than the aspiring structuration view (e.g., GSS has “spirit” represented

in given functionality, while users' "appropriate" GSS via selection and modification of functionality) (cf. Poole & DeSanctis, 1990; DeSanctis & Poole, 1994).

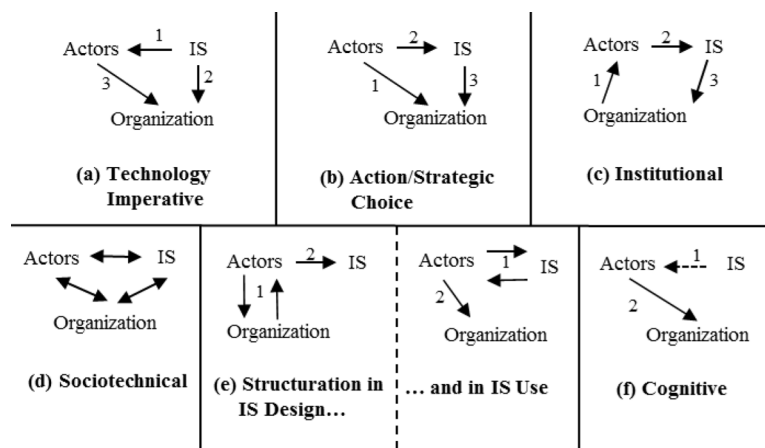
Structuration ontology couples action with structure in a dialectical whole. It overcomes dualism of the sociotechnical view since action cannot play outside structure, and structure manifests itself only via action. This mutual causality is indicated by the reciprocal arrows between actors and organization in Figure 2e. Actor draws on organizational resources and implements organizational rules when designing an IS. Resources (allocative and authoritative) engender power that can expand design beyond a rigid application of rules. When an IS is used in work practices, it poses as a pool of both the rules embedded in it and resources. Structure (organization) is reproduced by materializing the rules or it is evolved via power action. Veracious applications of structuration ontology in IS research are still to expect.

The cognitive view (Weick, 1990; Weick et al., 1999; the symbolist approach addressed in Chapter 6) focuses on a reflection of IS in the mental models of actors (hence the dashed line of causality in Figure 2f). Based on their cognitions, users act in organization. The process may not be rigidly linear, as acting and cognizing can be intertwined. A crying gap between exceptional insights that cognitive ontology can generate and the paucity of corresponding research is quite paradoxical.

Emergent Process Perspective

The emergent process perspective is in part a response to limitations of the here discussed ontologies. It acknowledges that causality may follow the action path, institutional and others in a manner of an evolving process, possibly resulting with unintended or unexpected outcomes (e.g., Markus, 1994). This is similar to basic ideas behind Mintzberg's (1978, 2007) concept of emerging strategy, where an important, long-range trajectory of a company does not result from a definite plan and deliberation, but rather evolves in an indetereministic manner through many plans, opportunistic choices, and actions. It follows from the emergent process perspective that the character of IS may metamorphose through its

Figure 2. Ontologies of information systems



life cycle. The planning and design of an IS could be explained by the institutional perspective, while its adoption could mirror the action or sociotechnical axioms. In structuration terms, the institutional heritage is manifested only via action. A specific type of IS can make more of a difference in particular phases of a system life cycle. For example, for adoption of GSS the sociotechnical stance can be more revealing than the institutional. For any system that is accepted and regularly used, regular system upgrades could be absorbed by users in the fashion of technology imperative. Finally, as an IS is cognized by various stakeholders throughout system life cycle, cognitive ontology is always relevant—more so when big problems arise. One way of applying it is by investigating metaphors of infoculture, which is discussed in Chapter 5. The emergent process ontology offers an expansive potential for theorizing, but it also bears significant challenges of research complexity. The following discussion will propose a model inspired by the emergent perspective's temporal variation in system ontology, with an addition of a stakeholder aspect contributing to the variation. The discussion draws partially on the study by Travica (2015).

The contemporary state of affairs manifests complexity. Complexity is usually viewed as a higher degree of differentiation within an entity and a significant multiplication of relationships between the differentiated parts. Today, complexity characterizes technology, its social context, as well as mind and products of the intellect. Complex social and technical systems evolve in a non-linear manner and exhibit stochastic rather than deterministic behavior. (Gill, 2013; Kirshbaum, 2002; Lucas, 2007; Raymond et al., 1997).

A technology developer responds to problems in the social and natural environments. The environmental problem can rest on apparent material facts, such as a lack of food or energy sources. The problem can also result from a creative process that frames something less apparent as a problem, such as performing a known activity in a new way (e.g., telephoning while moving, as it is possible with the cell/mobile phone). Physical intricacies and social conditions chart the problem space in either kind of problem. Technology in itself is an intellectual representation of the problems, that is, applied knowledge (Campbell, 1988; Lee & Vitányi, 1997; Wood, 1986). The smart phone is more complex in design and functionality than the cell phone that, in turn, is more complex than the landline phone. Computing requirements associated with multiple tasks applied to many data types set apart design of the smartphone from the cell phone that is limited to transferring voice and alphanumeric data. The knowledge applied in particular technology varies with the overall state of knowledge, the inventor's ingenuity, and social conditions. The historical metamorphosis of the cell phone from a bulky, heavy apparatus to an elegant, hand-held device demonstrates such a historical evolution of technology.

Technology in operation, or its internal workings, constitute the third domain of complexity. The processor and numerous parts of a smartphone interact among themselves and with network environments, thereby creating a dynamic open system. Technologies for storing, mining and modeling structured and unstructured data deluging simultaneously from various sources make the world of Big Data a higher order of complexity than do relational database systems.

The last domain of complexity resides in the technology user's cognition. This is a world unto itself that includes mastering the know-how and know-what, recall effort, coping with technical ignorance and/or uncertainty, and managing the locus of control. In the case of an IS user, complexity also involves the informing process. This is about applying personal knowledge to the system's outputs in order to infer information-meaning – a dimension of complexity that is neglected when information is assumed to be a thing.

It follows from this discussion that complexity is manifest in the problem to be solved, in the intellectual solution to the problem, in technology design and its workings, and in technology user's cognition. Two technology-related actors are implicated in the analysis – the designer and the user. The cited domains of complexity are represented in Figure 3.

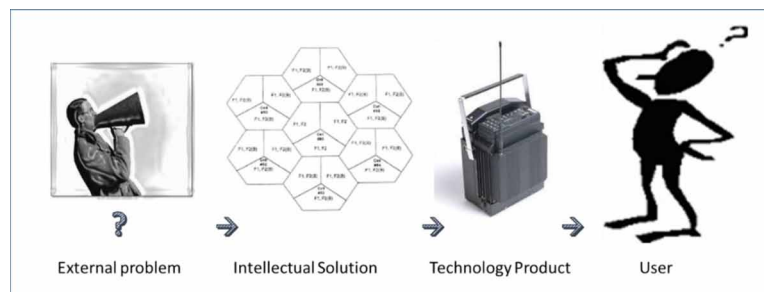
External (environmental) complexity is correlated positively with technology design that is aiming at resolving the environment-located problems. This follows from the cybernetic law of requisite variety—a system capable of surviving in an environment must be capable of generating responses that match variation in the environment. More complex design correlates in turn with more complex internal workings of technology. The complexity trajectory extends to user's cognition although not necessarily in a linear fashion. A virtue of quality design is in flattening a complexity curve caused by the environment and intellectual representation of the environmental problem. Therefore, the craft of design (applied knowledge) paves the way to a possibility of coping with observed danger of a self-amplifying loop of complexity, the problem noted by researchers (Gill, 2013).

In order to address this complexity, the work of philosopher Karl Popper's may be a good start point. His ontology rests on three "worlds" of— material, individual mind, and creations of human thought (Popper, 1978). World 1 is made of physical objects (inanimate and animate, implying technology, as in Popper's example of airplanes). World 2 consists of individual cognition (experience, perceptions, and emotions). World 3 refers to shared intellectual creations – knowledge (theories), arts, and other. This concept makes Popper's philosophical contribution. It could be seen as a result of differentiating the traditional idealist position on individual and collective segments. Popper attributed to World 3 an ontological status (a potency of fundamental cause) matching those of matter and mind.

Popper's worlds are interrelated domains of the being. For instance, intellectual creations (World 3) are instantiated in publications (World 1) and influence individual mind and emotion (World 2). Individuals cognize the physical reality (the World 2 to World 1 relationship) that, in turn, inspires these knowing subjects to formulate problems and create solutions that advance knowledge (World 3). In cognizing World 1, individual mind (World 2) learns from and is being shaped by World 3. As a dramatic example, Popper cited Einstein's special theory of relativity. As it became part of the physics science, it made its students think it further and extend it to originally inconceivable consequences, such as designing the nuclear bomb.

It follows from this reasoning that particular technology or an IS incorporating technologies are created through a combination of shared formal knowledge (World 3) and a designer's (inventor, engineer) mind (World 2, consisting of personalized formal knowledge and personal experience). An IS is imbued with

Figure 3. Complexity domains



certain functionality and it exists as part of physical phenomena (World 1) since it involves hardware, user interface, and work procedures. Thus, there is a symmetry with ontology of technology imperative. In addition, World 2 of individual mind have similarities with action and cognitive ontologies. Moreover, relationships between Popper's worlds have parallels with the socio-technical and structuration ontologies.

Since an IS represents a response to problems in the social world, it follows that the latter influences design of the former. A developed system is adopted and resides in the social context, such as an organization (group, company). Therefore, it stands to reason that there is a place for yet another, social world. This World 4 impacts on World 3 (human intellectual creations, which can be in the form of shared organizational knowledge) and influences World 2 (individual mind of technology designer and user). Therefore, the resulting ontology involves four interrelated domains captured in a MIPS model (Travica, 2015). The name is derived from the domains' initials – Material, Intellectual, Personal, and Social.

MIPS can help in understanding complexity of technology and stakeholders' relationships in the context of social media (Travica, 2015). For the current discussion, however, it is relevant that the MIPS model extends the emergent process approach discussed above. Figure 4 depicts relationships between involved entities from the perspectives of designer and user. In the designer's view of MIPS (Figure 4a), institutional ontology surfaces via impacts of organization on organizational knowledge (e.g., business processes and cultural norms) and on the designer (system requirements). Organizational knowledge itself is part of the institutional forces influencing the designer. IS design is ultimately the designer's creation, which implies action ontology.

Moreover, the end-user view of MIPS (Figure 4b) suggests again institutional impacts of organization on the end-user. Structuration ontology could possibly illuminate relationship between the end-user, on one hand, and IS and organizational knowledge, on the other.

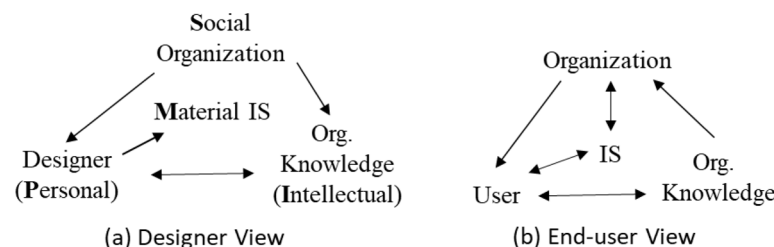
In summary, MIPS model extends the emergent process philosophical approach that combines different ontologies. MIPS can be used for social media and similar modern system complexes.

Two philosophical approaches have recently attracted attention of IS researchers – critical realism and sociomateriality. Both earned a special issue of the MIS Quarterly. These do not fit to the discussion on causality in the IS-actor-organization triangle as discussed in a section above, and thus they are not depicted in Figure 2. Each approach is discussed below.

Critical Realism

Critical realism (CR) was established by British philosopher Roy Bhaskar (1975, 1979). Followers extended some parts of his work. This discussion gets back to the original works and contrasts it with some of IS research claiming allegiance to CR.

Figure 4. MIPS model of emergent process ontology



Ontology and Epistemology of Natural World

Bhaskar's 1975 book *A Realist Theory of Science* focused on ontology and epistemology of natural world. Following Emmanuel Kant, he sought to reach beyond empirical reality and thus declared his position as transcendental. In contrast to Kantian idealism, however, Bhaskar opted for materialism that he termed "realism". Hence, *transcendental realism* was the initial label for Bhaskar's position. In his 1979 book, *The Possibility of Naturalism*, Bhaskar (1979) turned to the social world and science, naming his theoretical position as *critical naturalism*. The key goal was to apply his principles of the natural world to the social. The final labelling of Bhaskar's theorizing had settled to a compromise term *critical realism* which could be associated with a critical approach to modern society, as in *critical theory* of the Frankfurt Circle's version of Marxism.

Bhaskar's natural world ontology differentiates between three domains of reality: real, actual, and empirical. The *real* domain is the deepest and houses causal forces that Bhaskar characterizes in terms of "structures and mechanisms" that "normally exist and act independently of people" (Bhaskar, 2008: xv). (Note: all further citations of the 1975 book are based on the 2008 edition.) The *actual* domain refers to events generated by real structures and mechanisms. Although structures and events are related, the former preserves the independence: "real structures exist independently of and are often out of phase with the actual patterns of events" (p. 2). Finally, the empirical domain refers to human experiences of the actual domain. Although related, "events occur independently of experiences", and "experiences are often (epistemically speaking) 'out of phase' with events" (pp. 2-3).

Since the real domain is the seat of essential "things" that "act", also called "generative mechanisms," science must focus on these "intransitive objects of knowledge" which are not produced by men (p. 11). Bhaskar was quite concerned with proving objective character of natural world that is always the same – with or without people. For example: "The Wiedemann-Franz law would continue to hold although there would be no-one to formulate, experimentally establish or deduce it" (p. 12).

Bhaskar supplemented the three-domain natural ontology with corresponding epistemology. Although each domain has to do with the previous one, the out-of-sync assumption sets the limits to knowing. Empirical realists, whom Bhaskar lines up from David Hume to contemporary positivists, are bound to the empirical domain and can only see events' conjectures. Idealists, like, Kantians, impose intellectual constructs on the objects of knowledge. Therefore, material causes in the "intransitive" domain of the real remain opaque to both of them. Bhaskar posits that only CR can transcend into the real domain.

Since empirical facts do not suffice in quest for knowledge, scientists should be aiming at "transfactual or normic statements" which "need not, and in general will not, be reflected in an invariant pattern or regularly recurring sequence of events" (p. 3). A scientist can establish such knowledge via *retrodiction* (latter termed *retroduction*). This is a stage in a four-stage scientific process, which focuses on selecting among an event's possible antecedents that the scientist had previously identified. Bhaskar elaborates:

[Retroduction] will need to be supplemented by independent evidence for the antecedents until we have eliminated from the total set of possible causes all but the one which, together with the other factors at work, actually produced the effect on the occasion in question (p. 115).

Imagination is indispensable in the scientific process (pp. 4, 36). It fuels the understanding of antecedents and selecting the true ones. It is "the task of science to discover which hypothetical or imagined mechanisms are not imaginary but real" (p. 136). Here is when the empirical domain plays a role and

particularly so in the form of experiment. It is so because normic statements have “factual instances” in the controlled context of a laboratory (p. 3).

In summary, Bhaskar’s framed the natural, material world as a domain of causal forces independent of people and generating events that could be just partially experienced. The true character of the material world, the domain of real, is well-hidden. It is inaccessible to empiricists and can be understood only via a scientific process in which a scientist’s imagination identifies antecedents to observed events (retroduction), and uses experiments and additional evidence to validate new knowledge.

Ontology and Epistemology of Social World

Bhaskar announced some key ideas of his social ontology already in *A Realist Theory*. He brought up basic premises on the centrality on human action and on social structure being distinct from natural world because it exists through action. Society is “ensemble of powers” and structures include languages, forms of economic and political organization, systems of belief, and cultural and ethical norms (p. 187).

The Possibility of Naturalism further polished the distinctions between social and natural structures by positing that the former do not exist independently of the activities they govern or of the agents’ conceptions of what they are doing; also, social structures are only relatively enduring and not universal (p. 38). Society is always in flux and so it fits to a “transformational model of society.” (Note: all citations are based on the 1989 edition of *The Possibility of Naturalism*.)

Bhaskar framed the relations between structure and action (praxis, in his parlance) in terms of “dualism”:

Society, then, provides necessary conditions for intentional human action, and intentional human action is a necessary condition for it. Society is only present in human action, but human action always expresses and utilizes some or other social form. (pp. 36-37)

Bhaskar used the concept of structure to advance philosophy of society. Endorsing Marx’s approach, he suggested that society is structures of relations (sometimes termed “relationships”). These constitute reality in itself, which is manifest in “causal efficacy in affecting states of the material world, as mediated through intentional human agency” (p. 80). Instances of relations making society are capitalist and worker, member of parliament and constituent, student and teacher, husband and wife – all being “general and relatively enduring” (p. 29).

The author further explained the “transformational model of society” by arguing that social relations are ultimately “relations of production of various kinds” (p. 44). Here he again referred to Marxism as a guide, particularly the postulate on relations of production that Marx confined to economy. Bhaskar described Marx’s concept but did not explain how it could apply to other social domains.

What can we learn about social structure viewed through the CR lenses, and how? Bhaskar’s social epistemology begins consistently with the ontological postulate on “intransitive, transfactual” reality. Epistemology must drill below visible events in order to uncover “tendencies of things” with aid of retroduction, as in the case of uncovering “things” (structures) in nature. An instance of “tendencies of things” are the “individuals possessing powers” and the individuals’ “actions that are the realization of their potentialities” (p. 19). Psychological aspects of individual action, that is, individual intentions, meanings and reasons should be the subject social science, that is, sociology (pp. 106-107).

A drift toward the individual as a study subject is at some places countered by switching back to relational social structure. Social structure (“reproduced or transformed” via action) cannot be read just

from individual action since structural relations must be hidden in a “transfactual” domain of real. Bhaskar tried to resolve this theoretical problem by suggesting “mediating concepts” (p. 41). In particular, he proposed a “position-practice system” to be a “‘point of contact’ between human agency and social structures.” Supposedly, “positions (places, functions, rules, tasks, duties, rights, etc.)” are occupied by individuals performing “practices (activities, etc.)”, which altogether should make an accessible subject of research. However, there are just two occurrences of the term “position-practice system” in the whole book and further explanation is missing.

In summary, Bhaskar’s social ontology postulates a relational structure of society and dialectical duality of structure and action. The social real domain differs from natural real because it cannot exist independently from human agency. Society is a totality of relations of production of various kinds. Structure provides conditions for action that, in turn, reproduces or transforms structure. Epistemological access to such society shifts between individual and relational foci, and a resolution via the concept of “position-practice system” is sketched.

Evaluation

The ontological postulate of a veiled character of nature and society alike, which Bhaskar advocated, has raised a worthy epistemological caution. A social researcher, for instance, should not trade a pursuit for causal phenomena for a superficial exploration of epiphenomena. In academic disciplines that intend to support management, this cautioning may amount to a revolution in research, which is yet to come. The conception of society is relational, thus endorsing mainstream sociology. Bhaskar’s differentiation between natural and social structure also merits attention. A log in forest does not afford any social function if there is no human around. It is only through human action that matter can act in the social world.

On the downside, technology has no place in Bhaskar’s theorizing. This fact indicates limits of his work and difficulties that the students of IT face while trying to get anchored in CR. Their endeavor is complicated by properties of Bhaskar’s social philosophy that is less assuring than the natural counterpart. His materialistic ontology of the social exhibits problems. Materiality is assigned to social relations (structure) as well as to the psychological source of individual action (motives, intentions). The author warned, however, that action should not be reduced to brain matter (*The Possibility*, pp. 98-102). However, the irreducibility argument appears unconvincing (Pettit, 1981). Mechanistic materialism appears also in Bhaskar’s premise that meanings should be “regarded as Spinozian attributes of sounds” (pp. 106-107).

Another issue is that social ontology of CR zigzags between the individual and the relational (collective) perspectives, between action and structure. Attempts of balancing the two remain at the level of postulate that resembles Giddens’s (1976) duality of structure and structuration theory (structure conditions action, and action reproduces or transforms structure). But the balancing act falls flat at a more concrete level, like with the concept of “position-practice system” proposed to be a manifestation of social structure. Moreover, the relational concept of society is incomplete since the parts that could be cornerstones are merely sketched (production relations across social domains). This is aggravated by missing other theoretical possibilities.

Bhaskar adamantly rejected Max Weber for his idealistic position, and thereby threw a relational baby out with the “dirty” bathwater of Weber’s idealism. However, Weber convincingly demonstrated a relational character of the social role concept in his portrayal of the “iron cage” of the contemporary society impacted by bureaucracy. Merton’s (1957) role-set theory could also inspire CR. Obligations, expectations, norms, and practice patterns, which a social role implies, are all potentially relevant

instruments of social inquiry. In other words, Bhaskar overlooked contributions of institutionalism to understanding relational aspects of society.

As for Bhaskar's natural epistemology, it is punctured by his fervent attempt to underline objective character of science. He neglected the scientist as agency and the socio-historical context of science. However, science develops through setting up new and upsetting old theories, and it always bears an intellectual stamp of its historical period. Bhaskar's arguments do not recognize that the quest for scientific truth is an endless historical process. Possibly for this neglect of the scientist as agent in science making, Bhaskar arrived at the peculiar conclusion that a natural law named by its authors would exist and be so-named even if the scientists had never existed. In particular, while the physical phenomena that Wiedemann and Franz theorized certainly exist, conceptualizing these as thermal conductivity, electrical conductivity and temperature, and assembling these concepts into formulas is an original, unique, authored, intellectual product (Popper's third world discussed in this chapter), rather than a mere reflection of nature. To the extent that "naturalism" applies to society, these epistemological problems cast a shadow on social epistemology of the original CR.

Another puncture in natural epistemology of CR is methodological reductionism. Imagination, experimentation and retrodution are praised, but other methods are discredited as alleged descendants of empiricist and idealist traditions which Bhaskar deemed incapable of discovering causal forces. However, Galielos and Einsnteins of science would disagree that the empirical observation and induction play no role in science making. Likewise, the scientists would find peculiar the claim that applicability of a formulated physical law could not be deduced to other objects. Provided that Bhaskar presumed an equivalence of natural and social sciences, these epistemological problems reflect on the latter.

It remains unclear what the word "critical" in "critical realism" is supposed to mean. Note that he viewed society as an ensemble of powers; society is always in transformation; action is the realization of individual potentialities; and he invoked Marxist thought several times. Bhaskar's later work reiterated an emancipatory teleology, contours of a new critical theory of society, as the label "critical realism" insinuates. However, this is not clear. For example, an epistemological interpretation was offered, asserting that Bhaskar meant to be critical in a Kantian sense by positing epistemic relativity (historical character) of social science knowledge and rejecting judgmental relativity (Mingers et al., 2013). Only hermeneutics can resolve the incongruence of this claim with the ahistorical character of Bhaskar's "naturalism" mentioned above. More importantly, the puzzle remains.

Puzzles of this sort have resulted in part from Bhaskar's writing style. It was branded as the example of how not to write theory (Pettit, 1981). Bhaskar's writing is laconically brief, replete with neologisms that are weekly defined (e.g., "thing" signifies the core ontological concept), inconsistent terminology-wise, axiomatic if not overtly prophetic, logically challenging, and tiring for insisting on a long sentence that expresses several thoughts. Even a philosophically competent reader may feel inferior before Bhaskar's cannonade of peculiarly alloyed terms and statements. A new reader of the works examined here is advised to start with Bhaskar's postscript to the second edition of *A Realist Theory*, where the author revealed his intention of using an open-ended vocabulary that leaves a space for different interpretations.

What is the applicability of CR in IS research? There are some enthusiastic followers of CR among IS researchers. The cited issue of the MIS Quarterly is emblematic. Some authors have built on British extensions of CR, like Archer's (1995, 2012) work focusing on culture and action. Others draw on CR disciples in Scandinavia, where Bhaskar spent quite some time (Bhaskar et al., 2012; Danermark et al., 2002; Hedström et al., 1998). Outside the Western world, CR has attracted attention of students of deploying information and communication technologies for development purposes (Heeks and Wall, 2017).

As this is not a place for detailed analysis of this newer CR literature, just a summary note will suffice. First, there appears to be a focus on epistemology (particularly, the retroduction method), while original CR ontology is either neglected or “adjusted” to study purposes. The CR followers that equalize natural and social structures may want to revisit the original CR postulates. And second, the motives for deploying CR rather than alternative approaches as well as the contributions of CR to knowledge are not always clear. An example is the interesting case study of Norwegian Air by Henfridsson and Bygstad (2013). The authors argued that a generative mechanism approach could explain the technology and organizational innovations that evolved at the budget airliner (e.g., SOA architecture, Internet-based booking, the use of mobile phones and Facebook). A simpler, alternative explanation could invoke the familiar cost leadership strategy, where the IS and the business side successfully partnered. Scientific parsimony tends to be neglected as a guiding principle in competing on differentiation in the racetrack of academic research.

In summary, the original CR merits attention for focusing attention on social causality that is inaccessible to empiricism. The shortcomings are in a neglect of technology, and in inconsistent and incomplete social ontology and epistemology. IS research focuses on epistemology and particularly the retroduction method, while original CR ontology is either neglected or “adjusted.”

Sociomateriality

This section discusses some key ideas of the sociomateriality approach and ends with an evaluation of it. The focus is on select works of some of key advocates of this approach.

The label “sociomateriality” can be traced back to a 2002 article by Suchman (Mutch, 2013). It brings together notions of the social and material, thus resembling a unity as in the term “spacetime.” The preferred term for the relationship between the social and material is “entanglement.” This is a central concept which Orlikowski (2007) explicated memorably: “There is no social that is not also material, and no material that is not also social” (p. 1437). The social refers to people (action, relations, cognition), while the material refers to inanimate objects, such as digital technology (and other organizational objects like tables, buildings, vehicles, books, and documents). The assumption of entanglement is akin to Actor-Network Theory (ANT).

As discussed in Chapter 6, ANT raises the ontological status of material things to the agency height, thus equalizing both things and humans as “actants.” Sociomaterialists endorse ANT, but insist that they go even further by denying ontological separation of material and social entities; rather, these entities constitute (define characteristics) of each other. This stipulation comes from Barad’s (2003) philosophy of agential realism which provided another key source for sociomateriality. A nuclear physicist by training, Barad assumed that principles of the behavior of matter at a particle level could apply in the social world as well. In her own words:

While the ontology of classical physics divides everything into the mutually exclusive categories of particle and wave [...] there is now mounting empirical evidence that there are no inherently bounded and propertied things... (Kleinman, 2012: 80)

An example of how this assumption applies to society is that “gender is no longer understood to be an inherent attribute of the individual subject, but rather a reiterative doing through which the subject is constituted” (ibid.). Therefore, reality is always in flux as entities emerge through “intra-actions” of

matter. Intra-action is the “mutual constitution of entangled agencies” (Barad 2007: 33). The emergence of an entity in a stable form represents an “agential cut.” Examples could be particle matter taking on a particular form or socially defining gender in a particular way.

Sociomaterialists have proclaimed that materialist ontology based on the cited assumptions differs from technological determinism as well as dualist approaches (e.g., structuration theory). Orlikowski (2007) stated:

... a reconfiguration of our conventional assumptions and considerations of materiality will help us more effectively recognize and understand the multiple, emergent, and shifting sociomaterial assemblages entailed in contemporary organizing. (p. 1435).

Sociomaterial reality is relational so that its character emerges from the social and material constitutive entanglement. To illustrate:

It is not so much what materials ... symbolize within social action that matters but their constitutive agentic effects within the entangled networks of sociality/materiality” (Pels et al., 2002: 2).

From the sociomaterialist perspective, technology is a material thing by design, which matters really when it obtains specific characteristics via “recursive intertwining” with people (Orlikowski, 2007). Instances of the technology discussed in sociomateriality articles are email on smart phones, Internet search via Google, TripAdvisor website, and Google’s PageRank system. Ontologically, technology is in line with humans. People and technology are supposed to constitute each other by making “composite and shifting assemblages” (Orlikowski and Scott, 2008: 455). These “assemblages” occur in practice.

Consistently with the sociomateriality vocabulary, familiar social practice (relations, action) is not of interest any longer but “sociomaterial practice.” This is another central concept. Sociomaterial practice is the context in which technology and human agencies are “constitutively enmeshed by means of a dialectic of resistance and accommodation” (Pickering, 1995: 567). This brings us to the last notable concept – “performativity.”

Sociomaterialist research is not interested just in the performance of technology but in the consequences of user-technology (sociomaterial) practices, which are referred to as “performativity.” The concept is credited to Barad, although its origin is older in Searle’s (1969) speech act theory. According to it, a speech unit, such as a request, can move the receiver to action. Similarly, performativity in the sociomateriality vocabulary refers to the outcomes of sociomaterial practice. To emphasize its causal capability of generating material effects, sociomaterial practice is also labeled “material-discursive practice” (another borrowing from Barad’s work). Here is an example of applying this concept by advocates of sociomateriality:

These ongoing efforts by TripAdvisor to alter its services can be seen as material-discursive practices that continue to codify, manipulate, and compute the content on the website. The service produced and delivered by TripAdvisor is an ongoing enactment, entangling and entailing activities, bodies, and artifacts in sociomaterial practices. (Orlikowski and Scott, 2015: 214)

The sociomaterial approach has attracted some attention of IS researchers (e.g., a 2014 special issue of the MIS Quarterly). However, there are differences among them regarding the acceptance of basic assumptions and vocabulary. A differentiation between strong and weak sociomateriality has been noted (the above description outlines the former side). (See Cecez-Kecmanovic et al., 2014; Mutch, 2013)

Evaluation

Sociomateriality can be viewed as an attempt to refocus IS research on materialistic ontology. This is a worthy undertaking. After technological imperative (a form of materialism) ceased being the mainstream research, idealism became influential. Take for example the popular cultural approach in IS research, which is entirely rooted in idealism as it focuses exclusively on shared assumptions, values, and norms. It absolutely neglects material properties of IS. Indeed, it deviates from the anthropological approach that gave birth to study of culture and differentiated between material culture (e.g., tools for food production) and non-material culture (e.g., beliefs) (Travica, 2012). Studying beliefs about an IS without understanding what the IS looks and acts like makes research incomplete.

As argued at several places in this book, the specifics of functionality, user interface, system interfaces, hardware, networking, data and use procedures, which altogether make an IS, take a back seat in IS research. An IS is usually studied as a black-boxed potential, utility, or hindrance. To the extent that sociomateriality advocates accounting for materiality of technology, it is compliant with the IVO framework. IVO aims at materialism by offering the concept of infoculture that accounts for both material and non-material aspects of organizational culture pertaining to IS. Also, IVO advocates focusing research and management on material properties of IS in other organizational aspects as well.

Some other aspects of sociomateriality, however, are questionable. In particular, the equalizing ontology of human and technology actants or entangled human-technology assemblages is a problematic axiom. This could be a consequence of a new philosophical materialism that sociomateriality follows (Fox and Alldred, 2017). The ANT concept of actant is examined in Chapter 6. Here it suffices to mention that regressing ontology from relations between people back to associations between people and things, and things and things resembles early forms of materialism that treat all matter as alive. ANT ontology also rejects the mainstream sociological conception of materiality attributed to social relations for the sake of reintroducing a historically older approach branded “sociology of associations.” However, it is yet unclear what gains in explanatory and predictive power could come from discarding materialist theorizing of founders of modern social thought like Durkheim and Marx. The burden of proof is on the ANT advocates and on their sociomaterialist endorsers, who take the actant ontology even further by postulating “human-technology constitutive entanglement.”

The postulate of constitutive entanglement is at the nexus of the sociomaterial vocabulary. Sociomaterialists have developed a case for proving it by using a limited selection of technologies and IS. These typically have a high communication component and malleable content. In a communication or social media system, both the input and the interpretation of the output are subject to very high variation. Therefore, interaction between the end user and the system is hard to predict with regard to the outcomes. This may give an impression of a mutual ad hoc constitution of the system and the user. Still, the workings of Google’s PageRank system that feeds the Google search system, which Orlikowski and Scott (2014) explored, are programmed by software engineers rather than being ad hoc phenomena.

To elaborate, the basic idea of ranking the Internet’s sources of literature is well-known: look at the references to a publication (citations) as a measure of authors’ impact. This is what a reference librarian did in the past manually or with help of print indexes of citations. In the Internet context, a reference is a back link that points to a website. There is more to the PageRank system but, again, old techniques of bibliometrics were a precursor in the institutional sense. As well, the body of publications has always been dynamic and growing. The only thing different with the Internet publishing and publication search is the speed. Finally, the input of new literature has always influenced research; again, the process now is just

faster. A look at technology in this way dispels the alleged mystery behind the page ranking algorithm. However, this sort of deeper analysis and understanding of technology is lacking in sociomaterialist study.

If the range of digital technologies and IS is broadened, how applicable sociomateriality is? Consider highly automated types of IS, such as the aircraft flight management system (FMS) discussed in this chapter. How would a mutual constitution of FMS and the pilot work in the course of flight practice? If an FMS is not clearly defined and constrained beforehand in functionality and use procedures, and the pilot is not previously trained to understand the workings and uses of FMS, what comes out is a scenario for disaster. Indeed, that is exactly what happened in the case of fallen airplanes. The same applies to other high-tech instances that Perrow (1984) branded as candidates for “normal accidents.” In order to increase credibility of sociomateriality, its advocates need to demonstrate its applicability to various types of IS.

Further to critically examining the concept of constitutive entanglement, one should note that technology is not *deus ex machina* but a human product. Designers and the stakeholders behind them push for certain algorithms to be put into application software. Software is a materialization of both special knowledge and of power relationships between its creator (exerting the influence) and the user (receiving the influence). Technology is not agency in its own right but it rather extends the creator’s agency. If technology “entangles” anything, it is by mediating a power relationship between the expert designer and system user. Consider the TripAdvisor case. If this social medium has any power over its readers and the hospitality industry, it is so because the system designer and TripAdvisor management intended so. Institutional ontology, which views social structure in terms of social relations, can tap into these power relationships imbued (inscribed) into technology. As for the reception of TripAdvisor’s output on the readers’ side, other philosophical approaches (sociotechnical, structuration, cognitive, and IVO’s semantic view of information) prepare us to expect aberrations from the creator’s intentions. Proving contributions over these optional approaches is another task for sociomateriality research.

The context of technology can also be lacking in the sociomaterialist approach. Specifically, why do organization members in Orlikowski’s (2007) study use compulsively a BlackBerry-based email system so vividly described:

the ‘push email’ capability inscribed into the software running on the servers has become entangled with people’s choices and activities to keep devices turned on, to carry them at all times, to glance at them repeatedly, and to respond to email regularly (p. 1444).

It appears that the social context jumps out of the description above as an answer, but it did not catch the author’s attention. Where do people’s choices and activities come from? Could it be that the company’s organizational (and informing) culture was receptive to technology and process innovation? Were there particular management incentives for utilizing BlackBerry introduced, which stimulated a cultural shift? The author did not address such questions. Instead, the reader is left to speculate that the cited system’s capability somehow aroused its compulsive usage. If the explanation is left at this level, it amounts to technological determinism (and opaque one). If the constitutive entanglement is taken both ways, then we could speculate that there was also something on the reader side motivating the compulsive usage. But we are not told what it is and can only put faith in the constitutive entanglement assumption (the system and users defined each other through practice). It remains unclear what sort of insight such an explanation offers beyond brandishing the new terminology. To further argue this point, let us get back to the TripAdvisor case.

The TripAdvisor technology and use can be seen as a complex, Internet-based IS for accepting and transforming primary users' (writers, travelers) input, whose output interacts with the secondary users (readers, to-be travelers). The input transformation function is a result of design and management choices. As for the end-users (readers) who may accept the TripAdvisor's output as truthful ("reality"), this effect is not any different from other mass informing media - new and old alike. As discussed in this chapter, mass media indeed create reality for the audience. It follows again that optional explanations could provide more insight.

Sociomateriality is devoid of predictive power. The discussion so far has already pointed to this problem. Indeed, since the human-technology entanglement produces ad hoc consequences, surrendering predictive power appears to be an epistemological postulate. In the advocate's words:

As Cooren et al. (2006: 11) write: 'Agency is not a "capacity to act" to be defined a priori. On the contrary, it is "the capacity to act" that is discovered when studying how worlds become constructed in a certain way.' (Orlikowski 2007: 1438)

By surrendering predictive power, sociomateriality impairs itself academically and practically. What can a manager gain by relying on an approach postulating that nothing can be known about effects of a new technology before it is deployed in practice? Consider the strategic perspective. Not only strategic planning is doomed, but so is any sort of strategizing. Even an emergent strategy cannot afford to rely on chance. Google that epitomizes emergent strategizing of Internet-centric companies, tends to leave a free space for opportunistic shifts in the strategy process. Still, the company carefully tests new pieces of software and analyzes the test results with scientific scrutiny before making decisions of strategic significance. Obviously, sociomateriality needs to reconsider its lax position regarding the issue of predictive power.

Finally, some fundamental assumptions of sociomateriality appear dubious. In particular, extending principles of quantum physics into the social world by following Barad, amounts to violating systems thinking (general systems theory, complex systems theory). Even within the same environment, the properties of a whole cannot be reduced to its parts located at lower levels of organization. This is to say that parts do not simply add up or mirror themselves in the whole. For example, while the particles of brain cells making the center for balance may be in flux, the function of this center still is permanently established.

Even less credible is the extending a principle of parts' behavior within one environment to behavior of a whole in another environment. Denying stability to social forms because people are made from matter, the particles of which are in flux, results in ambiguous social ontology and self-defeating epistemology. If the being is inherently evasive, how can we know anything valid about it? Skepticism is the only philosophical position left. It should be noted in the end that Barad's interpretation of quantum physics principles is also dubious (see Mutch, 2013).

In summary, the sociomateriality approach has merits in refocusing attention to materialism in IS research. Problems with this approach are in equalizing ontologically humans and technology, lacking a deeper understanding of digital technology and systems, narrowing the range of IS studied, missing predictive power and usefulness for IS strategy, and violating principles of systems thinking.

Primacy of Human Agency

This is the appropriate place to restate the philosophical position behind IVO. It is close to structuration theory with the stipulation that social structure is institutionalized in IT/IS. Social structure is relational as in mainstream sociology and critical realism. In contrast to the equalizing ontology of sociomateriality, IVO posits that technology is not *deus ex machina* but a human product which materializes power relationships between the human actors involved with it. Therefore, agency is human.

Human agency underlies the core IVO concepts. Personal knowledge and wisdom act upon perceived data and infers information (the meaning). As a human product and extension of social relations, IT/IS operate data. More than just being data mill and carrier, IT and IS interact with human mind and so different technological characteristics may lead to different effects. These premises constitute broad-based and flexible ontological grounding that draws on and advances certain ontologies.

Ontologies used in IS research do not address data, information and knowledge. The tacit premise is materialistic—these are viewed in a reified manner, as objects that exist outside human agent and can be manipulated as any other material object. It is assumed that these objects can also be in agent's cognition. The problem of differentiating between the character of physical and cognitive realities is obvious. Agent's power is reduced to passive receiving of reified information and knowledge, which are "provided." This poor agent is juxtaposed to IT conceived of as the carrier of data/information/knowledge-things. The underlying analogy is that of kitchen faucet (technology), water (information, knowledge), and water consumer (agent). Poor agent has power to open the faucet handle and consume the provisions, and then to close the kitchen faucet.

In contrast, the perspective of informing agents attributes agential character to information-meaning, knowledge and wisdom. Resulting from applying agent's knowledge or wisdom to perceived external data, information becomes result of human intellect. The dismissal of reification unleashes agent potentials. Poor agency of a passive consumer gives way to rich agent with transformative capacity inherent to mind. Structuration ontology comes alive, enriched for insight in agent's cognition. Rich agent interacts with IT and data constituting IS. Structural inheritance of IS is recognized but so that it must be cognized even if its impositions limit agent's autonomy to apprehending severe constraints or equivocal ambiguity. This assumption brings the conceptualization of informing agents close to the cognitive perspective.

In all the ontologies discussed but structuration theory, structure is typically opposed to action. In the sociotechnical view, the two stand against each other as two realities that are doomed to collide. A too narrow stream of water annoys a needy consumer, who struggles to open more the handle. The institutional lenses deny even the possibility of collision since action has no significant consequences. Not only is the faucet an extension of institution, but cultural properties of institution force mind and act to acquiescence with the faucet as given.

IVO diverges from such stances by positing that informing agents are orthogonal to organizational properties. This intersection engenders the domain of organizational phenomena labelled with the term "informing." An informing aspect, such as infoculture, brings together structure and agent in a close relationship of mutual dependence and influence. These characteristics parallel structuration ontology. The water faucet metaphor collapses. Instead, knowledgeable agent engages IS resources to get informed (to infer information), thereby revolving or evolving structures of signification, legitimation and domination. From the perspective of a particular IS, agent can also act in a denying manner to reject the system. While this assumption is in agreement with the structuration view of structural change, its radical character expands agent's power beyond evolutionary capacity.

In summary, IVO defines IT in terms of tools, devices, and machines that are used for manipulating data. The relationship between IT/IS, agency and organization (structure) can be viewed through the lenses of several ontologies, each presuming different paths of causality. In the conceptualization of informing agents, IVO draws on and advances ideas from other ontologies.

SUMMARY

This chapter introduced the topic of informing structure—infostructure. Infostructure refers to stable patterns of relationships between data segments and in IT arrangements, or to the structure of informing agents. Infostructure parallels and complements formal organizational structure. The discussion covered infostructure dimensions called infohierarchy, infocentralization, infoformalization, infodispersion, and infofragmentation. Changes in infostructure are indispensable for changing organizational structure and often spearhead it. Extremes in some infostructural dimensions can indicate problems in organizational structure. The concept of infostructure was applied to assess the properties of Big Data.

The perspective of informal social structure is also important for research and practice. It can be identified by the means of network theory and analysis. These have regained importance with the advent of CMC in the 1980s and social media in the 2000s. The perspective of infostructure can assist in social network analysis. Next, characteristics of social media as a type of business were analyzed in connection with the broader world of media. Characteristics of social media and a model of their relationships were introduced.

The chapter also discussed organizational technology and IT as a branch of it. It was argued that organization scholars think of technology in broad, abstract terms, blending it into a larger social frame of transformational process. This approach typically does not address IT, except in hi-tech research. In contrast, IS scholars have usually thought of IT in reference to computers, deploying materialistic and social ontologies. Connection points do exist in social ontology and the concept of IS.

The chapter finished with a discussion on the IVO concept of IT. IVO defines IT in terms of tools, devices, and machines that are used for manipulating data. IT can be studied appropriately at the IS level of analysis, where IT is part of IS. Ontologically, IS is viewed as the result of action, force influencing actors or both actors and organization (structure), a technical system interacting with a social system, a resource used to reproduce/change structure, or some emerging combination of these causal paths. A MIPS model of the emergent process perspective was introduced.

The discussion continued with newer philosophical approaches deployed in IS research – critical realism and sociomateriality. Both were evaluated with regard to theoretical and practical implications. The chapter ended by clarifying the ontological perspective of IVO and reiterating the primary role of human agency.

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ENDNOTES

- ¹ Suggestions on using the structurational approach (Barley, 1986, 1990; Orlikowski, 1992; Roberts & Grabowski, 1996; Weick, 1990) invoke propositions on mutual causality and dialectics of organization, action and IT. Orlikowski (ibid.) is quite explicit in this respect. This proposition poses serious challenges to formal theory (quantitative hypothesis-testing inquiry). The historical dimensions of the subject of study, multiplicity of variables, timing of measurement, the use of objective measures, and estimation of errors are but a few of the problems. The complexity of research models could grow to unwieldy proportions. If nothing else, the IS area might find itself in a pioneering role of exploring frontiers of social science that is modeled after physical sciences. In physics, for example, models are much simpler, operating with just a handful of variables. And this is complex enough! The IS research seems to be moving in a diametrically opposite direction. Perhaps a realization will mature that formal science has limitations just as its counterpart does, and that both are needed indeed.
- ² Abstract approaches are becoming a concern in the IS field. Proponents of different ontologies and epistemologies of IT share the concern. In addition to the article by Orlikowski and Iacono (2001), one may want to consult contributions by Benbasat and Zmud (2003), Hanseath et al. (2004), Hirschheim and Klein (2003), and Whinston and Geng (2004). Searching for more explanatory concept of IT has been an aspect of the process of “identity crisis” (Benbasat and Zmud, 2003; Markus, 1999). There exists a need to define “essential characteristics of IS field” and “its difference from research in fields such as law, economics, communication, and computer science” (Whinston and Geng, 2004: 149). The call for “theorizing IT artifact” still awaits clear responses. And sometimes clarification calls are curious in their clarifying effects. For example, while criticizing the literature for missing “IT artifact,” the authors stated: “[IT artifacts are] those bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software” (Orlikowski and Iacono, 2001: 121).
- ³ The IS field appears to be pressed between an urge to prove its identity and the speed of IT development. In a rush to reflect constantly on new kinds of IT, which is compelled by main publishing outlets and a self-imposed call for being relevant to practitioners, IS researchers seem to be caught in a “Catch 22.” They need more time for the contemplation that would lead to developing a theoretically more universal and relevant stance on IT and other core issues. But if they take that time, they risk being left behind by new technological trends that, in turn, can result in increasing the lack of practical significance.
- ⁴ It appears that this interpretation of structuration theory was strongly motivated by the authors’ intention of discrediting technological determinism, and it ended in a social determinism. As the author stated: “different assumptions, knowledge, and techniques ... [are] embedded in different kinds of artifacts;” “rules and procedures [are] structured into a machine” (Orlikowski, 1992: 399); “It seems that the ‘technological imperative’—rather than being an inherent aspect of technology—can be socially constructed, a product of the social practices that evolve around the use of a technology” (p. 416). The author intended to “conceptualize material artifacts as the outcome of coordinated human action and hence as *inherently social*” (p. 403; italics added).

Chapter 5

Infoculture

ABSTRACT

The chapter examines stable beliefs, behaviors, and artifacts that revolve around organizational informing agents—culture of informing (infoculture). This concept deepens the insight into some well-known artifacts of organizational culture. The argument deconstructs the literature on organizational culture to expose such infocultural aspects. It is argued that different infocultures can exist in the same company, based on the occupational group, profession, department, and other grounds. Six types of infoculture are described, including newly introduced the team and knowledge infocultures. Case evidence on infocultures in three companies studied is used to illustrate these categories. Both a method of categorizing infocultures grounded on the idea of metaphor and the associated research inquiry are explained. The discussion also addresses the impacts of big data on infoculture. The chapter ends by presenting a case of colliding infocultures contributing to deadly air accidents.

INTRODUCTION

The topic of organizational culture has been legitimate within organization theory since the 1980s. It indeed has a longer tradition, if the cognate notion of organizational climate is considered. In IS theory, the topic of organizational culture has been notably addressed in study of CMC, ERP systems, adoption and use of GSS, and decision making. We have already come across several cultural issues. For example, we saw that at The World Bank, the technical capability of anonymous discussion collided with the culture that assigned different weights to opinions of different experts (Bikson, 1996). Although cultural issues have been in mind of IS researchers, there exists no explicit recognition of that part of culture that is related directly to informing agents.

Some researchers have come very close, but stopped a step short. For example, Davenport and Prusak (1997) discuss “information culture;” however, this term refers only to the cognitive informing agents (data, knowledge), and not to IT. In contrast, technology-focused researchers address only IT-related beliefs, conceiving these as just another part of organizational culture. Similarly, Kaarst-Brown and Robey (1999) differentiate between five archetypes attached to IT: the revered, controlled, demystified, integrated, and fearful IT. Also, Leidner and Kayworth (2006) have proposed a model of relationships

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between group values, IT-related values, and values embedded in a specific IT. In the organizational theory camp, there are no attempts at unifying a cultural framework from a perspective of informing agents. Still, theorizing on occupational culture as it applies to IS professionals provides some useful leads (see Chase, 2008). Conceptualizations of the role and impact of IT in organizations are also helpful (e.g., Deal & Kennedy, 1999).

IVO posits that it is possible to separate a part of organizational culture that relates directly to informing agents—*infoculture* (short of informing culture). More than being just a possibility, such a move is necessary, given the salience of these informing agents in today's organizations. This chapter will introduce the concept of infoculture by proposing a new way of reading relevant literatures. Various aspects of infoculture will also be discussed, and a typology of infocultures proposed, which can be useful for research and management purposes.

THE CONCEPT OF INFOCULTURE

Law firms and banks maintain strong norms aiming at securing confidentiality of client data, and corresponding work practices are carried out. Innovativeness and production of new knowledge are raised at a level of cult at organizations like 3M and Microsoft. The Internet, as a rich technological and informing context, features in stories explaining the advent of organizations such as Amazon.com and MediPlan (an international Internet pharmacy in Canada). Clerical work in government, education, and non-profit organizations maintain norms and work practices that help to maintain paper documents in a usable form. In high-tech companies, the same efforts can be identified albeit as involving documents in electronic form. Monitoring employees' emails has been legitimized as a practice in many companies. There are attempts to electronically monitor the work of subordinates, and such a cultural shift may need to go through several hurdles before becoming a norm and routine practice.

In software firms, engineering companies, and IS departments, a particular sort of thinking (attention to detail, process focus, formal logic) have been praised and reinforced. Financial experts may have a high appreciation of accurate, complete, and timely news and reports, but little patience for experimenting with new kinds of IT. IT professionals may be on the opposite end. And of course, everybody who tries to use email or some other technology for electronic communication is likely to learn that some different norms may apply to it than those used in face-to-face communication. All these examples point to items of organizational culture that are focused on informing agents. Let us first look at organizational culture and draw relationships between infoculture and itself.

Organizational culture is about shared cognition, patterned practices, and behaviors that differentiate members of one organization from members of other organizations. Thus, organization members can share some beliefs regarding their organization and they can interact in the professional and social domain specific ways, which are alien to outsiders. As with a larger cultural system (e.g., culture of an ethnic group) in which the idea of organizational culture finds inspiration, organizational culture spreads through socialization or indoctrination. One can feel organizational culture more or less intensely, depending on the level of reinforcement. Some cultures are stronger (a more radical indoctrination is involved and culture maintenance is more persistent), while others are weaker.

Organizational culture (culture) eases communication by creating a high context in which words and gestures belong to a known repertoire of agreed meanings. Therefore, culture facilitates the transformation of data into meaning. In this respect, knowledge of an organization's workings is part of culture

(indeed, that special part we will call culture of informing). Culture legitimizes a certain way of thinking and behaving, and discourages and sentences inappropriate ways. Also, self-identification with an organization is influenced by its culture. For these reasons, culture is often considered to be an additional method of integration based on voluntary compliance rather than coercion, which is the backdrop of formal organizational structure. However, there is usually more than one culture in organizations. Departments, professional groups, and even hierarchical levels can have their own cultures; yet, there can be a set of beliefs and behaviors that is considered to be a mainstream culture. These different cultures may not be mutually congruent.

Infoculture is the part of organizational culture that pertains to informing agents. Infoculture, therefore, is a subset of the larger culture. It captures specific cultural aspects, such as technological culture, the values attributed to knowledge, norms guiding manipulation of data and other informing processes, and so on. As indicated above, knowledge of the organization itself belongs to infoculture. This knowledge mediates in the transformation of data into meaning. How a certain phrase is interpreted in an organization depends on the knowledge of the organization's lingo. How an employee interprets a boss's email on the annual performance depends on the employee's knowledge of the broader organizational context. If the organization is conceived as collegial and professional, the message can be understood as a fact; if the organization is taken as the opposite (competitive and confrontational), the message could mean warning or threat. Keeping in mind these basic ideas on infoculture, let us try to read the literature through the lenses of infoculture.

Ducks, Badges, Think!

IBM is a good place to start, since the organizational culture of this company has been studied extensively in the past. It was a strong culture that left no alternatives. In the 1930s, IBM employees used to sing the company's hymn every morning before starting work. While this ritual was later abandoned, it used to be easy to recognize IBM employees by the way they dressed and talked, where they lived, what cars they drove, and loyalty to the "Big Blue" (a nickname given to IBM). The company resembled a piece of well-greased machinery, with a bureaucratic structure and what Handy (1993) would call *role culture*. IBM's culture has been often characterized, if not outright glorified, as a contributor to the creation of IBM and to elevating the company to the pedestal of the most profitable enterprise in the history of American economy (Deal & Kennedy, 1982; Peters & Waterman, 1982).

The things started changing in the 1980s, as IBM was losing some important technological battles with younger, agile competitors in the computer industry. The company embarked on a painful journey of radical changes and after ten years, emerged as a very different company. It had half the number of employees than before, was decentralized along several lines of business, and much of its famous old culture was dismantled, along with the norm of life-long employment. The product strategy made a 180 degree-turn, meeting its antipode. Previously, IBM insisted on "wrapping its customers all in blue"—software, hardware and support-wise. However, the new strategy permitted a more open perspective towards other proprietary products and, then, even toward open source software. Today, the IBM hardware runs alien operating systems, and IBM application software runs on different hardware platforms and operating systems. Prospects became bright again for IBM, as it successfully passed the "change or die" test of the late 20th century. Some others did not, such as DEC, which used to be a big player in the computer industry. But IBM today is a very different company than IBM from twenty years ago, and the company's culture is far from being strong and monolith. There is a huge disproportion in the literature

between the coverage of IBM's old and new culture, and old culture is still used as a school example of the relationship between organizational culture and good organizational performance. So, how do these classical examples appear through the lenses of infoculture?

One of the values in IBM's old culture was termed simply with "Think." The Think value was taught through stories portraying the founder of IBM Thomas Watson, Sr. in problematic situations (e.g., how to make a sale, or how to respond to a challenging customer request). The typical story describes Watson holding to his Think value, which would make him invent an appropriate solution for the problem at hand. The idea was not so much to glorify the founder's wisdom, but to make the listeners of the story think about solutions they would invent in similar situations. A particular informing aspect can be identified in the Think value and the stories referencing it. What has been culturally valued is a flexible approach to problem solving, based on skill, experience, wisdom, self-confidence, and optimism. Problem solving and the basis to it, with the exception of the last two psychological items, refer to organizational informing agents. Using brains has always been important for companies making product and marketing breakthroughs. IBM employees had to propel themselves to think well as much as Microsoft's people being part of a "high IQ company" have to do decades later.

Consider the famous "green badge story," which features Thomas Watson Jr., who succeeded his father at the helm of the American part of the company. The story has it that Watson Jr. was stopped by a guard at a factory gate, because he forgot to put on a green identification badge. The guard who stopped him endured the pressure of the executive's company and probably a stress while acting straightforwardly upon the security regulation. The story goes that somebody brought the green badge to Watson Jr., and that only then he was let in. The dramatic conflict between the file staff and top executive is supposed to bring to the fore the underlying cultural belief that nobody at IBM can be beyond rules. So far, the story reads as a classical example of organizational culture at work. But concentrate for the moment on the green badge. Although Watson Jr. was undoubtedly recognized by the guard, this visual, sense data based recognition was not legitimized as a means of security clearance. Only the green badge was. At IBM, this green badge was considered an objective means of identification, which could not be supplanted by anything else. The situation resembles tragic events with the military organization, when rigidly applied identification rules make a difference between life and death. The emphasis, therefore, is on a cultural artifact (the badge) that represents an objective and accurate signification of personal identity.

The salience of valuing informing artifacts becomes clearer in a multicultural context. The IBM green badge is a token of an objective or "universalist" culture that relies on applying universal rules and procedures to ensure equity and consistency (Trompenaars & Hampden-Turner, 1998). In contrast, a "particularistic culture" relies on personal contact and encourages flexibility by adapting to particular situations (ibid., pp. 3-44). This author's personal experience from a Spanish-speaking country in Central America, indicates that personal identification via face-to-face communication with security personnel counts more than any identification symbol or document (Travica, 2002).¹ Security guards in some important organizations insisted that getting familiar with the face of a visitor constituted the true identification check. Bureaucratic universal regulation painted IBM's organizational culture, which in turn framed perception, thinking, and conclusion on the guard's side. Particularistic organizational cultures based on a more personal contact shaped the informing norms and practices (infoculture aspects) of the other guards.

Another interesting example of infocultural values and stories from IBM's history exploits the idea of wild and tame ducks. The narrative tells about a flock of ducks living on an island—some are tame, others wild. The wild ducks leave the island prematurely and split apart, thus weakening their own sur-

vival capabilities and those of the entire flock. The tame ducks gradually deplete food resources and, consequently, starve to death. The story inspires on searching for a successful way that strikes the wild and tame ways—status quo and progress. This story has had various renditions. One applies to Don Estridge, who led the development of the IBM PC (see Rogers & Larsen, 1984).

Estridge himself was a “wild duck” that spent some time in a “penalty box” (a unique cultural institution at IBM, where a violator of company’s order would be left in an office with nothing else to do but to contemplate about his mistake). Estridge was chosen to lead the IBM PC project, which was technologically unique. The choice outraged many of the fine IBM technologists who were used to technologies underlying mainframe computer. And Estridge did it his way. He established an independent business unit (IBU), outsourced software development work to a fledgling small company called Microsoft, and engaged a mix of IBM and sub-contractors in hardware development. The IBM PC was born a year later, and the rest is history. From the infoculture perspective, the wild duck fable tells about the vital importance of making intelligent choices that sometimes deviate from ordinary ways (IBU, outsourcing software development).

Infoculture is apparent in informing businesses. An example is from the Internet early era was Internet Securities (ISI Emerging Markets), a broker of news and analysis on newly emerging markets. The company founders drew a business value from the Internet by avoiding data transfer costs applicable to private networks. The Internet served as the main communication channel between the company and its suppliers and customers. Much of the company’s culture was revolving around inventive methods of communication and the content sold. For example, one office was chronically slow in responding to email. This behavior was disruptive to core organizational processes and the office was eventually closed. Challenges of sharing experience and company’s knowledge emerged as soon as the company began expanding into new countries. The leadership realized that values and practices of sharing the know-how of setting up offices in virgin markets had to be strongly encouraged by incorporating them into organizational culture, that is, infoculture.

If infoculture influenced by the Internet has emerged in a spontaneous way at Internet Securities, a more concentrated effort in this direction played out at Amazon.com. This company started as a Web bookstore, and evolved into a Web department store. The process of cultural indoctrination at Amazon.com starts with a story of the company’s advent. Employees at Amazon.com learn that the company was born out of the founder’s realization that the Web was turning into an expanding marketplace. Jeff Bezos left his job at Wall Street and moved to the West Coast to start an Internet-based bookstore. (In fact, it used to be a mail order bookstore at the very start.) The Internet has continued influencing the thinking and product philosophy of Amazon’s employees. New products emerged, such as hosting third party’s online stores, e-publishing, digital readers, and Cloud hosting services. Since the Internet is an informing agent in its own right, this example indicates how it shapes an infoculture, and how infoculture becomes a predominant organizational culture.

Computers: Good Guys, Bad Guys

Much of managers and researchers’ attention have recently been concentrated on ERP systems (also called just enterprise systems). These complex systems should integrate the management of data and organizational processes at the enterprise level, thereby minimizing data inconsistency and redundancy, increasing the speed of data flows and centralized control of data. Implementation of ERP systems has

proved to be very challenging and success stories are in short supply. One of the possible lessons to learn is that organizational culture and infoculture do matter for effective implantation of ERP.

Krumbholz & Maiden (2001) studied modules of the SAP R/3 enterprise system, which were in the post-implementation stage at British and Swedish subsidiaries of a large multinational pharmaceutical corporation. The respondents expressed beliefs that computerized systems should provide a holistic view of data and improve service to the customer. (Note that the first assumption is infocultural in character.) The modules were failing to meet goals in these organizations and had undergone extensive configurations. Some interviewees pointed out that problems resulted from the assumptions on organizational workings and cultures, which were built into the system.

A similar clash between cultural assumptions built into ERP and those followed by organizations is reported by Soh and colleagues (2000). The authors identified a “misfit” between “Western cultural assumptions” and informing practices that were used in medical institutions in Singapore. For example, there were differences in payment procedures, the content and formats of reports, and data entities. Therefore, here one can see even more clearly the cultural differences behind IT and how these differences pertain to data aspects. The data models and business rules coded in the software recreate what is usually called “best practices”—the ways of running business invented in other, successful organizations. If implemented to a toe, ERP solutions effectively serve as a Trojan horse for importing alien infocultures (other IVO aspects are also imported, such as infostructure and infoprocesses). Therefore, the host infoculture has to change or clashes and system rejection follow.

Another illustration of this fact is in the study of Sarker and Lee (2001). The company they studied would not start implementing ERP without changing its “dysfunctional culture.” The authors explained it in terms of a lack of trust, inefficient processes, “sea of paperwork,” and inadequate technological infrastructure (p. 419). (Note that the last two items refer to our concept of infoculture.) Departments tolerated the atmosphere of ambiguity regarding the status of orders, and production and engineering departments could not get to terms in schedule planning (the former would routinely set production deadlines without asking the latter, and the latter would routinely resist). These problems came under critical lenses during preparations for the ERP system. Solutions were identified and implemented owing to leadership demonstrated, open communication, and an effective implementation team. In the end, the ERP system was implemented successfully. One manifestation of the new infoculture was more open communication between departments. It became normal for an Engineering manager to walk down to the Production Planning office and chat with the planners. This and the previous examples indicate that approaching ERP systems from the angle of infoculture may help in understanding nuances of their challenging adoption.

Computers are not always seen as good guys that just need to be set in motion in a proper way. On the contrary, some authors believe that computers are a direct threat to a traditional “good corporate culture.” Consider the following thoughts:

- “Rituals that used to be social are now machine-timed and dictated. Face-to-face communication is more often than not replaced by impersonal electronic exchange. This new white-collar workplace culture is different from any that history has ever known” (Deal & Kennedy, 1999: 146);
- Cultures used to consist of thousands of rituals reinforced by “stories about what so-and-so had done and what it meant in the grand scheme of things.” Routine was punctuated by social gatherings, which were “celebrations of cultural values.” (146) All this has now changed or is high-

ly threatened, and these changes were stimulated by new technology, particularly the computer (ibid., pp. 146-147);

- The new culture finds heroes in “the whiz kids who can fix software glitches or the computer system itself” (ibid., p. 148);
- Before, “the old hands in the organization took newcomers under their wings.” Disputes would be resolved in informal gatherings, and socialization was relegated around the coffeepot or in the local pub. Now, “computer-mediated life” reigns in the modern corporation, assert Deal and Kennedy (ibid) and picture it as follows. An employee comes to work in the morning and may not greet colleagues for fear of interrupting their work at computer terminals. Then he performs “the first official task of the day: firing up the computer.” He works electronic messages with people from his company and elsewhere. If he does routine work, his daily agenda is further “dictated by the computer.” When he takes a short coffee break, he meets nobody around the coffee machine. Instead of socializing old ways, he returns to the computer, and, while sipping coffee, checks on-line the company’s joke line to find out the laugh of the day. He may pass some jokes via email to someone, and then he turns back to his computer-based work. (ibid., pp. 147-148).

Deal and Kennedy (1999) have not denied entirely usefulness of computers. But usefulness comes at a high cultural price. The authors warn that “pluses are offset by diminished social interaction with one’s peers and a sterile interface with a computer rather than a supervisor.” Also, modern communication capabilities of computers “are superb,” but they are rarely used “to reinforce core cultural messages” or to encourage staff “to go beyond the confines of current jobs to look for new ways to add value to the collective good.” Computers are a “double-edged sword,” as they can be used both for enhancing the skills of the workers and to “trap workers in dead-end jobs.” But the authors are convinced that computers are detrimental to organizational cultures. “Although the jury on computer usage is still out, it seems unlikely that from the cultural view the verdict will be favorable.” (p. 148) For Deal and Kennedy, computer technology adds to the causes that have created undesirable aspects in corporate cultures, including employees’ fear of being fired, elimination of loyalty, cynicism about management, and uncontrolled rule of self-interest. Computers bring in “cultural isolation,” a malady the authors deem as serious as “short-termism” due to over-emphasizing shareholder value, “corporate lobotomy” due to downsizing, “corporate amputation” due to outsourcing.

Even if reflective on a particular historical period, the negative verdict of the organizational culture patriarchy is haunting. From the IVO perspective, it makes a strong case for infoculture. Computer and the informing practices it enables do become cultural landmarks. In other words, as in the case of Amazon, infoculture becomes a dominant cultural content. Of course, the next step upon this realization should involve management action which depends on the result of evaluation (not everyone may endorse Deal and Kennedy’s criticism). If an infoculture is viewed as undesirable, actions toward countering or counterbalancing it are sensible. Creative adjustments to the inevitable are equally needed. Generations that grow with video games and social media may have a different understanding of the notions of presence, personal, and socialization. Creative management is needed for grasping and using the new conditions.

The IS literature also provides clues for conceptualizing infoculture. Orlikowski (1994) used the term “technological frames” to refer to the way organization members make sense of and assign meaning to organizational artifacts and to assumptions, knowledge, and expectations expressed symbolically through language, visual images, metaphors and stories (ibid, p. 176). The organization Orlikowski studied was implementing groupware on a large scale. The author identified two different sets of values and assumptions

in this organization. One characterized the IS department and the other pertained to the business core of the organization (the users). The IS staff was driven by values of technical indicators of work, believed that the new IT could change the firm, assumed the users were rather ignorant about IT in general, and that users “would come if the system was built.” In contrast, the users were focused on economics of chargeable hours and could not understand how the groupware could contribute to earnings. In contrast, they had strong interest in the quality of documentation and communications, valuing confidentiality, security, and accuracy. Neither side was able to understand the other. From the IVO perspective, it can be said that the technological part of informing agents fared poorly in this infoculture, while the cognitive agents enjoyed prominence. This split is common to many organizations, and it gives rise to problems in system development and maintenance.³

Markus's (1994) investigated an organization in which email became the main communication channel for both vertical and horizontal communication. The company experienced desirable changes, such as reduction of the paper trail, and acceleration of communication. But some changes were not so desirable. One was the insertion of social distance between organizational members and depersonalization of work relationships. For example, a manager could not fully focus on his visitors because he had to monitor an unending flow of email that carried announcements, reports, and orders. These elements of the new infoculture threatened the larger organizational culture, and management felt compelled to apply remedies. This study indicates that a strong infoculture can emerge around a new communication system and affect the respective organizational culture.

Orlikowski's (1996) study of a software company's help desk offers additional leads for identifying infoculture. The help desk deployed a new, dedicated system, involving databases and communication functionality. New values and practices emerged around the process of documenting problem-solving work performed by the desk staff. One was a value of documenting well individual experience. For instance, a professional and diplomatic language were considered part of good documentation. A dramatic story on frustration caused by poor documentation reinforced this value. In the story, the documenter and the user were the same person. An associated value was that the document authorship was a seal of quality. Rituals of praising good documenters surfaced at the help desk.

New infoculture involved managers. They discovered that the help desk system could be used for monitoring the help desk staff. However, employees reacted against the Big Brother attempts, fearing that these could become legitimate. The tension settled down owing to trust between managers and workers, which existed in this firm. Workers accepted monitoring under the condition that it would not be abused, and managers performed monitoring according to clearly defined objectives. Interestingly, the workers used the monitoring as an opportunity to demonstrate their problem solving skills before managers' eyes. In the IVO parlance, this monitoring was an informing process on the management side, representing a new ingredient to the company's infoculture. The spin the workers put on monitoring was also an informing process directed from workers to management, adding another element to this infoculture. This case demonstrates how infoculture evolves spontaneously with a new IS.

In his study of La Roche, Ciborra (1996) identified new work practices and beliefs that can help to understand infoculture. Distributed project teams at the pharmaceutical firm Hoffman-la Roche (Roche) used the GTR (Global Team Rooms) system on a regular basis in order to set in place a new process for creating drug documentation. They encountered a number of challenges in the domain of infoculture. One referred to the timeline and process of creating the project documentation. Previously, team members would hold private their drafts before polishing them for presentation to the colleagues. This would usually postpone document releases until the very deadline. The new process required building a

prototype of the final documentation from the very start. This meant that teammates had to start sharing their work from early drafts on. Half-baked thoughts, therefore, could creep in.

Implications for a change in the culture around informing agents were obvious. More mutual openness, accountability, and trust had to be vested in the documentation created by individual team members. Another change was associated with whiteboard technology. A practice of “going to the whiteboard” while using GTR emerged. This was different from using videoconferencing, and some team members felt awkward. In addition, R+D professionals were compelled to turn decisively from paper to electronic format. Their traditional focus on paper was in connection to a sense of control. Switching to electronic documents impinged on this assumption, since electronic format was perceived as being less controllable and more volatile. It is interesting that a similar phenomenon was discovered among early adopters of computerized IS in American banks, where managers felt insecure because they could not see files or lay down their hand on them.

Cultural resistance to adoption of GSS has also been identified. Munkvold (2003) studied the use of GDSS, video conferencing, and chat in a Norwegian oil company and found that these were used to a smaller extent. The authors determined that some cultural aspects imposed roadblocks. One was a tradition of face-to-face meetings. Managers maintained that meetings were a “holy cow” that must not be “affected with technology.” Meetings were considered a “free zone” in which the attendees, holding different expectations, had an opportunity to express their thoughts. Imposing a principle of effectiveness on this zone would antagonize many people. In addition, the company people were accustomed to travelling to conference, which apparently was incongruent with teleconferencing.

Summary

Stable beliefs and patterns of behavior (practices) that refer to data, knowledge, meaning and IT can be identified in any organization. Knowledge, norms pertaining to proper manipulation of data, preferred ways of thinking, values attached to IT in general, stories about particular kinds of IT/IS, and practices of informing can be commonly found in organizations. All these are examples of that part of organizational culture that revolves around informing agents, infoculture. Putting on lenses of infoculture yields a deeper insight into some well-known artifacts of organizational culture, such as the stories on green badge and on wild ducks at IBM. By the same token, we can differentiate between different organizational contexts that may not appear different otherwise: if a badge is valued as a proof of identity in one infoculture, no badge or any other objective/official symbols work in an organization that values meaning drawn from sense data.

Digital technologies feature in infocultures of Amazon.com, Internet Securities, and some companies relying on ERP systems. Deal and Kennedy (1999) warn that computers can be bad guys leading to “cultural isolation.” Case studies by Orlikowski (1994, 1996), Markus (1994) and Ciborra (1996) furnish leads to understanding the notion of infoculture and how it comes into being.

Defining Infoculture

Infoculture refers to stable beliefs, behaviors and artifacts related to informing agents, which are shared by organization members (see Figure 1). If organizational culture is the way things are or the way of life in an organization, then infoculture is the part of this way and life that revolves around organizational data, knowledge and IT. Clearly, infoculture is a part of a broader organizational culture.

This definition has certain similarities and differences with relevant concepts in the literature. For example, Davenport and Prusak (1997) discussed “information culture,” defining it in terms of “a pattern of behaviors and attitudes that express an organization’s orientation toward information” (p. 84). An example of the cultural attitudes is preferences for facts or rumors, while examples of the behaviors are patterns of sharing work-related data and preferences for types of communication channel (e.g., face-to-face vs. email). In accord with their “ecological approach to information,” the authors distinguished between information culture at the group level and “information behavior” at the individual level (e.g., methods of searching for data) (pp. 84, 87). The IVO definition of infoculture has apparent similarities with ideas of these authors. The difference is that IVO uses a different concept of information, accounts for IT as well, and accounts for cultural artifacts in addition to behaviors and attitudes.

Bressand and Distler (1995) used exactly the term “infoculture” in their analytical framework of social networks. They defined infoculture as several items: “shared objectives and mutual expectations” on whose basis members can agree upon joint projects for which network resources will be mobilized, “rules that govern changes of rules,” and “background knowledge” that actors take for granted and enact in their daily use of the network. Infoculture is expressed through narratives, war stories and social relations, and its role is to define the basis for learning, sense making, and shared understanding of specific situations (cited in Ciborra and Pariotta, 1996, p. 122). From the IVO perspective, all these are valuable points in conceptualizing infoculture, with the stipulation that infoculture in IVO is not limited to social networks and a cognitive domain.

Infoculture complements organizational culture. Therefore, a more analytical view of the concept of infoculture should follow a breakdown of organizational culture. As Figure 1 shows, using logic of organizational culture, infoculture is composed of three components—beliefs, behaviors, and artifacts. These are interrelated. For example, in the infoculture of the software vendor that Orlikowski (1996) studied, there are beliefs (assumptions and values) that support documenting well problem solving experiences. These drive documenting practices (behavior). The language (an artifact) used for this documenting complies with quality standards. It is further plausible that documenting practices involve IT (a thing), which is valued on its contribution to documenting (a belief). A story about poor documenting (artifact) underscores what is undesirable. The very event described in the story (the user of the poor documentation is its author) has a character of drama (a deviant work practice as an instance of behavior). In contrast, using a documentation produced by a reputable documenter, whose authorship is a value in itself, constitutes a ritual of reinforcing the documenting item in this infoculture.

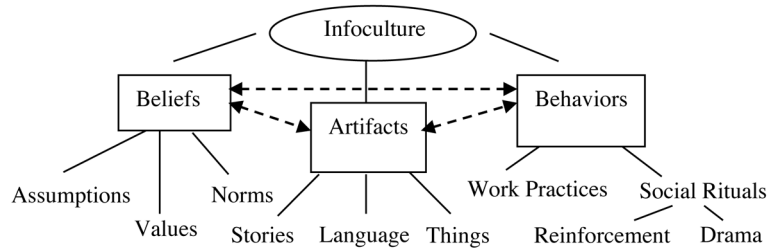
Interplay between behaviors and beliefs unfolds in a historical process. At the point of inception, work practices of documenting problem solving (behavior) rested on free, creative action and subjective unwritten rules. Once certain documenting practices were endorsed as successful, these influenced the creation of values and norms on how one should go about documenting problem solving. In the further discussion, each of these infoculture components will be addressed.

Beliefs

Beliefs are a complex category, and they have attracted attention of many researchers of organizational culture. One kind of beliefs are deep-set assumptions. Assumptions are about a correct way of perceiving, thinking, and feeling in relation to problems of external adaptation and internal integration (Schein, 1991). Assumptions define nature of human relationships (e.g., competition or cooperation), character of governance (e.g., technocratic, bureaucratic, or autocratic), reward philosophy (e.g., tenure or merit),

Figure 1. Components of infoculture

(Note: Solid lines signify the is-relationship, and dashed lines the flow of influence.)



the relationship between an organization and its environment, and so on. Assumptions are axiomatic and for some authors they are the deepest level of organizational culture that is manifested in upper levels (Schein, 1991). An example from the domain of infoculture would be the assumption that there is (or there is not) business value in IT (Orlikowski, 1994).

The value is another kind of beliefs. Value refers to a conviction on what is good/should be done and what is bad/should not be done. For some authors, values are the deepest layer of culture (Hofstede et al., 2010). Preferences regarding communication channel fitting particular tasks (email, meetings, telephone) are another example of infocultural value (cf. Davenport & Prusak, 1997: 102).

Norms are unwritten rules on how to behave or how to do something. Norms extend on values and allow members of a culture to know precisely what behavior is expected from them (Hatch, 1997). The how-to-do segment of norms represents cultural procedural knowledge. Those norms that regulate handling of data and IT belong to infoculture. As data and knowledge activities enlarge in scope, infoculture expands. This trend can be traced back to the advent of bureaucracy organization that introduced extensive paper documentation (“paper trail”). It extends to date when electronic format co-exists with and gradually supplants paper.

Behaviors

Behaviors are the next component of infoculture. There is a tendency among contemporary researchers of organizational culture to assign the secondary role to the behavioral segment. In other words, behaviors are seen as the effect of causal beliefs (Hofstede, 1991; Hofstede et al., 2010). In contrast, behavioral part of culture was recognized in earlier theorizing on the topic. For example, Jaques stated that “the culture of the factory is its customary and traditional way of thinking and doing things” (1952: 251). While modeling behaviors in function of beliefs meets reality, this may not be the whole explanation. Behaviors may be carried out irrespective of beliefs (say, due to social pressures that institutional theory explains). Actors may be unaware of beliefs or these can be long forgotten, while old practices perpetuate. Indeed, here lies a deep meaning of the word “tradition”—doing something because that has always been done and not because of realizing particular assumption/value. Therefore, actual behavior is the culture inasmuch as related beliefs, which can more or less influence the behavior.

In the domain of IS, new behaviors emerge around new pieces of IT, and can form patterns over time. This is the primary, salient infocultural change. The cases discussed above supply examples. When system change, old behaviors are supplanted, while beliefs can survive and be just partially eroded. This inertia is well captured in the idealistic conceptions cited above. Still, they cannot explain change in beliefs.

We posit that new beliefs emerge through practice. Before the advent of email, communication values and norms covered pre-digital technologies (paper, telephone). In some organizations, these beliefs were quickly extended to email when it was introduced. In others, user action was less constrained, thus leaving more space for beliefs about email to morph. In either case, particular distinguishing capabilities of email systems, such as the asynchronous character and documenting capability, could have inspired different beliefs in different organizations. For example, the asynchronous character may be limited by norming a normal response time; the documenting capability could be moderated by a value discouraging email forwarding to a third party. It follows that behaviors makes infoculture in two ways—as the precursor to beliefs, and then as the belief reinforcement or a mere inertia in the sense discussed above.

Behaviors can be routine work practices and social rituals. Social rituals are (a) reinforcements—the practices of confirming infoculture (e.g., celebrating good documenting in the example above), and (b) dramas—the practices of sentencing deviations from infoculture (a hypothetical example would be if a manager makes a public demonstration of a damage to business caused by poor documenting of problem solving).

Artifacts

The artifact category contains stories, language, and material things. Stories are narratives that express beliefs; note that Figure 1 indicates that beliefs and artifacts are related. Stories can be categorized on the proportion of their real and fictional content. For example, a fable is closer to fiction (e.g., the wild duck story discussed above), while a narrative is closer to facts (e.g., the green badge story). Many companies maintain stories on the advent of a company. A contemporary instance of this sort of story with an infoculture slant tells about Amazon.com, the world's largest online bookseller, which is making moves toward becoming a Wal-Mart of the Web. The story features Jeff Bezos, the company's to-be founder, who in the early 1990s realized that money lied in the Internet; he then left his lucrative job at Wall Street in New York, and moved to the West Coast to start Amazon.com.

Language is a cultural artifact that can differentiate members of an organization from others much like national languages differentiate nations. Lingoes of professionals grouped in functional departments abound today, and there can be an overarching lingo within a certain company. For example, at Disneyland, employees are “cast members” that play their “part” (perform jobs) according to “scripts” (job descriptions) when they are “onstage” (on duty) (Collins & Porras, 1994: 128). Similarly, the jargon of IT professionals is full of technical terms esoteric to outsiders, and Microsoft programmers speak “Hungarian” (they use a method of describing textually computer code that was invented by a Microsoft's expert of Hungarian descent).

Can organizational culture, and thus infoculture, have material aspects? The proponents of idealistic approach tend to relate culture exclusively to the belief domain (Schein, 1991). Physical things are excluded from organizational culture. This implies IT and IS in its physical manifestations. This postulate is curious as it counters concepts of culture used in cultural studies (e.g., anthropology and ethnology) that inspired theorizing on organizational culture. Studies of past cultures typically define these by technology for food production. (Other technologies may also play part in differentiating cultures, such as the means of transportation, housing, food preparation and consuming, hygiene maintenance, and wardrobe). There is no good reason why this logic would not apply to organizations. Organizational technology is part of organizational culture. Electro-mechanical machinery requires different work practices than automated machinery. Extended to infoculture, this logic includes IT and IS in its physical manifestations into the

scope of infoculture. Thus, it makes a difference if a medical institution still records patients in carton files, or a DOS-based system, or an Electronic Medical Record (EMR) system. Different technologies determine different infocultures, which in turn influence larger organizational culture (and possibly subcultures of doctors and nurses), which in turn may reflect on hospital performance.

Other material items may also belong to infoculture. For example, a consistent design of office space can be part of organizational culture. However, if the design determines patterns of communication or document flows, it acquires infocultural significance. Open cubicles hosting members of different levels of expertise and hierarchical levels can be part of organizational culture. But if this design facilitates oral communication or regular passing of documents “over the wall,” then it is an aspect of infoculture. An arrangement of computers within the office space can signify infocultural values that an organization attributes to computer technology (see the dramatic portrayal by Deal & Kennedy (1999) above).

The last point to be made in conceptualizing infoculture concerns communication. Communication is both the instrument and content of infoculture. On the one hand, communication uses language to convey stories and values (directly, unrelated to stories) concerning informing agents. Thus, communication reproduces infoculture. On the other hand, communication is part of social and work practices involving informing agents. In this role, communication is *the* infoculture. For these reasons, communication is inseparable from infoculture and cannot be treated as its component.

Summary

In this section, infoculture was defined in terms of stable beliefs, behaviors and artifacts related to informing agents, which are shared by organization members. It is a part of organizational culture. The literature background to this concept was discussed (Davenport and Prusak, 1997; Bressand and Distler, 1995), and three interrelated components of infoculture were analyzed—beliefs, behaviors, and artifacts. Beliefs were broken down to assumptions, values, and norms, and each item was discussed.

Furthermore, behaviors were broken down to work practices and social rituals that, in turn, were categorized as reinforcement and drama. It was argued that the contemporary study of organizational culture had unjustly treated the behavioral segment as secondary to the belief segment. Works practices are particularly important for understanding infoculture since they can precede infocultural beliefs.

Lastly, artifacts were analyzed in terms of stories, language, and material things. It was argued that IT and IS in their physical manifestation make aspects of infoculture. This perspective draws on broader cultural study that inspired study of organizational culture. The section concluded by characterizing communication as both the instrument and content of infoculture.

DIFFERENTIATING INFOCULTURES

Organizations nurture different infocultures, and they may not be internally homogenous. The same applies to organizational cultures. Researchers usually talk about mainstream culture and subcultures. They disagree, however, in valuing this phenomenon. Some hold that differentiation and fragmentation is undesirable and that subcultures are deviations (perhaps with certain worth) that should be brought back under the wing of the main culture (e.g., Deal & Kennedy, 1999). This perspective is sometimes referred to as integrationist or monolith approach. Others maintain that cultural fragmentation is simply the way things usually are in organizations (e.g., Kunda, 1992; Martin, 1992). Cultural fragmentation

can go deep into the tissue of an organization and it keeps organizational reality in a flux. A review of literature that illustrates differentiation in infocultures will set the ground for introducing a typology of infocultures.

The Fragmentation Perspective

Kunda's (1992) research identified some aspects of high technology, including IT, in infoculture of a high-tech company. He studied engineers, managers, and some support staff and identified cultural rituals and work practices (training programs, managerial speeches, meeting behavior, etc.) that supported the company's values of hard work, competition, mission, and task dedication. He also identified burnout among the staff, which some saw as a sign of weakness in enduring competition pressures, while others treated it as a sign of hard work and dedication. The author also detected a resistance sub-culture expressed in labeling professional life. Some of the labels were "crucifying, tech strokes, tech watching, the fear of God, midnight telephone calls." IT was deployed by the management to keep up the pressure. The resistance culture opposed such use as indicated in terms "tech strokes" and "tech watching." Therefore, this study shows that infoculture can be segmented over the IT artifact on two segments: a management segment (IT as a tool of oppressive control) versus the employee segment (IT as a villain to be resisted).

Wynn's (1996) study of an insurance company also speaks of a differentiated infoculture. This time, the split is inside the IS force. There were two groups of systems developers—one engaged in the development of large-scale database systems and application software for mainframes (the mainframe/legacy group), and the other in charge of PC software (the PC group). The mainframe group was invested heavily in legacy systems and it supported the core production systems. In contrast, the PC group was freer in technical orientations and it supported auxiliary informing needs and business tasks, while "playing around" with new software. This group was tasked to develop a workflow system for creating insurance policies (complex documents involving many linked pieces of data, legal and temporal logic, and experience). The mainframe group worked on the back end of the system. The whole project was a success, even though the groupware developer came from the mainframe group. However, the same developer resided in the users' department throughout the development cycle, reported to the PC group's manager, and deployed some elements of participatory development. This case suggests that infocultural differences among IS experts (different beliefs about IT and work practices) could be buffered by effective management.

Infocultural differentiation can also arise from hierarchical differentiation of organization. Strategic management is interested in summary figures on organizational performance, the mid-level management is interested in data aggregation at the department/division level, while operational management is focused on transactional data and summaries across shorter periods. These different informing needs gave rise to basic types of IS—Executive/Decision Support Systems, Management Information Systems, and Transaction Processing Systems. Financial data can be presented in different ways. In particular, the top and middle management can look differently at earnings and expenditures. An expression of clear-cut, completed financial figures may preferred by executives may look less realistic from the perspective of a department manager who is more familiar with dynamics of the cash flow. This amounts to some differences between managerial and financial accounting. As for operational management, their primary interest of controlling transactions leads them to insist on the quality of transactional data (e.g., timelines, accuracy, completeness, consistency). These management levels also differ on the technological side so

that the likelihood of using IS is negatively related to the management level. These differences outline different infoculture bases.

Enter the political interest to get a fuller picture of infocultural differentiation among management ranks. Mintzberg (1979) suggested that different “pulls” characterize different management levels. Executives pull to centralization, middle management toward division, and operational management to professionalism. Extending Mintzberg’s model to the perspective of infoculture, it follows that the centralization pull naturally tends to centralize reporting at the top, while the mid-management pull tends to filter what is transferred upward and to control transformations of departmental data into financial figures. And operational management does not tolerate interferences into the operational data domain, which may come from the above.

In conclusion, hierarchical differentiation of organization is accompanied by different infocultures of three typical management levels.

In summary, infocultures can get differentiated on the bases of occupational group and management ranks.

CATEGORIZING INFOCULTURES

This section expands the exploration on infoculture by grouping infocultures into categories (types). Since infoculture is a part of organizational culture, the discussion will concentrate on categorizations that bring to the fore connections between the two. Specifically, Boisot’s (1987, 1998) mapping of organizational designs and corresponding knowledge forms will be explored. The discussion will then address relationships between organizational designs in Boisot’s model and taxonomies of organization developed by Handy (1993) and by Trompenaars and Hampden-Turner (1998). Organizational cultures identified by these authors will serve as a blueprint for categorizing infocultures. Finally, a concept of knowledge infoculture will be proposed.

Boisot’s Codification/Diffusion Model

Boisot’s (1987) taxonomy of organizational designs identifies bureaucracy, clan, fiefdom, and market. These designs are well known in organization theory. Boisot’s contribution is in mapping the designs into informing dimensions, and in identifying forms of knowledge fitting different organizations. Boisot thought of these dimensions as *codification* and *diffusion* of information. A result of their relationship is the C/D model presented in Figure 2. Without going much into Boisot’s concept of information it suffices to note that it refers to what IVO considers the complex form of data organization of *knowledge representation*; indeed, Boisot used this term in addition to “information.” Codification is represented by the vertical axis in Figure 2, and it refers to a manner of representing knowledge, which Boisot explained in terms of formalization, compression, and classification. An example of higher codification is a patent document, because it contains a formalized language, formulas as a “compressed” expression, and possibly graphical representations based on a notation standard. In contrast, there is little (if any) codification in the tacit knowledge of an expert. Communication modes vary in codification. For example, spoken language is less codified than text, which is less codified than numerical expression (cf. Boisot, 1987: 108). Drawings may be between text and numerical expression on the extent of codification.

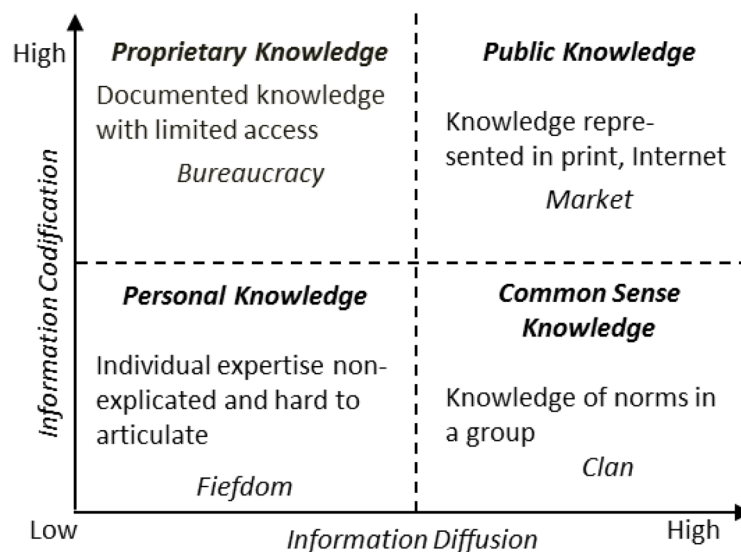
To illustrate these ideas with the practice of system analyst. He usually starts collecting system requirements by talking with users (lower codification). On this basis, a system analyst creates more formal written documents that determine system data, their transformations, data flows, storage, and system outputs (higher codification). Certain system aspects can further be expressed in numerical figures (e.g., the aspect of cardinality/multiplicity, formulas on execution speeds, and so on). This part of documentation would increase codification. Overall, the system analysis moves from the lower quadrants in Figure 2 to the upper ones.

The second dimension in Boisot's C-D model is diffusion of knowledge representations (refer to the horizontal axis in Figure 2). Diffusion refers to the percentage of a population that knowledge representations reach. One can think of diffusion in terms of distribution, availability, accessibility, and sharing. Knowledge represented in printed forms or in widely shared electronic spaces, such as the Internet, is more diffused than patent or tacit knowledge (refer to Figure 2.)

Boisot's model intersects codification and diffusion to devise four forms of knowledge: personal, public, proprietary, and common sense knowledge (Figure 2). The notion of personal knowledge was inspired by Polyani's (1966) tacit knowledge, which Boisot referred to. In the example of system analyst, this expert moves from personal/tacit knowledge of organization members, to common sense knowledge shared among members of homogenous groups, to arrive at official system requirements that are highly codified and accessible to authorized members—proprietary knowledge.

As is it apparent in Figure 2, different knowledge forms correspond to different organizational designs. These can be understood as forms of organizational culture as well. Boisot relates personal/tacit knowledge (small on both codification and diffusion) to fiefdom. This is a medieval sort of organization resembling a closed, guarded system, that in today's terms can be described as a professional turf today. Public knowledge sits diametrically opposite (high codification and diffusion) in the market organization. Market organization is characterized by competition, uncertainty, flexibility, and self-regulation via demand and supply rather regulation via hierarchy and rules (e.g., a decentralized corporation). Public

Figure 2. Boisot's C/D model with types of knowledge and organization



knowledge is diffused via the Internet, books, mass media, classrooms, and other contexts accessible to masses.

Proprietary knowledge is also high on codification but lower on diffusion. Access to it is regulated and controlled. These properties fit bureaucracy, the organizational design characterized by supremacy of rules, formal procedures, and hierarchy. Diametrically opposite to proprietary knowledge is common sense knowledge (low codification, high diffusion). It suits clan organization (boards of directors, clubs, joint ventures, oligopolies). Indeed, any more closed group can be thought of as a clan. Clan members share knowledge, which due to a high level of indexicality needs not be more codified. Ouchi (1980, 1981) characterized the clan organization in terms of strong culture maintained through a strict indoctrination, which supplants for both bureaucratic rules and market performance indicators as well as IS that enable control of these rules and indicators. (See also Hatch, 1997: 337-341.)

From the IVO perspective, Boisot's C-D model is important as it places knowledge as an informing agent at the nexus of organization. In addition, Boisot's dimensions have similarities with the dimensions of infostructure discussed in Chapter 4. So for example, a higher codification of a patent document can be explained by IVO's dimension of data formalization, its lower diffusion can be explained by IVO's dimension of data dispersion (even though this dimension refers to IT as well).

Taxonomies of Organizational Culture

A step in proceeding toward categorizing infocultures, this section will discuss Handy's (1993: 180-190) taxonomy of organizational cultures—Role, Task, Person, and Power culture. It will be complemented with Trompenaars and Hampden-Turner's (1998) taxonomy that differentiates between Family, Eiffel Tower, Guided Missile, and Incubator organization, and some other relevant forms. These taxonomies complement and expand the forms discussed in the previous section.

Role culture is Handy's model of bureaucracy introduced in the previous section. This culture places formalized roles in the center, thus emphasizing regulated, rules-driven operations and behavior over other ways of doing business. This culture characterizes the military, various public institutions (e.g., in domains of education, public administration, transportation, postal, and communication services), companies involved in distribution and sales, insurance companies, vertically integrated corporations, and certain organizational units (e.g., the accounting department and the mailroom). The driving value is that nobody can be above rules and regulations. In Trompenaars and Hampden-Turner's (1998) taxonomy, a symmetric culture is called *Eiffel tower*. Invoking the idea of this tall, pyramidal structure symbolizes the principle of hierarchy that is typical of bureaucracy. The authors argue that this culture praises logical, analytical, and rationally efficient thinking.

Power culture revolves around an individual or a group that concentrates social power in their hands (Handy, 1993). The power concentration shapes the main cultural beliefs and behaviors. A prominent place belongs to the values of trust and empathy, which power holders share. Buying into these provides legitimacy for getting in the inner circle. Communication in the form of personal conversation and "telepathy" are also important, suggests Handy (p. 84). Charismatic founders of organizations can create this sort of culture. Both smaller and larger organizations can be power culture. Its landmark is that cultural elements are dependent on the will of the power center. Perhaps the only exception refers to the case of beliefs and behaviors that serve the function of preserving the privileges of the power center, that is, the status quo. Power culture is similar to clan culture on the role of beliefs and rituals, as well as the power and group and aspects.

Person culture revolves around the individual (Handy, 1993). This is the culture of professional organization and technocracy, where experts autonomously create most of the work-related norms and carry out original practices and behaviors. Examples are university professors, consultants, and artists. The norms of a wider professional culture compensate for the lack of organization-specific cultural norms. Implications for a person infoculture are that beliefs and behaviors, if not being voluntarily adopted by the professionals, bear an individual stamp of these professionals. Variation in individual teaching styles, for example, makes it difficult to identify a style that characterizes a mainstream infoculture of a school. In a way, person infoculture contains an intrinsic tension between the individualistic part and the whole that attempts to curb individuality in order to create a common culture. Person infoculture is similar to Boisot's fiefdom.

Project-driven organizations engender what Handy terms *matrix culture*. Organizational design is Galbraith's (1973) *matrix organization*, which has crossed lines of reporting (to a project manager and to a functional manager). Project work varies with project goals and tasks, and so it is not easy to define it fully beforehand. Uncertainty reigns in a matrix, and the struggle for making sense in the midst of the flow of events is normal. Variability in the input and process part of projects calls for flexibility in organizing and task execution rather than adhering to predefined rules. Trompenaars and Hampden-Turner (1998) discuss a similar organization and culture calling it *guided missile*. Their description reveals interesting elements relevant for this infoculture. Thinking is problem-centered, professional, practical, and crosses disciplinary boundaries. Criticism is constructive and task-related. Intellectual effort is committed to resolving project problems. Knowledge and the capability of inventing solutions to new problems (improvisation, wisdom) are highly valued.

Family is another organizational design/culture Trompenaars and Hampden-Turner (1998). It resembles the above discussed clan and Mintzberg's (1979) simple structure. Trompenaars and Hampden-Turner find examples of this culture in Japan and Latin America, and Hofstede in China (Hofstede et al., 2010).⁴ Small or larger businesses owned by a family are an example of this culture. Small family organizations are less differentiated horizontally and vertically, and most of management functions concentrated in hands of a head or group of family members. But in any family organization, family leadership sets up the cultural blueprint and initiates its changes. Relationships are personal as in a biological family. Trompenaars and Hampden-Turner (1998) suggest that thinking and learning in the family culture are intrinsic and holistic. Since family-shaped beliefs and behaviors are superior, the authors note that project needs may be in a friction with the family culture. Both these notions are relevant for understanding a corresponding infoculture.

The market culture has attracted attention of scholars, but it is not a unified concept. Comparison with a village market is intuitive and reflects some characteristics (Hofstede et al., 2010). Hofstede likens this form to Mintzberg's (1979) adhocracy, pinpointing a capacity for facing uncertainty and a lack of hierarchy. Indeed, adhocracy is shaped by a purpose at hand (ad-hoc purpose reigns). Still, it may have traits that are not necessarily of market character, such as team focus, and it generally fits better into a category of new organizational designs (Travica, 1999). Other scholars define market organization in contrast to hierarchy, thus emphasizing coordination and other organizing principles alternative that counter rules and hierarchy (Heckscher, 1994; Malone et al., 1987). For example, an extensive discussion on democratic dialog as the substitute for bureaucratic organizing has been proposed (Heckscher and Donnellson, 1994). The authors view trust as a basis of a persuasive ability that substitutes authority and legitimizes a necessary hierarchy.

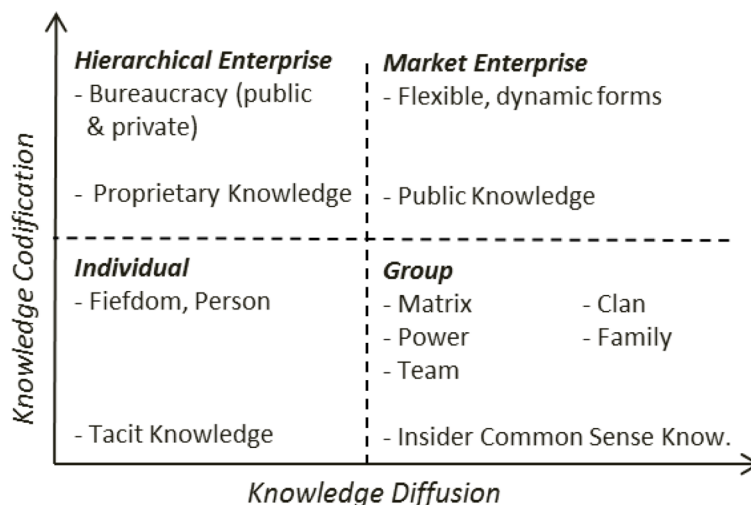
In spite of the differences, it is safe to note that market is viewed as a flexible enterprise. Indeed, there are several new organizational designs that are more flexible than bureaucracy. An example is the virtual organization as inter-organizational design (virtual corporation, alliance, or team with members from different organizations) (Goldman et al., 1995; Mowshowitz, 1984; Travica, 2005, 2008). Created by the purpose of delivering a special product, the virtual organization intentionally keeps at bay more formal structuring and cultural framing. The network organization, conceived as both intra- and inter-organizational organizational design, is also flexible, flatter, and more organic design (Miles & Snow, 1986; Rockart & Short, 1991). From the perspective of the C-D model, all these cultures need to keep public the core knowledge necessary for carrying out production operations. But these cannot be places squarely in the upper-right quadrant, since they can depend on group and individual work, and may need to resort to bureaucratic means in some areas.

Note that several cultures discussed so far have to do with the group context—clan, power, family, and matrix (its team-based production core). These differ regarding the core element, character of social relationships, power distribution, communication aspects, the dominant way of thinking and learning (although clan and family are close, while matrix is distant from both). Still, looking from the perspective of codifying and diffusing knowledge content, all these fit the lower-right quadrant in Boisot's (1987) C-D model. We will call this a group quadrant. It contains one more entrant that will be discussed below (team infoculture). The group quadrant is contrasted to the individual appearing left of it, and from the upper quadrants representing the macro-organizational level. The upper-right quadrant is elaborated in the light of the discussion above. These ideas are represented in the adapted C-D model appearing in Figure 3. Note that axis are renamed in order to sharpen a knowledge focus. These new names also account for both external knowledge representation and knowledge in mind.

Team Infoculture

It is possible to think of organizational design in which team is the cornerstone rather than a complement to functional organization as in the matrix form. Greiner (1972) argued about a collaboration culture, and

Figure 3. Extended C/D model



the group organizational context has been the mainstay in the research stream of computer-supported cooperative work. It is assumed here that it is possible to frame team culture and infoculture. The basic characteristics are those conceptualized by theorists of the matrix and cognate forms (see above). Empirical evidence fills in more specific details as follows.

Travica (1999) studied large firms in the public accounting industry in the United States from the perspective of team organization and use of communication systems of the time (email, electronic bulletin boards, telephone, and some other). Communication systems were in the focus since it was assumed that communication has been the essential component of work and management. In the firms studied, the work was carried by two-person engagement teams. They performed much of work directly on client premises. The teams had much autonomy in planning, organizing daily work, and managing budget. Knowledge sharing among team members and with other colleagues (a dimension of infoculture) correlated with the value of carrying accountability in a group manner (a dimension of the team culture). Interestingly, the exchanges transpired more in a face-to-face mode rather than via communication systems. Another finding referred to IT: the extent of technology-mediated communication (infoculture) correlated positively with the extent of trust (organizational culture).

The same author studied a small software and management consulting company (codename: Consulting) (Travica, 2013). A flat organization with but one management level, Consulting is entirely based on teamwork. Even the only management level is group-based, consisting of two teams (one monitors operation, the other sales). Trust is important for the company's culture and it works in conjunction with several cultural values, such as the aversion toward politicking, and the respect for others. The aversion toward politicking discredits backstabbing and turf building as a behavioral part of organizational culture. From the infoculture perspective, critiques of others in their absence and self-aggrandizing messages are undesirable informing practices. Respect for others has been a carefully nurtured value. Corresponding infocultural practice is an intranet-based process of complaining about offensive language. The process and its system involves a team of peers with a changing membership, which examines a complaint and mediates in a conflict until it is resolved. These practices have ensured that the individual members enter project teams in good faith. The infocultural complement to trust, resistance to politicking, and the respect for others is embodied in open communication channels. The annual plans, operation reports, and scorecards are accessible to all employees via the intranet.

Another interesting aspect is the sharing of leadership within teams. Consulting teams do not deploy classical management roles. For example, project manager has a supporting rather than directing role. Shared leadership materializes in Consulting as a whole. Everyone can exercise creativity, take ownership, and try to be a knowledge leader. One way of becoming a leader is by following the value of continuous improvement. A good professional continually improves professional knowledge in the domains relevant for Consulting. The infoculture furnishes support to shared leadership and continuous improvement in the form of knowledge management systems, presentations, blogging, wikis, and white papers.

Project teams are the natural location for sharing professional knowledge, whether explicit or tacit. That is where practitioner knowledge is created as well, while resolving clients' practical problems of management and IS. Innovation outside project work is equally welcome at Consulting. It combines individual and group dynamics. An example is an automated process of managing innovation initiatives. The process starts with an idea submitted by an employee or group, moves through evaluation of the idea by a standing committee, idea revision, via promotion of the idea, and the execution of an innovation project led by the innovator.

To summarize case evidence, team infoculture in the public accounting industry is characterized by knowledge sharing among team members and with other colleagues in association with group accountability in a group manner (a dimension of organizational culture). In addition, the extent of technology-mediated communication correlated positively with the culture of trust. The case of Consulting illustrates a team infoculture that discourages criticizing absent others and self-aggrandizing, maintains open communication, and knowledge management systems and events that balance group and individual initiative.

The discussion on infoculture categories is succinctly represented in Table 1.

Knowledge Infoculture

This section adds a new infoculture to the selection discussed so far—knowledge infoculture. This category is a consequence of the focus on knowledge management that started in the mid-1990s. At the outset, knowledge infoculture elevates the management to the pedestal of driving cultural beliefs and behaviors. It resides in organizations that have established a systematic knowledge process or cycle. This process starts with knowledge generation, and then moves through codification, storing of knowledge presenta-

Table 1. Types of infoculture

Name	Organizational Culture	Infoculture
<i>Role/Bureaucracy/Eiffel Tower</i> (Handy, 1993; Boisot, 1987)	- Adherence to formal rules and hierarchy are core values; - Public organizations and large private corporations	- Data and IT management subject to formal procedures; - IS embed rules & regulations; - Knowledge explicit and proprietary, high on codification/low on diffusion; - Tacit knowledge and wisdom pose challenges
<i>Market</i> (Boisot, 1987; Heckscher, 1994)	- Beliefs and practices of competition, coping with uncertainty, and demand & supply - Flexibility; - Decentralized corporation	- Adaptable data management; - IS important for performance tracking; - Public knowledge, high on codification and diffusion
<i>Power/Clan</i> (Boisot, 1987; Handy, 1993; Ouchi, 1980)	- Individual leader or group leader create core beliefs and behaviors; - Small entrepreneurship, trade union, boards	- Volatile norms and practices related to informing agents; - Communication as personal conversation; - Common sense knowledge, low on codification/high on diffusion
<i>Person/Fiefdom</i> (Handy, 1993; Boisot, 1987)	- Individual is source of beliefs and behaviors; - Impact of professional culture; - University, artisan/art organizations	- Individuals create own norms and practices involving informing agents; - IS at professional discretion; - Tacit knowledge, low on codification and diffusion
<i>Family</i> (Trompenaars and Hampden-Turner, 1998)	- Family is the driver and source of beliefs and behaviors; - Family-owned or run business	- Thinking and learning intrinsic and holistic; - Common sense knowledge, low on codification/moderate on diffusion
<i>Matrix</i> (Galbraith, 1973; Handy, 1993);	- Beliefs and behaviors praise and support project-based work - Hierarchy balances teams; - Engineering organizations	- Informing agents in function of project needs; - Mix of proprietary knowledge and common sense knowledge;
<i>Team</i>	- Significant team autonomy; - Beliefs and behaviors of trust; - Public accounting, software development, consulting	- Informing agents in function of team autonomy; - Moderate on codification/High on diffusion

tions, their diffusion or sharing, knowledge use, evaluation, and termination (cf. Davenport & Prusak, 1997; Travica, 2013). If the evaluation of knowledge in use, which occurs by the end of the process, indicates obsolescence, a knowledge update is in order. This step starts the process all over, hence the idea of cycle. (Refer to the discussion on knowledge management process in Chapter 7.)

Since there exists a great diffusion/sharing of knowledge in this infoculture, knowledge has to be highly codified so that it becomes public knowledge. Creating new knowledge has always been important for success, and progressive companies have always demonstrated leadership in this respect. The think value of old IBM and today's Microsoft (as discussed below) closes the history loop, demonstrating that creating knowledge is critical to effectiveness. Today, however, the use of knowledge is becoming increasingly important, because there is a need of selecting and filtering the rapidly growing amount of data in different formats in order to create information—not just any, but that which is critical for creating value (benefit) for an organization. New information can advance current knowledge. Thus, knowledge is a difference that creates a value—economical, technological, strategic, and so on. Catastrophic problems in informing happen not because there is not enough data, but because critical meaning has been out of reach. Knowledge is not the only agency that leads to this critical meaning; wisdom is certainly another, but it is usually in short supply. IT can be helpful, but if knowledge does not drive its use, IT may hurt more than help.

To have or be a knowledge infoculture, an organization has to be able not only to produce new knowledge but also to facilitate its diffusion (Davenport and Prusak, 1997; Nonaka and Takeuchi, 1995). Davenport and Prusak (*ibid.*) identify several obstacles on this path:

- Knowledge is valuable to individual careers;
- Fear that others can use knowledge to their advantage.
- Suspicion as to the intentions of the receiver;
- Time costs for sharing; and
- Lack of incentives for sharing.

Some companies excel in managing knowledge. At Minnesota Mining and Manufacturing (3M), there are explicit norms in function of facilitating action of managers and professionals toward invention. For example, managers are supposed to listen to professionals, encourage exploration of new ideas that solve real problems, and to provide necessary conditions (time, money). Potential inventors are supposed to take advantage of these conditions and to try out their ideas through experimenting and building prototypes. Sometimes, this may mean going against the current stream, as in the case of Dick Drew, inventor of Scotch tape. The advent of this now ubiquitous office and home item was a partly unintended, serendipitous outcome of the research process aiming in another direction.

The story has it that Drew's supervisor was not sharing fully his enthusiasm about this invention. In order to attract attention of upper management, Drew sneaked into the conference room while a meeting of the board of directors was in recess. There he taped their paper notes on walls. The executives were surprised to see their paper attached to the wall and got surprised even more when they realized that paper could be easily detached. They sensed a potential commercial value of Scotch tape—and the rest is history. (Collins & Porras, 1994; Morgan, 1989). The continuity of innovation focus at 3M extended after these brand successes. The goal has been to an infoculture that is both high-tech and high-touch: while modern IT is extensively used, human touch through face-to-face communication between informers

and clients is equally encouraged. This means, for example, that distributed teams may have a designated expert helping them with retrieving literature, organizing documentation, and so on.

Microsoft prides itself of being a “high IQ company.” Top values have infocultural character indeed, as these refer to knowledge and its protagonists—knowledge workers (systems analysts and developers). Consistently, cultural rituals reward successful knowledge workers with monetary benefits, by placing them in an exclusive part of the company and, in fact, making them a privileged professional group. These professionals work on a separate location in the US state of Washington, which is called Campus. The Campus is supposed to resemble a university—a powerhouse of research and knowledge creation. There is a certain egalitarian spirit and informality in behavior and dressing code at the Campus. All offices are of the same size, but the two used by Microsoft founders Bill Gates and Paul Allen.

The Campus offices are primarily for individual use, because software experts are supposed to spend most of their time concentrating on work problems. This behavior amounts to exercising the value of “Sit-and-Think” which Bill Gates formulated. (Note a similarity of this and IBM’s Think value). At Microsoft, knowledge is an essential artifact of infoculture. It combines individual and teamwork. Physical artifacts suit the purpose since campus offices are also easy to reconfigure (put more desks in, plug in computers) to house team members. Another physical aspect of the Campus infoculture is in complementing offices with cafeterias. These are supposed to attract professionals spending long hours on the Campus and to help spur up informal conversation about professional issues among team members. Communications systems have also played a role in balancing individual and collective principles, by allowing for individual work while keeping open electronic communication channels. (Dearlove & Cumber, 1998; Stross, 1996).

As competition increases, knowledge becomes the critical resource or intellectual capital necessary for competing and prospering. Consequently, traditional organizations are compelled to engage more systematic knowledge management. DiBella and Navis (1998) explored knowledge practices in Fiat Auto, the largest Italian car manufacturer. After acquiring two well-known car manufacturers (Lancia and Alfa Romeo), Fiat Auto embarked on a path of changes in knowledge management in the 1990s. One change was a method of “simultaneous engineering”—teams in different divisions would work on new car models at the same time rather than sequentially, as before. This required moving of some staff to establish physical proximity needed for simultaneous work. Another change was the use of Total Quality Planning, in order to identify areas of improvement. Knowledge development and sharing techniques were planted as well. The staff at the engineering division was expected to learn through the acquisition of “know-how engineering” and “shelf engineering.” Each unit also had to build a database on components and processes.

Nonaka and Takeuchi (1995) studied Japanese manufactures and created an elaborate framework, which is helpful for identifying a knowledge culture/infoculture. Much of authors’ effort was focused on setting in motion, externalizing and sharing tacit knowledge. (2+++) Two salient parts of their framework are (a) explanations of knowledge creation in process terms, (b) a model of knowledge spiral, and (c) conditions for effective knowledge management. Each is discussed in turn.

- (a) The knowledge process can start with a “strategic intention.” This refers to establishing relationships between organizational objectives, knowledge, and IT. NEC Corporation (the manufacturer of communications equipment and microelectronic components) is a case in point. The firm has paired the concepts of knowledge system and of core technology, and came up with R+D domains of pattern recognition, image processing and a very large scale integration. These domains were

then associated with product lines (e.g., functional materials/devices, semiconductors, communication systems, and knowledge-information systems) (Nonaka & Takeuchi 1995: 74). One of NEC's revolutionary products was personal computer PC-8000.

For the knowledge creation process to unfold, management needs to create a situation of "creative chaos," posit Nonaka and Takeuchi (1995). To this end, management can use ambiguous goals or "strategic equivocality." For example, the CEO of car manufacturer Nissan promoted a strategic intention on innovating organizational processes through his catch phrase – "Let's change the flow." The intention was to trigger creative thinking about the organization of work routines, and about habits and cognitive frameworks. A change of old culture was in order. This sort of creative tension negated a data processing assumption, in which a problem was taken simply as a given and a solution was sought by collecting and processing data according to a predefined algorithm (Nonaka & Takeuchi, *ibid.*, pp. 78-79). (Note a perspective of infoculture in this paradigm.) Facing the challenge, Nissan members began realizing that an ideal organization was not one premised on stability, clarity and certainty. A path to a more innovative organization led through a precisely opposite venue.

Lower ranks in an organization based on teamwork could sometimes initiate creative chaos. (Note that this characteristic provides a bridge between knowledge and team infoculture.) This leads to the next characteristic of knowledge creating company—*autonomy*. A case in point is Honda, the well-known manufacturer of cars and motorcycles. Top management unleashed a creative process by issuing a vague call: "Let's gamble." Product development teams took the norm as the stage point for brainstorming. One team launched several ideas: automobiles can go through evolution; the reasoning of Detroit's carmakers should be challenged; and design of a new car should be "man maximum, machine minimum." These were more concrete constructs, but still ambiguous (*ibid.*, pp. 12, 57).

The final design embodied the image of a sphere, a "short and tall" car, which was easy for maneuvering and parking in busy city streets, while providing maximum space for the driver and passengers. This was the Honda City, the company's distinctive urban car. The Honda evidence also indicates that knowledge creating culture has strong team components. City development team had autonomy in contemplating new car designs under the "Let's Gamble" cultural regime. The team was multifunctional, comprised of thirty specialists from R+D, production, marketing service, and quality control. The range of responsibility of the team was broad, encompassing development activities through planning the production plant and marketing (*ibid.* 76-77). All these characteristics exemplify an infoculture in which autonomy of team-based informing practices is a key value.

- (b) The second contribution of Nonaka and Takeuchi (1995) is a model hypertext organization and its knowledge dynamics. A "hypertext organization" has three layers. One is bureaucracy that furnishes overall design of organization and initiates the creation of new knowledge and products. Examples are the Japanese producer of household and chemical products Kao and consumer electronics producer Sharp. However, in executing projects of strategic character, experts from different divisions come together to form development teams. These teams enjoy considerable autonomy, and have to report just the project leader. (Note a similarity with the matrix organization.) Knowledge creation in teams is the second layer. Newly created knowledge gets embedded into organizational knowledge base, which is in organizational culture and technologies. This is the third layer in the hypertext organization.

The three layers are dynamically inter-related through mutual transformations of tacit and explicit knowledge. This materializes via four conversion processes—socialization, externalization, combination, and internalization. For example, socialization is the conversion of a person's tacit knowledge into another person's tacit knowledge, while externalization converts tacit to explicit knowledge. Combination (explicit to explicit) and internationalization (explicit to tacit) follow. Altogether these conversion processes form an unwinding spiral, which explains how knowledge is developed and shared in a hypertext organization.

- (c) Nonaka and Takeuchi (1995) also specified conditions for effective knowledge management—*redundancy* and *requisite variety*. *Redundancy* refers to intentionally mixing the informing on research and development, business activities, management responsibilities, and company as a whole. Especially in initial stages of the knowledge creation process, redundancy is important for sharing tacit knowledge. Redundancy enables people “to invade each other's functional boundaries and offer advice (...) from different perspectives” (Nonaka & Takeuchi, 1995: 81). This “invasion” leads to blurring role boundaries, “fuzzy division of labor” and “a rugby approach.” Note that this sort of organizing uses pooled and reciprocal coordination rather than sequential. The former ones require an informing-rich context; e.g., the workers who coordinate the use of their knowledge in the reciprocal fashion have to engage in a continuous exchange of ideas and opinions. In this situation, redundancy is useful and not a waste.

The norm of *requisite variety* has to do with the aspects of content and access. The content norm refers to combinations of various documentation, different interpretations of new data, and variation in data and knowledge content. The access norm implies that data and knowledge should be quickly accessible to many employees. Flatter organizational structure can help in this respect. Requisite variety facilitates knowledge exchanges and creation in different stages of an innovation project. In summary, Nonaka and Takeuchi's argument effectively profiles a Japanese knowledge infoculture: strategic intention initiates a knowledge creation situation; creative chaos mobilizes mental energy of many employees; autonomy helps unleash creative thinking in teams; and redundancy along with requisite variety encourage creating new practices and infoprocesses suitable for generating new knowledge.

Organization for Knowledge Culture

Which organizational design does have a fit with knowledge culture? What kind of knowledge suits knowledge culture? Both Boisot's and Nonaka and Takeuchi's work is helpful in answering these questions.

Boisot (1987) places market organization in the quadrant reserved for organizations with high diffusion and high codification. The notion of market conveys ideas of openness, exchange (of experiences), and competition (of opinions). However, some characteristics of market organization may reduce knowledge creation and diffusion—knowledge pricing and commoditization, mistrust, competition in knowledge acquisition and use. These are the same impediments that Davenport and Prusak (1997) warned about (see above). In addition, the market organization does not explain knowledge creation. Knowledge develops in the individual and group contexts. The evidence of knowledge contributions supplied by teams and team infoculture, which is presented in the previous discussion, clearly illustrates this point.

Some new organizational designs sharing the property of flexibility with market, may be better suited for knowledge creation than the market organization. Adhocracy is temporary and fickle, too busy with dealing with the purpose at hand to be able to host systematic knowledge management. The network

organization in its intra-organizational instance, can meet better requirements of knowledge creation and sharing (Senge, 1990; Holton & Baldwin, 2003). The virtual organization often creates new knowledge (Goldman et al., 1985; Majchrzak et al., 2000). However, the temporary character and competition over intellectual property limits sharing of knowledge and a systematic knowledge management (an exception to the latter could be virtual alliance). Overall, although some new organization designs can be more hospitable to knowledge infoculture, they cannot be *a priori* characterized as the milieu of the entire, systematic knowledge process.

Any organizational design taken individually cannot support effectively the entire knowledge management cycle. The solution can be in combining them. This idea is the background of Nonaka and Takeuchi's (1995) spiral of knowledge through four knowledge conversion processes. Notwithstanding the boundary conditions (the Japanese context and dynamics of tacit and explicit knowledge), it follows that knowledge emerges and lives when different organizational contexts are combined to suit different steps in the knowledge life cycle. In other words, each of the fundamental organizational designs contributes to knowledge infoculture. Different units in an organizational are designed differently, and so have different infocultures. This translates into a knowledge trajectory spanning across C-D quadrants. Each of these builds into a knowledge infoculture.

Organizational Learning

Knowledge infoculture is a learning culture. Practitioner knowledge emerges in practice. Members of an innovation-focused project learn from each other and learn together as a group. Relationships between culture, learning and knowledge are established in the literature (Purser & Pasmore, 1992; Weick & Ashford, 2001; Weick & Wesley, 1996). For example, Purser and Pasmore (1992) discussed "knowledge work organization," which "learns how to learn by maintaining processes that critically examine key assumptions, beliefs, tasks, decisions, and structural issues" (p. 55). This is similar to the challenge of "changing the flow" used by the Japanese executives (see above).

Weick and Westley (1996)⁵ looked for patterns of organizational learning in some unlikely areas. The authors identified these unorthodox means of creation of practitioner knowledge:

- humor (an instance of culture as language);
- improvisation on a routine (an instance of culture as action routine);
- small wins—incremental changes representing a pocket of order in a setting of chaos (an instance of culture as artifact).

Humor creates disorder within order, and it is a vehicle for expressing criticism and contradictions of existing policies and procedures, unmasking ambiguities, making unrecognized connections, and naming the unnamed. As such, humor is a condition for creative thinking (Weick & Westley, 1996: 452). If humor opens up the gate for disorder necessary for learning to occur, improvisation is another instance of learning that continues this disorder while creating some order (the learned, knowledge). In jazz, improvisation means to compose the music on the spur of the moment, build on what has just been accomplished without planning, balance individual expression with teamwork, and deliver both valuable creation and errors. Improvisation requires little structure and imagination, and the authors suggest that organizational artifacts that can fill the shoes of improvisation refer to vision statements, milestones, development sequences, and rituals, among other things.

Finally, small wins capture the learned, thus incrementally increasing knowledge, creating order. An example is the previously mentioned executive of Greyhound Canada who moved his staff to invent ways of improving customer service at bus stations, while using the unusual method of holding black tie dinners at station rest rooms. Small wins are not equal simply to accomplishing small tasks that follow from a rational breakdown of large tasks. The Greyhound Canada case contained humor (the location of black tie dinners and possibly an atmosphere of informal formality that could have been sensed by the attendees). The executive used improvisation (his method of engaging operations managers in dialog and creative thinking).

Later when the dialog and thinking started, there was an ensuing surge of improvisation on the operational level of the company, leading to improvements in customer service. The small win of improving the cleanliness of the restrooms, accumulated with other small wins. “The chances for learning increase as more small wins are initiated by more people in more places” (Weick & Westley, 1996: 455). Incremental changes are the art of the possible rather than an excuse for incapability of making a radical change. In fact, as the authors justly point out, many revolutions are merely constructs that in retrospect appears to be created by a number of small wins that were seemingly heading in the same direction.

In summary, knowledge infoculture supports effectively the entire knowledge management process or cycle. It utilizes different organizational units or contexts, rather than a particular organizational design. Characteristics of knowledge infoculture are summarized in the following list:

- Knowledge creation, sharing (diffusion), and use are salient practices and values;
- Values, practices and IS revolve around steps in the knowledge management process;
- Codification and diffusion evolve with the steps in the knowledge management process;
- Can be found in organizations with established knowledge management process or cycle;
- Unorthodox means of organizational learning, recognized in post-modern view of organization, can be invaluable.

Dynamics of Infoculture: Adding Technology to C-D Space

The previous section discussed different types of infocultures (and the complementary organizational cultures and designs). What is the internal dynamics of infocultures? The C/D model we elaborated on above needs further amending that can help in answering this question.

Specifics of IT and IS determine in part codification requirements. For example, a markup language, such as XML, sets a clear codification scheme for the data to be in an XML file (e.g., pieces of data must be marked by XML tags). Still, an XML file is less codified than data in a cube used for business analytics. A level of IT makes a difference. It can also affect the extent of data diffusion. The IVO approach to IT (Chapter 4), differentiates between the low-tech category (tool and device) and high-tech category (machine and systemic structure). IVO posits that infoculture involves IT and evidence exposed in this section supports this postulate. A dimension of “IT level” is introduced with this purpose in mind (Figure 4). IT level represents the level of regularly used IT that prevails in an organization. One can think of IT level as a categorical or continuous variable. This results in an expanded, three-dimensional model of codification, diffusion, and IT level (CDIT). This model contributes to explaining dynamics of infocultures, including metamorphosing of one type into another.

It is important to keep in mind that the IT level has a moderating rather than an antecedent role. This dimension can contribute to explaining infocultures, but it cannot predict types of infoculture. For

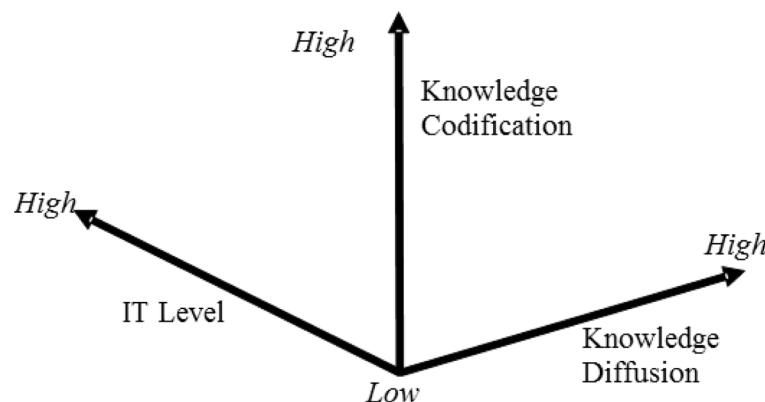
example, a team can be high-tech, equipped with specialized groupware applications (see the chapter on groupomatics for examples) or more toward the lower-end IT. Similarly, bureaucracy can be immersed in paper and simple office tools or equipped with modern computer systems. Although Ouchi (1981) posited that clans are of a low-tech character because they typically do not necessitate IS, one can think of clans using IT for the purposes of self-preservation. Consider the corporate scandals in the United States in the 1990s. The fact that clans of executives have abused high-end IT to corrupt financial data and propagate errors indicates that the clan organization can be high-tech. Therefore, low and high tech is identifiable with nearly any organizational design. An exception to this assumption may apply to some new organizational designs; e.g., it is rather difficult to think about the virtual organization based on paper rather than electronic flows, which link the constituent parts. The precise role of IT level is (a) to differentiate between variants of a specific type of infoculture (for example, low-tech vs. high-tech role infoculture), (b) to explain internal dynamics of knowledge infoculture, and (c) to strategically manage evolution of infoculture. Each is discussed in turn.

- (a) Any military is a bureaucratic organization, in which knowledge is codified according to strict rules and diffusion is restricted upon hierarchical levels. But some militaries can be more toward a higher IT level than others. The same applies to any other infoculture. This differentiation helps as part of an initial understanding of an organization. Insights could be surprising, in case of hybrid infocultures. For example, a public university in North America is likely to be a mix of person and bureaucratic infocultures. These two refer to the department (faculty) level and the organizational (campus) level, respectively.

If knowledge resources on the campus level are high-tech, such a fact suggests only that the given university takes care of managing proprietary knowledge. But the fact reveals nothing about the technological support to the university's knowledge creating capabilities because the support should be examined in the domain of person culture.

- (b) The IT level can explain internal dynamics of knowledge infoculture. As discussed above, this infoculture has no particular domicile but rather draws on several organizational designs, as the

Figure 4. The C/D/IT model



- cyclical knowledge process requires. Knowledge creation happens in the lower quadrant of the C-D model, while increasing codification and diffusion pulls knowledge to upper quadrants. Electronic IT brings higher codification requirements and higher diffusion capabilities than paper technology (an example is a difference between electronic full-text databases for documenting problem solving experience vs. using paper notes for the same purpose). Within the category of electronic IT, databases without restricted indexing schemes are less codified and diffusible than their counterpart.
- (c) The concept of IT level is useful for managing evolution of infoculture in a strategic manner. Management can use a higher IT toward modifying some of the group-based infocultures (e.g., the team or the clan) toward the market or bureaucracy forms. A move in the opposite direction is possible too. In either case, management utilizes relationships between IT and data codification and diffusion. The idea is similar as in outcome B, except that the time horizon is longer and organizational change is at stake. Figure 5 presents these ideas in the three dimensional C/D/IT space.

Reading Figure 5, a bureaucracy, which deploys specialized IT in order to systematically circulate the content of organizational knowledge repository to product development groups, is transforming toward the matrix infoculture (arrow A). Similarly, codifying individual knowledge that has traditionally been at individual discretion, and storing its representations in a system with controlled access, represents an evolution toward bureaucracy (arrow B in Figure 5). Management moves in public universities that are sometimes dubbed “corporatization” are an example of such evolution. Raising codification and restricting diffusion with aid of more sophisticated IT can also be strategically deployed for breaking up a power/clan infoculture (arrow C in Figure 5).

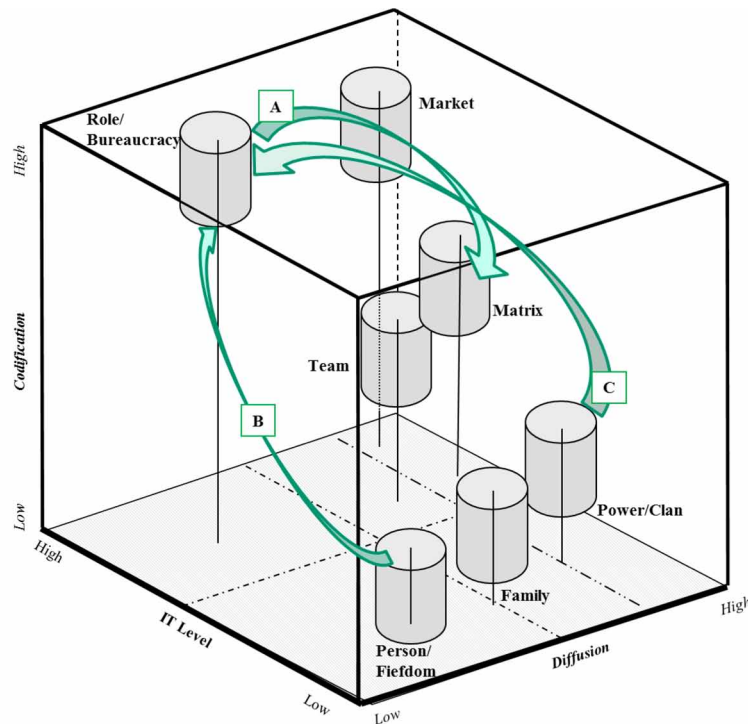
Big Data Impacts on Infoculture

A type of technology and particulars on an IS influence infoculture. The Big Data technologies and systems are the current case in point. It can be argued that properties and potential effects of these can make an imprint on infoculture in organizations of deployment. In particular, a large data set allow for drawing a large number of dimensions some of which may become significant in statistical analysis by mere chance. This is like tossing tokens enumerated from 1-1,000 and correlating a certain coin's head occurrence with a stock market index and expecting that the two events are related. Stephens-Davidowitz (2017) calls this a *Curse of Dimensionality*. Related to this is mistaking a correlation for a causal relationship. Furthermore, as Big Data analysis can quickly turn out numerous correlations, some could look sensible and thus drag a decision maker to quick decisions with no grounding in practical or theoretical knowledge. Vigen (2015) has supplied many examples of this mistake that pervades laymen and quasi-scientific reasoning. This can be named *Curse of Correlation*.

Both these “curses” shed the critical light on the truth value of findings, or the veracity aspect of Big Data (Lukoianova and Rubin, 2014). Some authors wrongly deem this to be a defining characteristic of Big Data (the fourth “V” in addition to variety, velocity and volume). If nothing else, the veracity of Big Data is a matter of scale rather than being a priori definitional “big”-aspect.

While these curses are statistical in nature, amassing various data on customers, citizens, employees, patients and others brings Big Data practices to the edge of breaching *legal and ethical* order. Surveillance capabilities fueled by Big Data are amplifying to generate something that can be called a Big Brother Trap of Big Data. How far can collecting and transforming of individual data go? This question has no clear answer in the world of changing demographics and leaping Internet technologies. Recent revelations of

Figure 5. The C/D/IT based view of infocultures and their dynamics



Facebook's practices of tracking the online movement of its members without their consent reveal how profit-making motives can be fired up by powerful Big Data technologies.

An infoculture adjusted to Big Data may assist in curbing Big Data curses and traps. While incumbents of a Big Data infoculture should believe in a potential big worth of Big Data-based IS, they would also benefit from additional "W" values. A value of *worry* should help focusing on the risks of hasty conclusions following from false inferences and privacy breaches. The third "W" stands for a value of *wisdom*. Analysis and decision making driven by wisdom should keep in a balance worth-related expectations and worries about inherent problems of Big Data. These are three "W" of a Big Data infoculture.

Summary

Boisot (1987, 1998) used dimensions of content codification and diffusion to explain different types of knowledge and corresponding organizational designs of bureaucracy, market, fiefdom, and clan. Codification expresses the idea of the organization of data that underlies the concept of infostructure used in IVO. Diffusion expresses the ideas of sharing and dispatching, having similarities with the IVO concept of infodispersion. Taxonomies of organizational cultures by Handy's (1993) and Trompenaars & Hampden-Turner (1998) complemented and expanded the discussion with concepts of role, matrix, power, person, and family forms. New organizational designs may exhibit a team infoculture. It has similarities the matrix infoculture to the extent that both deploy teamwork, but it is exclusively based on teams with very small hierarchy. A knowledge infoculture is proposed as the category of infoculture that supports

the entire knowledge management process. It uses a hybrid rather than singular organizational design. Next, dynamics of infocultures have been discussed by adding a dimension IT level to the C-D model. As a final remark, it should be noted that relating infoculture to organizational design places infoculture within institutional ontology. Finally, the discussion addressed impacts of Big Data on infoculture.

CASES OF INFOCULTURES

In this section, evidence on infocultures in three organizations that this author has studied will be presented. These are a government-owned utilities company (Utilities), a large public organization supporting a city infrastructure (Services), and a private telecommunications company (Telco). The studies were qualitative and interpretivist in methodology. Each was motivated by management interested in learning about issues in adoption and use of enterprise systems. But this question had different degrees of urgency and scope in the companies studied.

Utilities

Utilities Company is a bureaucracy with a long history. Few years before the case study was conducted, the company centralized human resources (HR) function at the corporate level. Introducing ERP-based system modules was the key vehicle in accomplishing this move. The structural change was enabled by centralizing HR data, applying the same data standards across the enterprise, and automating hierarchical access to the system. The main change with the new system was that mid-level managers were put in the self-service role. Instead relaying on clerks for checking employee hours and expenses, the managers had to do this by themselves via the system.⁶ Other occupational groups remained at previous positions or advanced. Clerks maintained broad access privileges that included handling records of blue collar workers, who also remained in the old position, barred from the system. HR professionals gained increased access across departments.

With the centralized HR function and system, Utilities Company hoped to achieve a higher rationalization of administration. However, about a year into the system's production stage, the adoption rate among managers was unsatisfactory. Violating the corporate culture of political correctness, they even voiced overt resistance to the system. They did not hide their dissatisfaction for getting more work to do than before. They did not appreciate the system and qualified it as yet another unpolished product of the IS department. Manager also argued that the pace of system development too fast (one manager said, "we're crippled by the computer"). In contrast, the part of IS department in charge of ERPS was enthusiastic about the new technologies ("Things will get better ... as anything else that you do in this area.").

Technologists had no understanding for managers' impatience and push-back. Their time horizon was long, connecting the past with future. They kept pushing forward with system development, unconcerned with users' view (an IS executive uttered: "You have to really question people who insist ... to do it the old way."). But the managers' stood opposed, entirely focused on present time. They had little patience for bugs and quirks the system exhibited. Indeed, they wanted from it, as from any IS—an efficient, easy

to use business tool. Weighing the system on benefits versus costs, managers argued that the ratio was unsatisfactory. They were quick to abandon the system even in favor of the old paper trail.

A softer method of the managers' resistance was sharing the intranet password with clerks in order to make them do approval tasks. This was in accord with a shared opinion that "computer was clerical and not management technology." Clerks did not object. They understood that their bosses were not yet "on the computer highway." Knowing ins and outs of the transactional functionality of the HR system, department clerks effectively confirmed their irreplaceability within the new regime. They acted as allies to system champions—technologists and the HR staff. The HR staff exhibited a great enthusiasm about the system and its future extensions into strategic HR planning. To facilitate system adoption, the HR department introduced games and entertaining competitions, along with scoring methods and their public displays.

Services

The organization of Services conveys a contrasting picture. Also with a long history, Services moved from centralized to decentralized design. In contrast to Utilities, Services is a pure cost center, unconcerned with making income. The HR at Services function was divided into department-based units leaving little connections between them. Even employee records could not be automatically shared when an employee moves from department to another.

The departmental HR units used the same ERP system for time management. The initial adoption weaknesses were overcome at the time of study and there were no burning issues. Still, no significant process changes occurred either, and the reduction of paper trail was minimal. Larger changes applied in data formalization, but sometimes the plans were just partly realized in some parts of the company. The investigation determined that there was great variation in data content, HR processes involving the system, pre-processing methods and technologies, and reporting.

Clerks were the biggest user group, partly by appointment, partly because bosses would delegate job to them. In general, there was a tendency of delegating system work use down the ladder. There was satisfaction with reports the system was delivering, but less so with querying users had to perform on their own while lacking professional support. Another aspect of the greyish picture surfaced around the adoption rate. While system login was automatically tracked, the study established that some users listed in a rubric of very high usage actually did not know much about the system. In effect, the adoption rate was uncertain, even though the official log data were readily cited in public.

While instances of direct opposition to the system were rare, it was clear that the system was adopted in a compromised manner, with great variation across departments. For example, some users added their own technologies in order to pre-process certain data. In some units the use was minimal. One department rejected the system in favour of its home-grown legacy system. Hence the department's HR function was disconnected from the rest of the company. Critics of the system cited an increase in red tape and data entry jobs. Many stated they were unsure of the goals the system was supposed to realize or why precisely it was introduced. It was also obvious that this HR system was incapable of supporting flows of HR data between departments. Rather, exchanges across departmental lines relied on the telephone and other low-tech channels.

Telco

Telco is also an old, large organization. In contrast to Services and Utilities, Telco was privatized in the late 1990s. At the time of study, Telco ran lines of business typical for a telecommunications company (cell phone, landline phone, Internet access, and cable TV). It was engaged both in the corporate and household market.

Telco's departments of marketing and sales were investigated as users of an enterprise system for customer relationship management (CRM). Serving as a call centre for customer requests, the sales department has transaction-focused and abiding to rigid work rules and performance measurement. The department's customer data were formalized in content and access privileges. In contrast, the marketing department housed professionals covering various areas. Each area resembled a small turf with its own informing needs, standards and technologies.

The CRM system was implemented with a goal of connecting marketing and sales processes across the two departments and providing an integrated picture of customer. However, the system failed in this role. Instead, data flow between these departments via alternative, lower-tech channels. For example, marketers would push campaigns to the sales department via electronic bulletins rather than by the enterprise system. On their side, the sales staff, in spite of being in constant touch with customers, would not record responses to the campaigns into the system. In addition, the system had never advanced through the development stages initially planned. The modules for managing customer orders, automating sales operations, billing and some others were never added. In effect, the CRM system could only offer a very limited picture of the customer, which consisted primarily of customer master data and plans for marketing campaigns.

Most of the sales staff was housed in a large customer call center. It was a busy place, where the sales representatives (most of the department staff) occupied desk-sized cubicles, and responded on the soft phone to customer calls. Large displays around the center displayed performance figures (e.g., the numbers of calls per hour, call average time on call, and variance to planned quotas). Supervisors monitored the staff electronically and in person. The clerks operated the CRM system under study and many more. The CRM system was the entry point accessed upon a customer call. A sales representative could search for customer records, some details of calls history, and the customer's total spend across lines of business. For product details, orders, billing and other tasks, one had to use other systems.

In a single call, a representative could operate several systems, up to a dozen. The systems used different technologies, and had limited or no connections between them. The sales staff demonstrated amazing efficiency before terminals cramped with windows. But when asked if they understood the reasons behind that complexity or what the future was going to be like, the staff showed a uniform ignorance. They were reluctant to comment about their feelings as well. Some supervisors broke the salience, admitting that too much system work was "off-loaded" to sales representatives, while the future was uncertain.

The marketing department showed a very different picture. Marketers had separate offices or comfortable cubicles. Many had a "management" title. They commented openly on the CRM system, typically in critical terms ("a system everyone likes to hate," "a multi-million dollar mistake"). In fact, many abandoned the system, even though their use licences were purchased, without any repercussion. They argued that the CRM system with its poor content could not assist them in market analysis, so they had to resort to other systems.

Infoculture Analysis

Qualitative analysis of case evidence from the perspective of infoculture is a two-step process. The steps are:

1. Codify evidence of beliefs, behaviors and artifacts relevant for informing agents into a particular category of infoculture according to the C/D/IT model;
2. Characterize metaphorically the identified infocultures.

Both steps have a differentiated point of reference—the whole company, organizational unit (department or smaller), and occupational group. The whole process requires evidence of organizational knowledge and data management, IT and IS. The inquiry can be focused on a particular IS, as in the cases presented. Therefore, the knowledge referenced in step 1 is knowledge about the system's role in business, design/development aspects, future, and the like.

The metaphor method is supposed to characterize succinctly and vividly a cultural context and it has some tracking in the literature (Kaarst-Brown and Robey, 1999). Metaphors belong to the cognitive ontology of IS. IVO's metaphor method has the goal of characterizing salient aspects of an infoculture type that is detected through investigation. It addresses the what, why/when, who, and how questions in reference to informing agents (Travica, 2012). Here are the driving questions in the metaphor analysis that in the past research have been applied specifically to IS:

- What is the purpose of the IS?
- Why/when does the IS change?
- Who are we in relation to the IS?
- How do/should we use the IS?

To repeat, the research steps 1 and 2 are related, and therefore the W+H inquiry may complement and expand an identified type of infoculture. A brief discussion on applications of these methods follows.

Motwani and Mirchandani (2002) investigated ERP system projects in two large companies. One was a footwear manufacturer, the other a pharmaceutical company. In both companies, top management championed the ERP system, managers appeared committed to change, employees were trained, IT was believed to be an “enabling rather than dominant factor,” and organizational learning ensued in response to technological change. However, the companies executed their ERP system projects in very different ways. The footwear company did it cautiously within an 18 month-period. It carefully managed organizational change based on a specially developed strategy and a process matrix. Three teams drove the whole process (the strategic, operations, and business analyst team), top and middle management coordinated activities during the switchover, and communication channels were open. In contrast, the pharmaceutical company had no specific deployment and change strategy. The process took just six months, being “mandated autocratically by top management.”

The footwear company can be indexed as a team infoculture, while the pharmaceutical company is of the power type. From the metaphor perspective, the two companies aligned on the what-question, but differed on the why/when and how-questions. The footwear maker resembled a well-performing sport team organized and performing on modern scientific principles. In contrast, the pharmaceutical firm resembled a military formation ordered into you-bet-your-life battle. Note that the meta-analytic ap-

proach applied here substitutes for a scrutinized investigation in which metaphors emanate from research data. Such an investigation should use W+H questions probing on the type of infoculture detected and combine these with open-ended questions.

In a study of e-Government systems in South Africa, Singh and Travica (2018) found that senior managers resided in a clan infoculture with elements of immature bureaucracy. The managers were constantly challenged on knowledge grounds, disempowered in decision making, and pressed to deliver politically desirable results while controlling systems' cost. They viewed e-Government systems as a budget filling tool whose failure threatened them with lay-off. These findings conjure up a metaphor of exasperating sport match (cricket, soccer, basketball...) in which the managers belong to the team under persistent attack.

Applying the metaphor analysis to the cases discussed above yields the results that appear in Table 2. At Utilities, the technologists in the ERP unit of the IS department think and act as a clan. They know where the system is going and how it can influence the company. The centralized HR department is also familiar with the HR system's role and development aspects, and champions its adoption. Theirs is an infoculture of bureaucracy. Clerks share the insider knowledge, as the early adopter and expert user of the system. They can guard their knowledge of the system against blue collars and even bosses. The middle managers present a fiefdom infoculture, as they reject to acknowledge the system and new ways of work it brings to bear.

At the metaphor level, these fragmented infocultures resemble a car with different riders and running at an accelerating speed. Technologists drive the car, while the HR staff and clerks across departments are in the front seat. The front seat passengers may have some influence on the driver. In contrast, middle management is in the rear seat, dizzied by the car's speed and routing. Using another metaphorical perspective, the technologists invoke the archetype of "revered IT culture," the system champions pull toward "integrated IT culture," and middle management conveys "fearful IT culture" (Kaerst-Brown and Robey, 1999).

At Telco, the Marketing department manifests a person culture. Marketers can decide to abandon the CRM system and choose different technological support at will. They are openly critical toward the system. They know that the system has no future. In contrast, the Sales staffs have to cope with the CRM system, in addition to many others, even though they know little or nothing about the system's role and future. Theirs is the infoculture of bureaucracy.

The infocultural split can metaphorically be expressed via a contrast between the daily grind and the book club. The sales staff is pressed hard and controlled, and in relation to the CRM system resembles

Table 2. Infocultures in case companies

Company	Infoculture Category	Metaphor
Utilities	Clan (ERP unit in IS dept.)	Driver of a speeding car
	Bureaucracy (HR, clerks)	Front seat passenger
	Fiefdom (Middle Managers)	Reluctant dizzy passenger
Telco	Person (Marketing dept.)	Critical reader in a book club
	Bureaucracy (Customer Call Center in Sales dept.)	Bolt in a daily grind
Services	Market (company as whole)	Customer from a gated neighborhood
E-government	Clan/Immature Bureaucracy	Sport team under persistent attack

the bolt in grind machinery. Adversely, marketers behave as members of a book club. They examine the system's shortcomings, criticize it, and make a verdict on its destiny.

As for Services, the company as a whole belongs to the market infoculture. Departments appropriated the HR system in different, custom ways. They maintain competing concepts of the system's role, use, and usefulness. Some departments and individual members did not buy into the system at all. Market-like uncertainty envelops understanding of the system's future. The Services market infoculture conjures up associations with a gated neighborhood. The company lives on a budget, without caring much about costs. Neighbours keep at a shoulder length-distance, and stand up to the system as choosy customers.

All three companies are comparable on the IT level. Theirs are enterprise systems that belong to high-tech. But all of them also resort to lower level technologies in order to compensate for not-adopted or not-supported functionality. It should be remarked that the metaphor method brings the infoculture view close to cognitive ontology. The real research challenge is to shape metaphors close to the mental models of organization members. This chapter will end with a case that addresses current interest in boundaries of automation and artificial intelligence.

Colliding Infocultures Resulting in Tragedy

Two Boeing 737 MAX airplanes crashed in 2018/2019, killing all 346 passengers and crew members aboard. These tragic events represent a case with a technological, management, and social importance. The central problem in this case is the relationship between the pilot and the automation systems/system designer. The pilot aspect will be approached in the contexts of flight and of occupational group. The automation systems will be examined with regard to functionality, their relationships, and the quality. The systems' designer will be explored in the context of design philosophy and the Boeing organization.

A brief look at the background of Boeing's automation trajectory may help in understanding better the research problem. The Boeing 737 MAX plane is the latest upgrade of the model 737, the best sell in the history of commercial passenger aircraft industry. Released in 1967, Boeing 737 has been a "work horse" of many airlines around the world. It has been an overall solid plane with a good safety record. As the aviation technology was evolving, so was Boeing's stellar product. The last and ongoing computerization stage has brought deep technological changes.

A modern airplane features an electronic Flight Management System (FMS) that controls the flight path, airplane stability, steering, navigation, engines, performance, etc. Parts of FMS include Automated Flight Control System (AFCS), Stability Augmentation System (SAS), Electronic Flight Instrument System (EFIS, "glass cockpit"), Flight Management Computer, Aircraft Navigation System, and autopilot (cf. Skybrary, 2019). Pilot commands are monitored and controlled to the extent of overriding. There are procedures for the pilot's overriding of systems and backup mechanisms in case of system failure. In effect, an automated airplane can fully run itself during the flight, as in the case of deploying the autopilot. Data input, processing, decision making and control over an airplane's mechanical parts and performance is performed with no human intervention.

Most of these automated systems originated in military aircrafts and spaceships, and have been gradually added to the civil aircraft. For example, electronic controlling of flying surfaces that orient a plane (wings, rear elevator, rudder) originated in NASA in the 1970s (Creech, 2003). Mechanical and hydrodynamic means of manipulating flying surfaces gave way to cables and electronic signals. In turn, Airbus (a consortium of European aircraft manufacturers) adopted it into civil aviation via a so-called Fly-By-Wire model (Air and Space, 2007). Airbus also replaced analog gauges by computer screens,

thus adding “glass cockpit” for interaction between pilot and systems. Today, this scaled automation is a standard, clearly manifested in the Boeing 737 MAX and its competitor Airbus A320 NEO. These airplanes are actually flying robots.

Advanced automation has increased safety and relieved pilots from a number of tasks. But it also brought challenges. As Brennan and Li (2017) explain, the designer has been given more authority and autonomy to automation, while moving the crew to new, supervisory and somewhat deskilling tasks. In addition, the integration of various systems has not always been seamless, and the systems’ interdependencies have not always been explicitly stated by manufacturers. A warning that the automation driver was in engineering feasibility and cost rather than in consideration for flight crew was issued at the onset of the automation era and it still holds four decades later (Brennan & Li, 2017).

It is noteworthy that Airbus and Boeing have different approaches to the pilot-system relationship. On an Airbus plane, the physical interface between the pilot and the plane is a joystick that is manipulated arbitrarily and effortlessly as in a video game. Still, if a pilot inputs a command outside the normal flight parameters, the flight control computer ignores it. In contrast, Boeing’s yoke (a steering device on the plane) has resistance force built into it. It increases when a pilot command gets close to or exceeds allowed parameters. (Brennan & Li, 2017) Boeing’s approach might also be seen as preserving an analog sensation of steering a massive flying object, which pilots of the 737 planes experienced in the pre-automation era.

Although Boeing 737 has matured into a modern automated airplane, the quality of Boeing’s automated systems has come under scrutiny with the fatal crashes of two brand new planes. In the following discussion, the focus will particularly be on the Maneuvering Characteristics Augmentation System (MCAS) which is part of the 737 MAX and has been implicated in the accidents (Blum, 2019; Broderick et al., 2018; Campbell, 2019; Travis, 2019; Wise, 2019).

In summary, automation of the 737 aircraft is a consequence of a continuous technological trend and competition in civil aviation. The trajectory has led to the MCAS system built into two fallen planes. What indeed is the responsibility of MCAS in the crashes; what is the relationship between MCAS and pilots; why was MCAS introduced in the first place? These questions will be addressed in the following discussion that will follow from the standard infoculture inquiry.

Pilot’s and Designer’s Infocultures

The first infoculture question is, What is the purpose of technology? Evidence of the crash of the Indonesian 737 MAX indicates that pilots were literally struggling physically with the control devices (Blum, 2019). As they tried to turn up the airplane, it relentlessly nosed down. From the technological perspective, MCAS and the flight management system counter-acted the pilots commands by pitching the plane down.

MCAS has been implicated as a cause of the crashes of the Ethiopian and Indonesian 737 MAX planes in nearly all sources used in the study (e.g., Blum, 2019; Broderick et al., 2018; Campbell, 2019; Travis, 2019; Wise, 2019). Some sources point downright to MCAS, while others start with broader analysis of possible causes, including human factor, and then zero into MCAS.

Technically, MCAS plays a crucial role in determining the plane’s up/down pitch (the angle between the plane’s longitudinal axis and the horizontal axis; see Figure 6). The system architecture depicted in Figure 6 illustrates the pitch control process. Fed by the measurements of the angle of attack sensor, MCAS determines any deviation from the normal climb angle. It interacts with other systems making

the overall FMS, which ultimately controls the stabilizer on the plane's tail. A change in the stabilizer's angle can affect the pitch angle. The stabilizer is moved occasionally, usually by the FMS, in order to keep the airplane in a proper, stable condition during a flight (so called trimming operation). A smaller part on the back of a stabilizer called elevator is even more movable and it serves as the main surface for moving a plane's nose up/down. A pilot manipulates the elevator continually during a flight for climbing or diving the plane. Normally, the elevator and the stabilizer should not counteract each other. A design change applied on the 737 MAX is that MCAS was given primary control over the stabilizer. When it determines an intolerable pitch, it starts rotating the stabilizer for a certain increment in regular intervals. (See Scott et al., 2019)

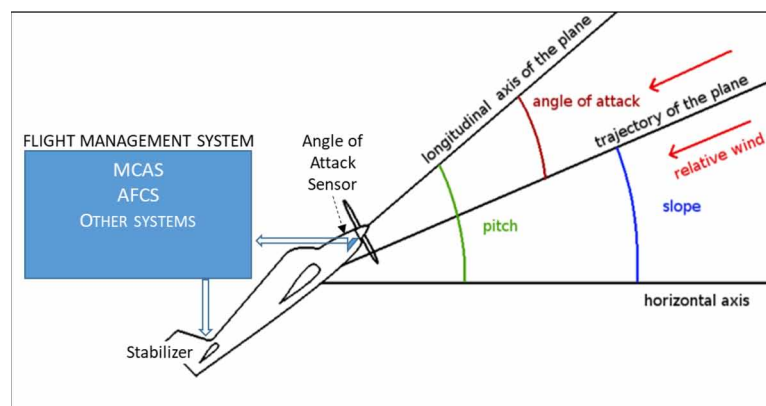
As Blum (2019) argued, it is likely that the force of pilots' muscles could not overcome the robotic force controlling the yoke while they were struggling to stop the diving via the elevator. The aforementioned mechanism of resistance built into command devices acted as overpowering force (Travis, 2019). In effect, control over the plane's climb moved from pilots to the FMS. Instead of serving as an aid, what the pilots would expect, technology was designed to be in total control in the critical situation. Put another way, technology policed the pilots.

How is technology used, inquires the second infoculture question. Pilots are educated in precise, technical thinking. Their cognitive profile features attention to detail, analytical and synthetic skills, and procedural knowledge. These are usually grouped into concepts of human factors in piloting, such as situation awareness and decision making (Green et al., 1996). As members of airline companies and professional associations, pilots carry a huge responsibility for material assets and human life. Given this background, pilots expect that aircraft technical systems, characteristics, flight procedures, known problematic issues, and emergency procedures are clearly explained in manuals and complemented by training. In pilots' view, an airplane is supposed to be operated according to well-documented, explicit, procedural knowledge. This can be combined with experiential knowledge of piloting.

In the case of MCAS, however, the pilots were left in the total dark. Boeing failed to mention MCAS in manuals and to provide training. The first time airlines learned about MCAS was after the crash of the Indonesian Lion Air's 737 MAX. In an official statement, Boeing revealed the existence of MCAS which is operated by the flight control computer and "activated without pilot input" when the plane is in the manual climb (Broderick et al., 2018).

Figure 6. Systems architecture detail involving MCAS

(Source: A Digital Commons graphic adapted)



By concealing that authority over the plane's pitch was allocated to MCAS, Boeing effectively deprived pilots of a life-saving workaround. Automatic control of the stabilizer could have been cut out and the erroneous diving stopped. This indeed had happened with the same Lion Air plane on its previous flight, which also nosed down uncontrollably. An off-duty pilot in the cockpit proposed such a solution and most likely prevented a catastrophe (Campbell, 2019).

It can be concluded that Boeing's expansion of automation with MCAS amounts to putting confidence in software over pilots. Boeing's answer to the "how" of technology starts and ends with technology: Technology should be used as other interacting technology prescribes or decides. In other words, unconstrained automation is the direction.

The third research question concerns the user identity in relation to technology. To answer it, further examining of MCAS must be performed. As already mentioned, MCAS locks out the pilot. Instead of augmenting human decision making, MCAS reverses the relationship between the plane and the pilot. As opposed to older models of 737, the MAX design demotes the pilot to an observer in a problematic situation. A pilot loses authority to computer-based systems. Put another way, the 737 MAX pilot has been moved from the primary user role (operating the system) to the secondary user role (merely using system outputs with a minimal physical contact with the system). Although the former role requires more effort than the latter, the savings bear a price if the user surrenders thinking. Business decision making systems can make errors and flight control systems can kill, as one can see in the case under analysis. Put another way, a pilot relates to MCAS as a powerless observing subject toward a veiled master.

It was already argued that this veiled master acted wrongly. But how come was this possible? The quality of MCAS has been questioned in the early commentaries that are thus far available. The system depends on multiple inputs that various sensors deliver. Some sensors can fail and deliver erroneous readings, as suspected to have happened in the first crash of the MAX 737 with a sensor for the angle of attack (AoA; see Figure 6), which is crucial for controlling the plane's pitch. The quality of programming code has been scrutinized as well (Travis, 2019). Using a single AoA sensor instead of both built on sides of the plane's nose may be another flaw because this device is known for failures (Frankel, 2019). It follows from this discussion that the powerless, pilot-observer of the 737 MAX faces a veiled authority with incomplete competence.

In summary, while the pilot as the systems' user would expect to have ultimate authority over systems, the designer turned the tables by moving authority to systems, some of which have malfunctioned.

Why/When Change Technology

Why did Boeing change technology, inquires the final infoculture question. Why introducing new technology that is so risky? An apparent motive behind constructing the 737 MAX was in taking advantage of a new turbofan engine that is more fuel efficient and powerful. The archrival Airbus A320 NEO had already done it and Boeing responded to competitive pressures. In order to mount larger engines without raising the landing gear, engines were moved forward and up. The previous generation of the 737 NG had already dealt with the problem of fitting a model of a large turbofan engine since the 737 was made to be close to the ground for easier cargo manipulation. Back then, Boeing had made some modifications to position the NG engine up and forward. But the turbofan engine for 737 MAX was even higher and heavier, according to published specifications. Further modifications followed upon the MAX design. In effect, key aerodynamic characteristics of the plane have changed (e.g., the center of gravity, points

of lift, the centerline of the engine's thrust) as well as maneuvering behavior. And so for worse, resulting in an unstable plane, with a built-in tendency to pitch up when climbing (Travis, 2019; Wise, 2019).

It is important to know that a plane pitching abnormally up loses the air pressure under wings necessary to keep the plane airborne. This problem is known as aerodynamic stall, a point of no-return resulting in a free fall of an airplane. A certified airworthy aircraft must have a capability to prevent the stall. The capabilities include aerodynamic properties, maneuvering capabilities, technology, and emergency procedures that reduce the probability and occurrence of stalling.

The problem of altered aerodynamic characteristics of the MAX plane renders MCAS in a new light. It is plausible that the true reason for inventing MCAS was in the constructor's attempt to amend the pitch problem (Travis, 2019; Wise, 2019). MCAS appears to be a patch for the faulty (non-airworthy) design of the plane. MCAS should stabilize the inherently unstable plane that tends to pitch up at high take-off speeds. Therefore, part of automation technology on the MAX plane has a corrective role over mechanical technology. Boeing's motivation for MCAS was technical and ultimately economic.

Prioritizing economy stands in stark contrast with safety goals upon which the industry is staked. Safety is in interest of all – passengers, pilots, airplane manufactures (who want to keep customers), investors, insurance, etc. From this stance, aviation technology should change when new technology improves safety. Aviation technology has indeed made big strides safety-wise since the 1980s (Brennan & Li, 2017). However, economics of airplane manufacturing could modify priorities. A company has to sustain large investments in R+D and production and management is under pressure to deliver competitive models. Fuel savings, flight length, payload size, and maintenance costs are some of the competition factors that play into the customer value proposition.

Boeing spent up to 3 billion dollars to bring the 737 MAX to market. Had it made major design changes the cost would have been quadrupled and the product would be a new plane obliged to undergo a lengthy certification process. (Wise, 2019) These figures clearly favor the choice of upgrading the 737. But the outcomes are chaotic. Although not declared as a new airplane, the changed aerodynamics maneuverability make the 737 MAX de facto a new plane (which somehow escaped attention of certifying authorities). Now, brand new planes kill people, and customers' confidence is undermined.

In conclusion, Boeing changed technology in response to economic factors that led to compromising plane design and amending this by automation. Safety was not bolstered but compromised.

The discussion so far shapes a finding on two infocultures whose characteristics are outlined in Table 3. From the pilot's perspective, technology is to be an aid to the pilot who should ultimately be authority in charge of the flight, using airplane technology in a clearly documented procedural fashion, and enjoying heightened safety that new technology should bring. From the perspective of Boeing and the 737 MAX designer, technology needs to control and command the pilot, works within its own loops possibly opaque to the pilot, be the ultimate authority in the flight, and change with economic opportunities.

Table 3. Infocultures of pilots and of designers

Infoculture Aspect	Pilot	Designer
WHAT is purpose of technology	Aid	Control & command
HOW to use technology	Based on use & emergency procedures	Unconstrained automation, possibly opaque
WHO we are in relation to technology	Authority	Authority
WHY/WHEN should technology change	Safety motive	Economic motive

Apparently, the pilot's infoculture and its counterpart on the designer side are opposed on each infoculture aspect. The what and how aspects sharply differentiate between the infocultures, and the who aspect indicates their direct collision. The why/when aspect reveals different origins of these infocultures. The next section will represent them via a metaphor.

Metaphors of Kerberos and Friendly Pooch

The discussion in the preceding section yields affordances for characterizing the identified infocultures via a metaphor of dog. The method used rests on key notions emerging in the discussion, such as aid, control, master, command, procedure, in charge, observer, emergency, and safety. These terms connote the context of dog-human relationships and differing dog roles in human life. What also gives a direction in semantic shaping is a joke circulating in the circles of aviation professionals, which ironizes the future of aviation with automation. The joke has it that the cockpit crew will be just one pilot and a dog; pilot will do nothing but feed the dog, and the dog's job will be to bite the pilot if he/she touches anything (FAP, 2013).

In analysis here, contrary to the joke, the dog represents computing technology. The MCAS and its placement in the flight management system conjure up a notion of total control that a dog can be made to exercise for the sake of its owner. The pilot's view triggers a notion of support and guarding the master that a dog can also do. The term "master" appearing also in the previous discussion fits to either concept of dog – dog-master vs. master-to-dog. These opposed concepts fit the two organizational and cognitive contexts: Boeing Corporation housing the MACS, and an airline company housing a pilot of the 737 MAX plane. It follows from this reasoning that there are two differing infocultures based on the two differing roles of domesticated dogs, as shown in Table 4.

The pilots' infoculture renders technology to a supportive role much like a service dog helps blind persons, detects humans buried in snow, or protects a person suffering a seizure. As a service dog is supposed to provide support according to procedures learned in dog training, aircraft technology should be used according to clear procedures. The crew (captain, first officer, engineer) maintains the role of primary expert user of the aircraft inasmuch as it is clear who is the master of a service dog. And as a service dog needs to acquire new skills that increase safety and wellbeing of its master, aircraft technology should be innovated when it can advance safety and the quality of a flight.

Opposed to the service dog metaphor stands a police dog metaphor pertaining to the designer's infoculture. The dog may as well be called Kerberos in reference to the mythical, overpowering, three-headed dog guarding the borderline between the world of the living and the dead. The police Kerberos is used for controlling everyone but the owner much like MCAS polices pilots. Designer of this controlling technology resembles a police dog trainer who is preoccupied with efficiency of policing regardless the safety consequences. Catering exclusively to economic reasons, as Boeing has done with the 737 MAX plane, is like abandoning a present dog when a cheaper breed, which is trainable for the same job, becomes available.

In summary, the pilot's and designer's infocultures compare metaphorically as a service dog vs. a police dog. The police dog infoculture has been overwhelming. From the perspective of infoculture metaphor, the gap between these infocultures and the dominance of the one that compromises safety indicate end-causes of the 737 MAX crashes.

This case also indicates an underlying ontology of technological imperative and poor human agency (see Chapter 4). The technological imperative approach gives technology the causal role, presuming

Table 4. Dog metaphor symbolizing two infocultures

Infoculture Aspect	Pilot Infoculture Metaphor	Designer Infoculture Metaphor
Purpose	Service dog	Police dog
Use	Upon trained procedures	For control
Identity	Master	Trainer
Change	When service needs change	When cheaper dog can work as expensive dog

that that it directly impacts and shapes the social context. Human agency become the object of technology impacts. Accordingly, the pilot is reduced to a passive observer of the automated flight, doomed to inaction even when technology is failing. The disregard for potentials of human agency heightened tragic aspects of the 737 MAX accidents.

It is important to keep in mind that technology did not act out of its own volition. Ultimately, it is designer agency that has been responsible for maliciously functioning technology. Software running in MCAS and the flight control computer was written by programmers working for Boeing. The work of systems analysts presumably preceded programming. Likewise, the faulty sensors came from certain producers. In final analysis, it is not technology that controls pilots but rather technology's designer. Power of designer over pilot was mediated via technology.

Institutionalized power espoused design of the MAX technology, which was staked on underestimating the human factor. The institutional impact on the aircraft design brings management agency to the bench of accountable party occupied by the designer. Both actors are responsible for the invalid design ultimately rooted in philosophy of technological imperative and poor human agency.

In conclusion, a clash between two opposed infocultures is responsible for poor airplane design and the tragic accidents. In a larger picture of the role of high-tech and automation in society, this case revamps the puzzle of *normal accidents* (Perrow, 1984/1999) as well as Weick's remedy in the concept of *mindful organization* (Weick et al., 1999). Does new technology inevitably brings unforeseen accidents? Do the prescripts for mindful organization need an amendment to cover the producers of high risk hi-tech? These important questions urge further research.

SUMMARY

Beliefs and patterns of behavior that refer to informing agents exist in any organization. From the perspective of IVO, these constitute infoculture. By putting on lenses of infoculture, one can gather a deeper insight into some well-known artifacts of organizational culture. While electronic digital IT plays key roles in infocultures in IT industry and e-commerce enterprises (Amazon.com, Internet Securities, etc.), this technology received criticism directly from a cultural perspective (Deal and Kennedy, 1999). Case studies focusing on modern IT provide a more balanced view and promising material for advancing understanding of infocultures (Orlikowski (1994, 1996; Wynn, 1996).

Evidence reveals the existence of different infocultures in the same company (the IT-focused versus the data-focused) and differences within the same professional infoculture. Therefore, IT can have different faces for different organizational groups—what is good IT for groupware specialists may not be seen the same way by specialists in legacy systems; beliefs that IS departments vest into IT may not be

shared by user departments that place business data at the pedestal of key value. All this demonstrates not only the existence of infocultures, but also the fact that an infoculture can be differentiated and fractured. The literature provides certain leads for devising a typology of infocultures. Examples are in studies of groupware, ERP, teams using communication technology, and of knowledge. The discussion also addressed. Finally, the discussion addressed impacts of Big Data on infoculture.

The typology of infocultures proposed in this chapter draws primarily on the work of Boisot (1987) and Handy (1993). The amalgamation of Boisot's concepts of knowledge codification and diffusion (partly related to IVO's conceptualization of infostructure), his organization types, Handy's typology of organizational cultures, and theorizing on the team and knowledge organization, resulted in a six member-typology of infoculture: role/bureaucracy, matrix, clan/power, fiefdom/person, family, team and knowledge. The chapter concluded with a presentation of case evidence on infocultures in three companies this author has investigated, and a case of colliding infocultures contributing to deadly air accidents.

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ENDNOTES

- ¹ In order to get past the security desk in an elite research institution, on the first day of my visit I had to be introduced to the guard by an insider. My passport and a letter showing that I had an office assigned in the building were of no help. On the second day, the guard recognized me, but showed eagerness to engage me in a little chitchat. The next day, the guard just smiled and let me pass. The problem, however, occurred when the guard changed, as the new person did not recognize me. Luckily, the old guard was around when I started explaining my identity and pulling out papers (which I knew would not work). Therefore, the old guard introduced me to his colleague,

and I was ready to roll. In numerous situations during that study trip, I learned again and again that paper IDs were useless. Rather, security worked on a person-to-person basis. Identification credentials that security personnel would consider valid had nothing to do with formal documents. Rather, the security relied on their visual and audio memory, which helped them verify visitors' faces and voices.

- 2 The concept of tacit knowledge that many organizational and IS researchers find attractive has both philosophical and psychological roots. Philosopher of science Michael Polanyi (1966) proposed it decades ago, which captured the attention of organization and management scholars few decades after. On the psychology side, cognitive psychologists operate with the concept of implicit knowledge that bears some similarities to tacit knowledge. Reber (1967) proposed the idea of implicit knowledge and conceived it as a product of unintentional learning that is expressed in performance but is difficult to verbalize and not accessible to consciousness. Children learn knowledge without intention or access to formal grammatical rules, and non-experts may start differentiating between Bach and Beethoven after merely some exposure to the music of these composers. In both cases, a conscious effort to learn (explicit learning) and to acquire a rules-based knowledge (declarative knowledge) is missing. Implicit knowledge can be understood also as skills, such as the knowledge of playing a sport. In contrast, explicit knowledge captures the physical laws and other conscious rules in the background of the sport. Alternatively, in the social domain, one may be an effective communicator without knowing anything about the theory of interpersonal communication (implicit knowledge), while a recognized communication theorist (explicit knowledge) can act clumsily in his communication with others. In organizational theory, this dichotomy resembles the difference between tacit and explicit knowledge.

Organization theory and psychology also concur that unconscious knowledge is subjective in character. The former has developed particularly rich descriptions. For example, Nonaka and Takeuchi (1995) posit that tacit knowledge is rooted in subjective ideals, values, emotions, insights, intuitions, images, and symbols (pp. 8-9). However, similarities between tacit knowledge and implicit knowledge stop here. Cognitive psychologists insist on the process leading to implicit knowledge—it is neither intentional nor conscious. This distinction, however, is not important to the concept of tacit knowledge. In fact, quite the opposite could be the case. An expert may repeatedly go through certain problem-solving exercises, and through this process he may eventually reach a stage where solving problems becomes a routine. This may be possible because the expert has accumulated vast experience and his brain no longer needs to put forth the conscious, concentrated effort in order to solve problems. His knowledge has been “moved” into the domain of the unconscious, becoming tacit knowledge. This knowledge demonstrates its presence in the expert’s performance, but it cannot be verbalized any more. Moreover, organizational and IS scholars are preoccupied with the issue of converting tacit knowledge into explicit knowledge, while such a convergence between implicit and explicit knowledge is not on the agenda of cognitive psychologists.

- 3 The infocultural split in the organization Orlikowski (1994) investigated is frequent. The IT people do not understand end-users, and end-users do not understand IT people. Neither side has patience for the other. Attempts to acculturate IT people into the values of service professions often fail. There appears to be a particular cognitive type of people drawn to IT/IS professions, having a cognitive makeup in which machines play a more salient (at least a more amusing) role than humans do. Users can take their share of the responsibility for this mismatch, since they may act as spoiled customers who want it all on a golden plate with no effort—and now! Management solutions

for patching this split need to start by acknowledging and fully understanding infocultures of IT people and of users in a given organization. No canned solutions can replace a concentrated effort to understand particular infocultures in a particular organization. The next step, then, would be to search for points of connection between infocultures, and to get each side to adopt some beliefs and behaviors of the other side. This step would lead to balancing the fragmented infoculture. On another count, the split between believers in cognitive and believers in technological informing agents reflects a similar split within the IS field of research. Coming to a balanced view that acknowledges equal importance of both of these organizational informing agents again appears to be one way to proceed.

- 4 Hofstede's cultural framework has attracted much of attention in the IS field. Many investigated organizational cultures using his dimensions as predictors for system adoption (individualism/collectivism, power distance, uncertainty avoidance, and masculinity/femininity). There is little justification for this approach. Hofstede himself has warned that organizational cultures "are different in many respects from national cultures" (Hofstede et al., 2010: 47). The cited 2010 book brings a separate chapter on organizational culture and discusses six dimensions (e.g., employee oriented vs. job oriented and parochial vs. professional).

To Hofstede's credit, it can be argued that he cannot be responsible for the misjudgments of his followers or, for that matter, his marketers who coupled "culture" and "organizations" in the title of the author's seminal work. On the other hand, a reader can become confused when presented with a mapping of organizational forms into exemplary countries, based on a grid defined by uncertainty avoidance and power distance (Hofstede et al., 2010: 314). Anyhow, the easiness of applying ready-made scales should not eliminate concrete research of organizational cultures (and infocultures). In responding to Hofstede-like surveys, respondents may express their private orientations (corresponding to their national culture) rather than cultures of their company. Organizations with weak cultures may take more influences from a national culture, which may not be true of organizations with strong cultures inspired by orientations of the founders, charismatic leaders, best practice creators, foreign successful companies, etc.

- 5 The approach taken by Weick and Westley (1996) reads as an alternative to the modernist approach insisting on organizational rationality in organizational learning. Such an approach illuminated the macro-organizational perspective of learning, focusing on the relationship between organization as a system and its environment (e.g., Argyris & Schon, 1978). The postulate is that organizations learn through a process of adapting to a stimulus from the environment. This big picture explains changes in operating procedures, theories-in-use and objectives of an organization. It does not reveal, however, who precisely learns, what cultural values drive the process, and the cultural practices by which individual learning is shared. A tacit rationalistic/utilitarian postulate that organizations regularly select a behavior that maximizes their benefit through an optimal behavioral adaptation lurks in the background. However, such an optimal adaptive learning may not be the case. Useful promising projects may become victims of political forces (Xerox missed to commercialize the microcomputer with graphical user interface and mouse, which the company R+D invented; once a formidable competitor in computer industry, DEC Corporation disappeared after missing to change product philosophy).

- 6 The self-service mode of using IS has not attracted attention that would be proportional to a revolution it could cause. The term refers to transforming secondary users to primary users. A secondary user is the one who uses the output from a system without really operating the system. In contrast, the

primary user touches and works with a system, has to acquire relevant technical skills, and factors the time spent on operating a system into work hours. Traditionally, primary users have been clerks and some professionals, while secondary users have been managers and remaining professionals. In a strict sense, “secondary user” is a bit of a misnomer because the person does not use a system but its informing service; therefore, the term “customer” would fit better. By the same token, a bus passenger is not a bus user but customer using the busing service. Anyhow, making managers to operate computers is a revolutionary challenge, particularly in the areas of routine administrative work that managers have traditionally pushed down to clerks (checks and approvals of expenses, business hours, schedules, reports, etc.).

Chapter 6

Infopolitics

ABSTRACT

This chapter discusses informing politics (infopolitics), which is defined in terms of power, agendas, and flight/fight behaviors related to organizational informing agents. The central concept in infopolitics is that of infopower. Infopower is defined, illustrated by examples from the literature, and grounded in structuration theory. Manipulative communication techniques are also discussed, and their relationships with infopolitics are demonstrated. The discussion further covers a three-member categorization of resource-based infopower: data/IT control, expert power, and meaning management. In addition, alternative ontological views based on the premises of symbol and object are proposed as a way of expanding theorizing on infopower based on dialectics of autonomy and domination. The discussion also covers topics of infopolitical agenda and flight/fight behaviors. A case study of infopolitics supplements the discussion.

INTRODUCTION

This chapter discusses politics of informing or informing politics, infopolitics, for short. This is another segment in the IVO framework. As is the case with other perspective shifts IVO advocates that have been discussed in previous chapters, the intention here is to complement the political perspective on organization with a focus on organizational informing agents. We will look at the literature that is useful for conceptualizing infopolitics, constitutive realms of infopolitics—infopower, infopolitical agendas, and fight/flight behaviors that have to do with infopower and infopolitical agendas. Categorizations of infopower will be proposed, and a case demonstrating the concepts of infopolitics will be presented.

Social power related to informing agents—infopower—takes the central place in our discussion of infopolitics. As a social phenomenon, power is omnipresent. It is conceived a major force in the social world. Still, power persistently evades understanding. This is due to many reasons, not the least important being a multidimensionality and an opaque disposition of power. This multidimensional character is indicated in many labels used for the phenomena that are believed to belong to the realm of power—control, influence, domination, subjugation, decision making authority, to name the few most conspicuous. For some researchers, these are distinct aspects of power, which merit defining. Others use the terms

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interchangeably as synonyms, and yet others sense that differences exist but give up pinning them down. The multidimensionality of power is also manifest in mutually incongruent typologies of power created within different research traditions.

Power is usually conceived in terms of a relationship that involves two sides, subjects A and B. Subjects A and B have different roles determined by an asymmetry in resources and enabling the privileged subject A to effect a change in conduct of B. Theorizing on the roles of A and B and on their relation has engendered some of the deepest divisions in the history of social science. The range spans from numerous variants of the master/slave model to modeling power in a dialectical way, where notions of mutual interdependence and exchange between A and B are essential. Big themes of action, institution, domination, and submission intersect in the realm of power. The pool of theoretical divides appears to be limitless. Take the issue of intention or awareness as an example. For a power relationship to work, does it suffice that A is intention-driven, or both A and B must have intentions? Could B intentionally change conduct without A's intentional involvement? Or could it so happen that power is exerted without either party's being aware of this? Different answers to these questions result in different conceptualizations of power.

The opaque disposition of power equally dares the researcher. In contrast to Hollywood's Machiavelian portrayals of corporate reality, the manifestations of power in real organizations tend to be subtler. The official register of authority attached to management positions, of course, is of some help. But it reveals merely the tip of the iceberg. While power is the central political phenomenon in organizations (as anywhere else), the politics of power tend to hide this very same fact. The most effective affirmations of a power establishment are stricken when organization members truly believe that they work in the best possible organization and that their leaders are extraordinarily smart, fearless, generous or in some other way unique. Charismatic power may be fed by subliminal sources that resist detection. Nonetheless difficult is it to discern power in horizontal relationships as occasioned in communication networks. And the naked eye can be of no more help concerning vertical relationships in which power is exerted opposite to the conventional direction—bottom-up. Although less investigated, this modus was introduced by French and Raven's (1959) classical typology of power and even more so by Giddens (1979, 1984).

All this reflects on the phenomenon of infopower. In sociology and in its extension to organization theory, knowledge has long been conceived as a resource that can precipitate the power relationship. Apparently, this is in the direct connection with the IVO framework that treats knowledge as one of informing agents. But data and IT can also be used as power sources, leading to a more complete categorization of types of infopower this chapter will present. A premise to the following discussion is that Giddens's structuration theory deepens the understanding of both the structural and action in their dialectical symbiosis. These guidelines are eye-opening for understanding infopower, and, consequently, infopolitics.

The analysis will also address different ontologies of power—social (institutional and structuration), cognitive (symbolist), and materialistic. This is a power focused extension of the ontology discussion presented in Chapter 4. The institutional perspective reveals the social background of artifacts. Efficiency concerns can be enforced by system design (Orlikowski, 1992, 1994), and data access and flows can be molded to shape political interests of certain groups (Danziger et al., 1982; Markus, 1983; Zuboff, 1988). The perspective of organizational symbolism refocuses lenses to cognitive and subjective aspects (Czarniawska-Joerges, 1992). The structuration perspective acknowledges institution as a constraint, but views it also as the enabler of action. Structuration theory will be the main frame for resource-based concepts of infopower. Attribution of connotative meanings to systems artifacts is also of interest, and particularly symbols of external force bestowed upon users. These assumptions underpin a symbolist

perspective that enriches cognitive ontology in IS research (refer to Chapter 4). In contrast, proponents of Actor-network theory (ANT) concentrate on material characteristics of human artifacts as these interact with people (e.g., Latour, 2005). The ANT perspective maintains that “nonhumans” or “actants” (including IT and documents) can prescribe human behavior. In a selective and critical take of ideas from ANT attempted here, the focus will be on influence that technology as an object gone awry can have over users.

The chapter will proceed in the following way. The relevant literature providing the backdrop for the concept of infopolitics is discussed first. Then, segments of infopolitics are defined and each discussed in turn. The central piece of this discussion is infopower. A duality character of infopower is discussed, two categorizations of infopower proposed, and influence of IS artifacts discussed. Next, the segments of infopolitical agendas and infopolitical fight/flight will be elaborated. Finally, case evidence of some infopolitical concepts based on the author’s investigation will be elaborated.

THE CONCEPT OF INFOPOLITICS

The term infopolitics (short of “information politics”) refers to that segment of organizational politics that is related to organizational informing agents. Power is akin to a lasting influence based on some resource or otherwise, and it makes the central part of infopolitics. Infopolitics also include self-interest or agendas, and political behaviors. These behaviors include fighting opponents that are perceived as a threat to one’s agenda as well actions of making coalitions to advance one’s power position and self-interest. If organizational politics is an “everlasting” issue, so is infopolitics.

That a part of organizational politics is related to informing agents means a number of things. Let us illustrate this by focusing on power as the core dimension of organizational politics and infopolitics. For example, possession of informing agents can be the source of power. These represent the resources that one party controls and on which another party depends. For instance, IT can be the medium by which data are managed in order to establish or alter the power relationship. Informing agents can also be the objects of political agendas, fights, and flights. Self-interests and power relationships get “embedded” in IS and channel users’ behavior, as discussed in Chapter 4. These are different instantiations of infopower, as the following discussion will show. Power is perhaps the most complex social relationship. Recent theoretical developments, such as those in structuration theory and ANT have revisited some essential conceptual issues. For example, questioned is the character of the social as well as the internal dynamic of power relationship emanating from the opposed aspects of domination and autonomy.

In the organizational literature, it has been maintained for long that possession or control of knowledge can be a source of power (e.g., Crozier, 1964; Pfeffer, 1981). Barley (1986, 1990) brought knowledge of manipulating a new sort of technology in a relationship with power changes. Technicians trained in computer tomography gained power at the expense of radiologists. Knowledge of early adopters of technology is one instance of expert power. This power modality was conceived by French and Raven (1959), along with legitimate (authority), reward, coercive, and referent power.

IS researchers have investigated the relationship between IS artifacts and organizational politics in connection with informing agents (see Jasperson et al., 2002). The case inquiry of Zuboff (1988), citing “power” in the title, is a remarkable example of deploying a political perspective in IS research. The author’s analysis is rich with political aspects that pervade the strategies, uses and outcomes of deploy-

ing different IS in eight organizations. For example, expert power is clearly implicated in the following statement of the DIALOG electronic conferencing system that Zuboff (1988) studied:

Lots of people have power that is not knowledge-based; it is forceful and based on their personality or position. In DIALOG, the power lies in the ability to communicate and pass on knowledge. I have extended my power base through my knowledge rather than through intimidation or style. It is strictly now the quality of your ideas, the way you put things in words, or your sensitivity to what others say that now determines your influence. (p. 371)

Communication systems can serve as media of other modalities of power as well. Zuboff (1988) also found that one manager could not discuss professional topics in a collegial manner because other participants in a communication system understood the manager's comments as recommendations for action or orders. The system thus served as a conduit of authority in spite of intentions of the authority holder. Orlikowski and Yates's (1994) discovered instances of both authority and expert power emanating in the context of an email system used in project work in a software company. The email system carried out democratic dialogue that was occasionally punctuated by voting acts. As opposed to verbal or paper-based dialogue, electronic dialogue had a capability of chaining the content, thus creating lines of conversation. These led to several ballots. Decisions derived from the ballots were just partially based on the majority vote since some actors gave advantage to authority. This behavior reinforced authority as the modality of power. Others favored knowledge and quality of argument, thus favoring knowledge-based power. Therefore, the email system enabled welding of power-based decision making over the basic democratic principle of majority vote.

Coming from the perspective of communication research, Beniger (1986) developed a compelling argument that the potentials and actual uses of communication technologies could be a mighty lever of control. Although he analyzed older theories like telegraph and signaling towers, his argument could be extended to modern technology. Consider potential consequences of instant messaging or of the cellular (mobile) phone: continual presence and accessibility in the communication space constitutes conditions for exercising continuous control.

A study of a GDSS in a large Norwegian oil company by Munkvold (2003) clearly indicates political aspects relevant for understanding infopolitics. The company favored face-to-face meetings in which members could rely on their position and verbal skills as the power base. Therefore, the GDSS was not welcome as it would limit such a basis. Management did not support sufficiently the GDSS, and it was difficult even to find space for GSS since many meeting rooms were owned by collocated work units.

An early example of focusing attention on organizational informing agents as the source of organizational politics is the study by Danziger and colleagues (1982). The researchers studied the adoption of computers in American local government organizations. They found that the process of switching from paper to digital format triggered old political questions on who governs and whose interests are served? The new computer-based IS supported speed, direction, content and pattern of data flows in the direction of reinforcing old power relationships. The authors named this phenomenon as "automation of bias." This study has confirmed that informing agents are political phenomena *par excellence* that power holders can leverage to prolong the status quo. This message is congruent with other cited research (e.g., Beniger, 1986; Zuboff, 1988).

Markus (1983) conducted another early, exemplary investigation of issues that are relevant for the concept of infopolitics. Hers was a case of a chemical company that adopted a new accounting/financial

IS (further referenced as FIS). The new system and changes in control over the corresponding data became the battleground between divisional and corporate accountants. Divisional accountants performed managerial accounting (processing real time data for management and forecasting purposes), while the corporate accountants performed financial accounting (processing historical data for the purposes of external reporting). The later function was new, placed between corporate management, which it served, and the company's divisions. A gap between the two accounting functions developed from the beginning. FIS was designed so that the flow of data was redirected from the divisional to corporate accountants. In the past, divisional accountants summarized raw data on the transactions in their divisions and sent summaries to the corporate accountants for consolidation. Divisions retained control over their data and exercised discretion in summarizing it. Consequently, the corporate accounting function depended on divisional accounting for reports. With FIS, however, all transaction data were collected in a central database under the control of corporate accountants. The system created reports automatically for perusal of both corporate and divisional accountants. The latter ones could not intervene into data before they reached corporate accountants, and effectively lost data ownership. Corporate accountants, however, obtained access to transaction data and could query them in order to assess divisional performance. Markus (1983) determined that the divisional accountants felt being at loss.

Markus's case (1983) reinforces the assumption that informing agents are at the nexus of organizational politics. In addition, the case supports the assumption of IVO that power based on informing agents precedes social power because one professional group gained power taken from another group owing to reallocation of access to data and reports. Contrary to the findings in local government organizations discussed above (Danziger et al., 1982), FIS was used for seizing infopower first, and then organizational power by the corporate accountants (a new professional group) and possibly senior corporate management (an already existing power center).

The management of meaning (which in IVO is synonymous with "information") can also be a source of power (Pettigrew, 1977, 1979). Feldman and March (1981) analyzed from a symbolic perspective management behaviors related to reporting. The authors argued that the request for reports symbolized the behavior of a rational decision maker. Possession of reports signified a well-informed manager who resided "in the loop" of decision makers. In this interpretation, therefore, management control extends beyond data flows to a domain of impressions created in the observer's mind. Informing practices symbolize a rational behavior agreeable with a culture of rationality. (Implications of the management of meaning for infoculture are discussed in Chapter 6).

Bradshaw-Camball and Murray (1991) addressed the phenomenon of meaning management in a study of budgeting in a public hospital in Canada. The authors found that the hospital's top administrators influenced the Board of Directors, staff and the Ministry of Health to buy a plan for an exaggerated annual budget. Following a flow of dramatic and somewhat humorous events, the larger budget was indeed obtained, but then the hospital ended the fiscal year with a surplus. The study explains that the administrators distorted the planned expenses, and engaged in an extensive management of meaning or "illusions." The later included labeling the Ministry of Health in pejorative and ironical ways, creating hit lists of services to be cut, calculated non-verbal behavior in meetings, and circulating stories about problems in the hospital. The researchers commented that the administrators acted partly consciously and partly unconsciously.

In sum, the literature in both the organizational and IS field supplies compelling evidence that informing agents are deeply involved in power relationships.

Political Tests of Information Systems

Control over informing agents is a permanent source of territorial battles. As indicated in the literature above (Danziger et al., 1982; Markus, 1983), a party gets formed around shared interests, develops an agenda (even if it is tacit), and engages in fight with opposed parties, provided that those exist. These phenomena chart the domain of infopolitical agenda and flight/fight. Usually, one can read access privileges to database systems or to an ERP system as a book of organizational power. These systems thus engender an eminent context of infopolitics. Design and development of these systems is also paved by infopolitics in the form of agendas and flight/fight behaviors. Still, a stigma of war zone may not necessarily apply. Limited evidence suggests that corporate databases may not be the domain in which ruthless self-interest inevitably reigns (Connolly & Thorn, 1990). No support was found for the assumption that corporate databases would be exhausted as shared grounds for grazing cattle because users would just take data out and not put new data in.

Hanseth and associates (2001) studied Norsk Hydro, corporation with a global span of operations, where the implementation of an ERP system has been attempted across corporate divisions. The champion was the management of the central division at the division headquarters, and the goals were to achieve a tighter integration and control of the corporation. However, as the project evolved, a number of user groups developed at dispersed units. In spite of the initial management intention to build one coherent common system, the implementation process diverged into developing many variants of the system customized to local needs. An implication is that work processes built into the system were not uniformly modeled across organizational units. In battling the efforts toward centralization, the spatially dispersed units managed to maintain certain autonomy in terms of system design, data management, and organizational design. From the perspective of infopolitics, this case indicates that centralizing data management (infocentralization) changes the distribution of infopower. In turn, the infopower changes are the condition for changes of social power.

Sarker and Lee (1999) studied business process reengineering (BPR) coupled with a new enterprise system in an American telecommunications company, and developed a case rich in political implications. The effort failed due to a number of reasons, many of which were political in nature. One concerned the role of top management. The President's push for the change did not meet continuous commitment of top management. The official plan was to dissolve the existing organization, temporarily lay off everybody, and then re-hire for a new process organization. The declared BPR goals were improvements in cost structure, service, speed and value. However, the authors found that the President's primary motivation was to downsize the company, as top management kept talking about savings in labor force. Privy to the second agenda, the vice presidents struggled to preserve their positions in the re-engineered organization.

In contrast, employees of the telecommunications company felt doomed to wait in the "parking lot" to be re-hired. The BPR planning team complicated the situation. Deploying 25 members from different departments, it resided on the top floor of the company building. The team was entrusted with the task of redesigning all the processes across departments within a year. The team's powers and insulated position created a veil of secrecy that triggered ill feeling and mistrust on the employee side. Under executive pressure, the team created some quick solutions, but labeled them awkwardly ("quick-hits," "low hanging fruit," "pulling a hatchet from one's head"). The employees perceived the solutions as offensive, targeting persons rather than issues. The case by Sarker and Lee (1999) teaches how BPR should not be performed. Since the goals of the change project cut to the existential turf of almost everybody

in the company, politics became overbearing. New infopolitics around the nascent system did not have a chance to be properly conceived, as it was chocked in struggles for survival between involved parties.

Implementations of larger scale ISES can affect a particular group rather than an entire firm. If that group has a distinguished position, the results of implementation can be as detrimental as in the case of the broader impact. Lapointe and Rivard's (2005) studied implementation of electronic medical record (EMR) systems in three Canadian hospitals. One of the challenges in adopting this type of system was a conflict between physicians and nurses. The new system imposed a new process in which the physicians had to enter prescriptions into the system. In the old regime, the nurses would do this based on verbal instructions of doctors. This practice was perpetuated as part of the organizational culture shared across hospitals rather than because of formal authority of doctors. With the EMR system in place in each of the hospitals studied, the doctors felt that operating the system by themselves led to their loss in productivity and quality of service. They fought the nurses who refused to take oral prescriptions as well as hospitals' administrators who championed the systems. In the epilogue, the conflicts led to withdrawing the system from certain units in one hospital. In another hospital, the system's scope was reduced and some doctors resigned. In the third hospital, the EMR system was indeed adopted, but with a modification. This case reveals that different occupational groups in hospitals have different infopolitics that cannot be easily changed. Doctors were used to records management that corresponded to superordinate ranks in relation to nurses. The introduced change in infopolitics disturbed the overall political position of doctors, which most of them rejected.

One interesting question concerns power shifts in labor-management relations. An argument is that modern IT can lead to empowering employees (e.g., Peters, 1992; Zeleny, 1990). Another is that old power distribution favoring management remains essentially intact (e.g., Danziger et al., 1982). Yet, another argument is that the outcomes could be different than zero-sum as power gains and losses are incurred on both sides. For example, Travica (1999) found that the usage of IT in American public accounting industry was positively correlated with perceptions of decreased centralization, although the hierarchy in organizations studied was similarly tall and indifferent of the IT usage. These findings tie into the problem of contrasting aspects of power whereby power implies dependence *and* autonomy on both sides of the power relationship. Giddens (1979, 1984) has devoted much attention to this issue. In his sociology, power is omnipresent because it is a defining characteristic of human agency. There is no action without power. As Giddens put it, "action logically involves power in the sense of transformative capacity" (Giddens, 1984: 15).

Power is intimately involved in the area of cognitive informing agents. Giddens (1984) emphasized that "structures of signification always have to be grasped in connection with domination and legitimation" (p. 31). In our interpretation, data, knowledge, wisdom and IT have power-bound origins and purposes. They can be treated as resources of infopower action that (re)produces domination and autonomy. Put another way, power is not a zero-sum game because "all forms of dependence offer some resources whereby those who are subordinate can influence the activities of their superiors" (1984: 16, 374). This is an expression of Giddens's proposition of *dialectic of control*. This dialectic plays itself so that even the party on the receiving side of the power relationship (as the object of domination) is capable of deploying resources to act back (as the subject of autonomy).

Power is the most complex social relationship. A triangulation of theoretical perspectives, therefore, is more likely to illuminate this complexity than single-perspective approaches. Take, for example, an organization with a culture of centralized decision making and autocratic management. Using the lenses of dialectic of control, one may find that the power of subject B trickles down to severely limited

transformative capacity, where the most radical action would be to say a “no.” Conversely, a critical perspective would expend energy on the task of revealing the breadth and depth of the domination aspect of power, which would be more appropriate for this sort of organizational context (e.g., Deetz, 1992).

Communication Techniques of Infopower¹

Deetz (1992) developed a repertoire of organizational communication methods used by power holders in order to preserve the distribution of power in their favor. He is concerned with communication behaviors (“micropractices”) that pose obstacles to realizing a full participatory democracy. From the IVO perspective, Deetz’s micropractices can help explain subtleties of infopower and other infopolitical phenomena. Several micropractices will be discussed below.

Deetz (1992) views dominant practices of organizational communication in terms of the interaction forms or micropractices—both face-to-face and technology-mediated ones—that erode democracy. Radical, participatory democracy undergirded by micropractices constitutes the long-term moral/political ideal of the good and wise organizational life. Because all participants discuss all the topics and all the voices are heard, organizational members are more likely to make and implement sound decisions, resulting in the high level of organizational effectiveness. The instrumental argument thus brings micropractices close to the mainstream form of teamwork practiced by many contemporary organizations. In a way, Deetz’s theory argues that organizational members, if they are committed and persistent, can have their cake (thoroughly democratic organizations) and eat it (high levels of organizational effectiveness measured by quantitative and qualitative indicators of organizational performance).

The heart of Deetz’s theory of organizational communication and democracy are the following eight types of interactions or micropractices: (1) disqualification, (2) legitimation, (3) meaning denial and plausible deniability, (4) naturalization, (5) subjectification of experience, (6) topical avoidance, and (7) pacification. Let us briefly define and discuss each micropractice. *Disqualification* refers to the situation in which top-level executives and their advisors or consultants exclude all other organizational actors from a serious discussion and from making strategic and tactical decisions. Because many relevant voices, views and arguments are excluded, organizations tend to make one-sided, highly biased decisions that undermine effectiveness and viability of organizations. *Legitimation* means that top-level executives and their advisors or consultants argue that only they have the right (legitimacy) and special knowledge and experience needed to run successful organizations. Including other relevant organizational actors—both internal and external—is purportedly inconvenient, time wasting, and ineffective. The next category is *meaning denial and plausible deniability*. In this type of interaction, top-level executives and their advisors or consultants defend their strategic moves by very abstract and ambiguous arguments. This allows them to take credit for organizational successes and ward off blame for any failures.

Naturalization refers to the situation in which organizational actors—both internal and external—buy in the arguments of top-level executives and their advisors or consultants. All excluded actors start to believe that their own exclusion is the way that organizations were, are, and will be run. The excluded organizational members lose the capacity to imagine that organizations could be run differently – for example, as an entity based on (almost) total participation.

Furthermore, *subjectification of experience* implies that the excluded organizational actors judge all of their actions by the standard of the extreme individual responsibility. In their conversations, they accept responsibility for organizational mistakes and failures although they did not have sufficient control of

resources, circumstances, and actions. The excluded actors blame themselves and thus let off the hook the top-level organizational executives and their advisors.

Topical avoidance happens when top-level executives and their consultants remove unpleasant topics from the agenda, and especially the topics calling for radical democratization of organizations. As a consequence, decision-making is characterized by the premature closure. Less than optimal decisions are made. Finally, *pacification* is a type of interaction in which top-level executives and their advisors must face, listen to, and respond to demands of some of the excluded organizational actors. The privileged decision makers then claim that they will consider all the relevant viewpoints. But they never do.

As more of these micropractices take place simultaneously or sequentially, organizational communication becomes increasingly distorted. Organizations themselves become increasingly oblique and less and less transparent. Similarly, as organizational communication becomes more distorted, all organizational actors/stakeholders, including the top level executives and their advisors, come to take for granted both the explicit content and the background rules of interaction that define the terms of communicative relationships as hierarchical-asymmetrical. Radical, participatory democracy thus requires a systematic reversal of the eight micropractices. However, precise relationships between micropractices and organizational performance and effectiveness depend on the ever-shifting configurations of power within and between specific organizations.

The Deetz's framework above indicates that methods of accumulating and maintaining infopower cover a whole range. These can be thought of as infoprocesses of data filtering via gate keeping and otherwise—legitimation, topical avoidance, disqualification, and pacification. Other methods indicate the management of meaning—naturalization, meaning denial, and subjectivation of experience. Therefore, Deetz's theory can be understood in terms of micropractices or infoprocesses of infopower.

Another implication of the Deetz framework concerns relationships between infopolitical phenomena. For example, significant asymmetries in the distribution of infopower may not necessarily lead to infopolitical fight. If organization members are *disqualified* as decision makers or *naturalized* to buy in the arguments of powerful subjects, they will tend to be agreeable rather than critical or confrontational. Put another way, the subtle workings of infopower can suppress infopolitical fight. Furthermore, Deetz attributes the role of subject A to a host of actors (top-level executives, their advisors, and consultants). Groups become the powerful actor via a process of consolidating infopolitical agendas. Therefore, the relationship between infopower micropractices and infopolitical agendas is established. Finally, if these infopolitical phenomena or organizational communication practices based on Deetz's framework acquire the character of a stable pattern, they become part of infoculture.

In summary, infopolitics was initially sketched in terms of the organizational politics related to organizational informing agents. The section reviewed the literature from different disciplines, which illustrates aspects of infopolitics.

DEFINING INFOPOLITICS

Infopolitics refers to power, agendas, and flight/fight behaviors that are related to organizational informing agents. The prefix "info" applies to all these items. Figure 1 depicts relationships between these concepts. We have already encountered examples of infopolitics in the review of literature above. Let us take a closer look at the aspects of infopolitics depicted in Figure 1—infopower, infoagenda, and infoflight/infopolitical fight.

Infopower

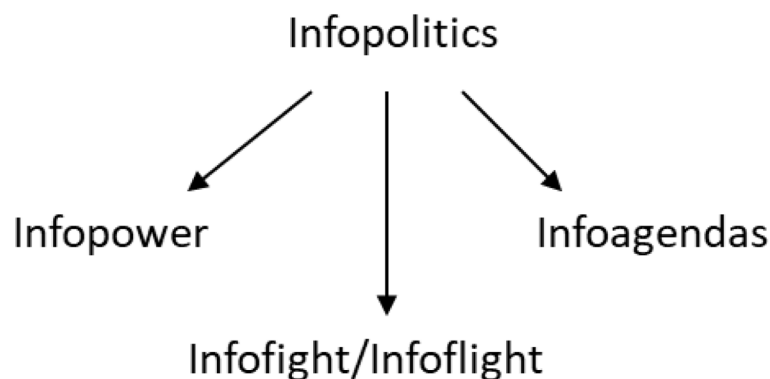
The essential phenomenon of infopolitics is the power that is associated with informing agents in conjunction with controlling these or with some effects of interaction between these and homo informaticus (actors). This will be called informing power or infopower, and defined as follows: infopower refers to the ability of subject A to make subject B do something that B otherwise would not do, based on B's perception that A has certain abilities related to informing agents. Therefore, the basis of power is in informing agents, as opposed, to other entities, such as authority (formal rights, privileges). Instances of infopower are expert power and management of meaning, which were already discussed above. Infopower can also emanate from controlling data sources, outputs from IS, and access to IT. In sections further below, different categories of infopower will be introduced, with ontology of informing agents shifted from the resource view to the domains of symbolic and physical.

The here advanced definition of infopower is a special case of the well-known conceptualization of social power used in organization theory. The conceptualization bridges Dahl's (1957) political definition of power (the asymmetric relationship between A and B) with French and Raven's (1959) typology of organizational power (the premise that B perceives that A has some special ability) (cf. Clegg & Hardy, 1996; Hatch, 1997; Pfeffer, 1987). To illustrate with the example of expert power, A can affect the way B thinks and acts in a certain domain because B believes that A possesses relevant domain knowledge.

Being derived from the concepts of social power, our concept of infopower builds on certain propositions inherited from the parents. These are:

- 1) Infopower is a sort of social force that has causal properties. It is stable over time, and it continuously induces cognitive and behavioral changes. This proposition is consistent with commonly accepted premises on power, excluding temporary influences from the conceptual space (French & Raven, 1959).
- 2) Infopower can be analytically approached from three aspects:
 - (I) a potentiality aspect or a structural condition (the relevant capabilities of B as perceived by A);
 - (II) a process or action aspect (A's action affecting B); and

Figure 1. Components of infopolitics



- (III) a consequence aspect (the change in B's thinking and/or acting that would not otherwise occur).

The structural condition I is complex in itself, as it includes B's perception. Perception is a complex process in itself, and it may or may not have a referent in the physical world. People may think and do what bogus experts suggest because of uncritical trust attributed to experts. Only a test of their expertise can help one to break out of the dependence on the false expertise. Consider a contrasting scenario in which A really possesses relevant, valuable knowledge, but B is mistrustful or simply unaware of it. In this case, no power relationship will be established.

In these cases, B's perception plays a generative role in the power relationship. Further to aspects I-III above, note that they are inter-related. However, they cannot be taken simply as constituents of a linear additive model. For example, does the process of power (aspect II) always have to occur for the power consequence (aspect III) to happen? Say, B makes decisions in the way A would like B to do it, but without A's actually intervening. Consider referent power. Interaction between A being a charismatic leader and B may never happen and A exists just through B's concepts and mental imagery that are more or less supported via communication media—press, documents, TV, books, memorabilia, etc. Extremely, the leader may be dead and yet continue to influence the followers via mental and physical symbols and various institutional forms. It follows that A's action affecting B may not be necessarily present for a power relationship to work.

- 3) Infopower does not include intention as a necessary condition. Although A possesses knowledge that B could benefit from and intends to use it for influencing B, expert power will not materialize unless B recognizes a knowledge asymmetry and a need for A's knowledge. And the opposite is true, as already mentioned in the context of referent (point 2 above): A may have no intention of influencing B, but B will be influenced because B appreciates A's expertise. The consequence is that infopower is invariant of A's intention. What about B's intention?

Although it has a generative capacity, intentionality on B's side is not necessary in cases of power relationships that are internalized and institutionalized so that they work by inertia. Usually, accustomed methods of problem solving continue to exist for some time after their creators are gone. Old and new organization members may keep using the methods without questioning their origin or value, and the power process approximates automatic behavior caused by internalized organizational culture. It follows that intention on B's side may not be manifested in some scenarios of infopower relationship. Presuming that power in general is indeterminate of intention is consistent with Giddens' (1984) position (pp. 8-12).

- 4) The definition of infopower is open to both formal and informal contexts. For example, A as a manager has a formal right to allocate IT to B, whereas A as an IT specialist has an IT-related expertise that could work as a basis of power on an informal basis. Balancing the formal and informal contexts in studying infopower is important since the same informing agent can be the basis of different categories of infopower (e.g., a manager controls patented knowledge as part of authority/legitimate power, while a professional the same to wield power over peers in a social network).
- 5) The concept of infopower applies to different levels of analysis: power can be placed in the interpersonal, between-unit, and inter-organizational contexts (Pfeffer, 1978). This proposition implies that incumbents of the A and B roles can be abstract, a product of social interaction or social artifacts. This idea is also implied in the concept of legitimate power: since the authority attached to

particular positions in organizational hierarchy is the basis of power regardless of the individual incumbents, it can be said that the social structure “dominates” the individual. Some interpretations of social institution are agreeable with this consequence. The possibility of abstraction of the power relationship beyond the interpersonal level of analysis prepares the ground for technology to take a more active role in power establishment.

- 6) Infopower can flow in all directions—horizontally, upward, and downward the hierarchical ladder. Data, meaning or knowledge can be resources of power emerging among peers. Also, a secretary who is a proficient user of an IS may influence decision making of a superior who is lacking such technical expertise. It is also true that a knowledgeable superior can enlarge his/her power owing to the possession of a special expertise. This all-direction property of infopower differentiates it from some other types of power, such as legitimate power (authority).
- 7) Infopower has both domination and autonomy aspects. Giddens (1979, 1984) contributed to understanding power in these dialectical terms (more below; also see Chapter 4.) The standard definition of power used in organization theory focuses analysis on the *power over* aspect or power as domination/dependence. A dominates B that is dependent on A. The domination/dependence facet is salient and important and it fits particularly authority as the type of power (legitimate power in French and Raven’s (1959) vocabulary). Philosophically, the backdrop is the master-slave dichotomy that could be traced back to a line of important philosophers and sociologists in Western thought. However, it can be argued that the power relationship can be more completely grasped from a dialectical perspective. While it is apparent that A has freedom to act, a not so trivial implication is that A would not have such freedom if B demonstrates no dependence. If B does not perceive that A commands a particular resource of interest, A has no autonomy indeed, and consequently a power relationship is not established.

As it is argued in Chapter 2, perception is not a passive process but rather one in which B acts as agency. For example, perception of A’s special ability can vary across individuals and situations, and this fact can influence variation in the extent of A’s power. But, B has some autonomy even *vis a vis* authority. It is at B’s discretion, even in severely constrained conditions of physical restraint, to decide to accept or reject A’s order. The power to say “no” means autonomy of B’s side, and it precludes enactment of legitimate power. Whistleblowers can stop wrongdoing of those in authority positions; “nay”-sayers stop demagogues and dictators.

All the propositions above are important for understanding the concept of infopower. The dialectical aspect of power illuminated in Giddens’ structuration theory is of particular interest. In the next section, we will turn to relevant points from this theory, since it provides a general foundation for all the categories of infopower we will purpose in this chapter.

Dialectic of Infopower

Giddens (1979, 1984) postulates that power is omnipresent since it is a defining characteristic of human agency (actors). Power refers to the capability of people to produce an effect, or bring about some change—intentionally or unintentionally.³ Therefore, action does not occur without power. That is why power is a “transformative capacity.” Power is generated by the actors deploying resources. But power is not only about bringing others into dependence, a zero-sum game, as it is often assumed. When actor A acts upon legitimately allocated resources toward actor B, A is constrained by rules (a part of domination

structure) and by autonomy of B. As Giddens (1979) noted, “Transformative capacity is harnessed to actor’s attempts to get others to comply with their wants, and it depends upon the agency of others” (p. 93). Although A strives to bring B into a dependence position, B can also act upon available resources and create a domain of autonomy. In Giddens’s (1979) words:

Power relations therefore are always two-way, even if the power of one actor or party in a social relation is minimal compared to another. Power relations are relations of autonomy and dependence, but even the most autonomous agent is in some degree dependent, and the most dependent actor or party in a relationship retains some autonomy. (p. 93) Therefore, autonomy and dependence co-exist, located on both sides of a power relationship, even though in asymmetry. This symbiosis of autonomy and dependence Giddens (1984) terms with *dialectic of control* (pp. 16, 374).

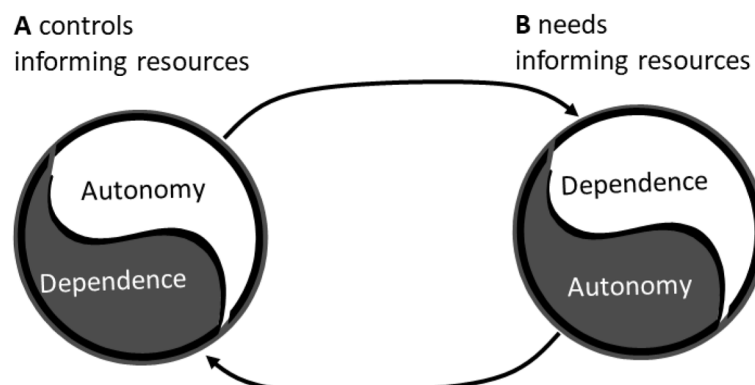
Resources are crucial in power action. Resources are the “bases” or “vehicles” of power (Giddens, 1979: 69). Structures of domination involve asymmetries of the resources employed (ibid, p. 93). As discussed in the context of infostructure (Chapter 4), resources are the media whereby transformative capacity is employed as power in the routine course of social interaction. Resources can take the form of authorization (capabilities which generate command over persons) or allocation (capabilities which generate command over things) (Giddens, 1984: 100).

These ideas frame a dialectical ontology of infopower. Infopower action draws on informing agents as the resources, and manifests the dialectic of dependence and autonomy. This proposition is depicted in Figure 2. Infopower rests on informing agents (data, knowledge, wisdom, and IT) as resources (informing resources, for short), and it plays out in social relationships exhibiting the dialectic of dependence and autonomy. Control over the informing resources by actor A can establish dependence of actor B, while B always has some autonomy to act back. Without this autonomy, it would indeed be impossible to establish dependence because B makes choices ranging from the denial to total acceptance of A’s influence. For instance, subject B can reject dependence on A’s expertise (and get self-educated) or on A’s control of data and IT resources (and seek for alternatives).

Modalities of Infopower Based on Resource Perspective

In the following sections, infopower will be discussed from a resource perspective. Three categories of infopower will be discussed: data/IT control, expert power, and meaning management (see Table 1).

Figure 2. *Dialectic of infopower*



Data and IT Control

Data and IT control is the category of infopower that refers to the capability of subject A to make subject B do something that B otherwise would not do, based on the A's control of data and/or IT. Therefore, data and IT pose as the resource for power or, in Giddens' (1979) parlance, as the medium of transformative capacity. The controlling agency can have a hold of either data or IT or both; in the last case, control is exercised over an IS, since system refers to data, IT, and procedures.

The concept of infopower based on controlling data formalizes the popular credo that "information is power." A typical example refers to a manager that has special privileges for accessing business data. These data enable the manager to understand the state and perspectives of business (the manager transforms the data into meaning and knowledge) and make decisions that affect subordinates. In following the decisions, the subordinates do not only accept the manager's authority (legitimate power) but they also acknowledge the asymmetry in informing. Because the manager has access to the data that the subordinate is deprived from, the manager's decision is taken as legitimate one. Thus, control over data (one kind of infopower) purports legitimate power.

A number of organization scholars made a connection between "information" (i.e., data) and power. Examples include Burns and Stalker (1961), Wilensky (1967), and Hersey and colleagues (1979). The data that form a basis of power can vary in scope and in levels of organization. Subject A can also time and contextualize the data in ways that arouse/cater to needs of subject B. Burns and Stalker (1961) argued that "information" could be an instrument for changing or preserving status in organizations. Hersey and colleagues (1979) proposed a concept of "information power;" for example, when somebody follows the suggestion of a colleague who has read the firm's strategic plan, that person is exposed to information power (cf. Goodstein, 1981). Provided that the term "information" in these works approximates our concept of data that can become meaningful and potentially add to one's knowledge, all these are examples of infopower that originates from controlling data.

Control of IT is also the source of infopower. Put in Giddens' terms, IT is the type of resources that is related to capability of allocation—command over things. On this basis, the party in need of IT is dependent. An example is allocation of terminals for accessing human resource management systems. In order to cut down on clerical costs, companies today allow workers to query and to enter some of their personal data into the system. If this access is controlled by clerical staffs, then they have infopower over the deprived workers.

Table 1. Categorization of infopower based on resource view

Infopower Category	Concept	Resource
Data/IT Control	A can change B's conduct based on A's control over data and IT. (Burns and Stalker, 1961; Hersey et al., 1979)	Data, IT
Expert Power	A can change B's conduct based on B's perception that A possess knowledge that B needs. (Crozier, 1964; French & Raven, 1959)	Knowledge
Meaning Management	A can change B's conduct based on B's expectation that A can mediate definitions of reality. (Pettigrew, 1977, 1979; Pfeffer, 1981)	Meaning

Less trivial than the plain control over the allocation of IT are manifestations of power when control of *both* IT and data is involved. In this case, the resource is an IS as it contains both data and IT. A familiar contemporary example refers to supervisors' control over the content of computer screens of office workers. The windows-based user interface (graphical user interface) makes it easy for running multiple systems in different windows, including those that have no direct relationship with the job. In one window a clerk can run a spreadsheet she regularly works on, while hiding in the background a window that connects to a Web store. To prevent such "cyberslacking," employers have resorted to various forms of controlling the screen. These include the automatic blocking of the Web browser with respect to accessing Web sites in certain Internet domains, filtering out graphical files, and automatic monitoring of the content of screens.

The similar familiar example concerns control over the content of CMC systems. In highly formalized and hierarchical organizations, it was clearly defined from the beginning that owner of the content was the employer. A good early example was a policy on using an IBM's computer conferencing system, which was inaugurated in the implementation process (Travica, 1991). But many organizations did not regulate this area and went through a "heroic period" in which the "heroes" on the employee and on the management side fought against each other. The former ones strived to protect privacy of employees' communication, while the latter ones fought for total control over CMC systems. Although anecdotes of the employees' autonomy gains were registered, disproportionally larger gains in autonomy were accomplished on the employers' side, as the judicial precedents in their favor accumulated over time. Eventually, in North America companies' policies have concurred that the employer as the owner of CMC systems has full authority over these systems; consequently, ownership extend on the messages exchanged.

New technologies revive the old power issue and associated conflicts. Consider the IT for instant messaging, such as chat systems. These systems rest on a store-and-forward network that allows for exchanging textual messages in real time. A sender's message is transmitted to a dedicated messaging center that forwards the message to a recipient. If unavailable at the moment, the delivery could be automatically attempted latter. Two basic types of instant messaging systems are the Internet-based ones and the mobile (cell) phone-based systems that use short message service (SMS), also known as "texting." Let us concentrate on Internet-based chat systems that have been used extensively in North America.

Instant messaging systems are interesting from the perspective of infopower because they have several unique characteristics. First, these systems support transient communication. As opposed to email, conversations are not automatically stored. This makes chat similar to the telephone. Email stores copies of sent messages automatically, and this documenting capability is part of the usefulness of email for different actors in the organizational context. But the documenting capability has conspicuous implications for infopower. Although various actors have stakes in this regard, their relative infopower gains are likely to be asymmetric because their initial power positions are not symmetric either. In principle, if a company's policy clearly allocates control over the content of communication to employer, the employer can use this right to monitor email storage. In this case, control over IT is the basis of the manager's infopower. In contrast, the unrecorded word that transpires via chat channels cannot be controlled. In this situation, employees can use IT to preserve autonomy of their communication (under the condition that chat log files, if they exist, are not monitored externally).

The next interesting characteristic of chat is functionality that translates into social awareness. Once logged into a chat facility, the user is "present" and visible to everyone. Someone's absence in the chat window is also registered, and it may be interpreted by others as the physical absence—which may or

may not be true. From the power perspective, the affordance of awareness implies that supervisors and peers can control whereabouts of the given member. But a member is not powerless. He can manipulate the monitoring and simulate presence by merely logging in the chat facility, and the move away from the office. In principle, others can be consistently made to believe what they would not if they had other perceptual data available. In all these instances, it is control of data rather than of IT that creates the basis of infopower. A function in chat systems designed to prevent such an outcome tracks if the computer is actually used (e.g., typing on the keyboard). Another interesting function with social implications is communication synchronicity. As with the telephone and in contrast to email, this characteristic eliminates arbitrary time lags in responding. Consequently, control can be shifted to the sender since the receiver cannot avoid responding without a legitimate excuse.

Quan-Haase and colleagues (2005) studied an instant messaging system in a small, high-tech organization. The system tracked automatically the state of users' activity. The user name would appear in black if this person was typing on the keyboard, and would become shaded when the user did not type. Some users indicated that managers could use this feature to control their work, and characterized it as an abridgement of their privacy. Users tried to manipulate this monitoring by letting computers run continuously. The researchers also found that employees considered chatting with superiors via the IM system preferable to face-to-face communication. CMC allowed time for deliberation in situations involving difficult decisions, sensitive topics, and expected disagreements with superiors. This was a "shield" for the employees, which helped them to keep the superiors at a distance. Overall, this study reveals how the employees and managers in one company struggle to use a chat system toward securing and enlarging their autonomy and dominance.

Finally, it is to be noted that a look back at creative uses of GSS discussed in Chapter 3 can reveal a variety of ways in which system users can create a domain of autonomy.

Meaning Management

Meaning management refers to infopower that is based on B's expectation that A can mediate a right understanding of reality. This category of infopower can exist with or without help of IT. When included, IT can strengthen the extent of meaning management when it is systematically used or managed toward that end. One should be cautious to differentiate between a random impact on the meaning others create management and a continuous, predictable impact that a power relationship engenders (refer the discussion on power assumptions above). Communication has a paramount role in meaning management because the meaning occurs as the consequence of exchanging data between communication actors—whether synchronically or synchronically.

There is a bridge between meaning management and infopower based on data/IT: the former can be antecedent to the latter. The difference between these two categories of infopower is in the locus of autonomy. Data/IT control appropriates most of autonomy for the controlling subject A, while subject B is apparently dominated. In contrast, with meaning management subject B obtains significant autonomy because meaning emerges in B's mind rather than being simply transferred from A to B. Therefore, meaning management can somewhat rectify the disproportional asymmetry of autonomy that characterizes the data/IT form of infopower. This characteristic supports the notion of power as transformative capacity pertinent to both sides in power relations (Giddens, 1979).

The Bradshaw-Camball (1991) study, which was cited in the literature review, indicates an instance of meaning management. The article does not indicate if IT played a part in their account of meaning

management other than citing instances of using paper reports, memos and other documents. The systematic distortion of financial data used in the budgeting process unfolding in a hospital, invoked an illusionary definition of reality shared by the hospital's board, employees and the Ministry of Health. The basic idea of meaning management has similarities with Goffman's (1959) *impression management*. According to Goffman, people play roles in everyday life with a purpose of conveying to others certain impressions about themselves. Several techniques are used to this end. From this perspective, the administrators played their role of whistle blowers, believing (to some extent) that the role was righteous. In addition, they engaged in a dramatic realization by using verbal and non-verbal communication in order to highlight and emphasize the extent of the budgeting issue. In effect, the administrators succeeded in planting and managing the scary definition of reality (a threat of the hospital's bankruptcy) that was accepted by their multi stakeholder audience. The dependent position of the audience, which fed the power of the administrators, was founded on this same definition of reality the administrators were able to mediate. The audience did not take much action to enlarge its autonomy.

Another instance of meaning management is in the mentioned study by Sarker and Lee (1999). The team of professionals charged with authority to propose redesign of the entire company used offensive terms for signifying areas of process improvement they considered easy to implement. In effect, they managed the meaning of the process in employees' mind, albeit clearly in an unhelpful direction from the perspective of implementation efforts. From the perspective of employees, however, this meaning "mismanagement" implied a much larger domain of autonomy than implied in the case presented Bradshaw-Camball (1991). The former autonomy could be measured by the degree of deviation of a created impression from the intended impressions. Contrasting these two studies also teaches that communication competence is an important mediating variable in modeling management of meaning.

Note that meaning management also surfaces in the Quan-Haase and colleagues' (2005) study of the instant messaging system in a high-tech company. These authors also discovered that some users manipulated their online presence in order to induce in supervisors' mind favorable perceptions of themselves. These users would keep being logged into the chat system regardless of their actual location, thus potentially creating a false impression that they were continuously in the office. Therefore, infopower of data/IT control can be related to meaning management as a necessary condition for it.

The origin of the concept of meaning management is in organization theory. Pettigrew (1977, 1979) is one of the authors responsible for initiating the concept. In his conceptualization, meaning management refers to the means of achieving legitimacy of ideas, values, and demands as well as of de-legitimizing the same on the opponents' side. To have power, one needs to rally support for his agenda, and placate and undermine the agenda of other contenders for power. Such legitimacy is important for stability of power and for preempting the space for conflict. Pfeffer (1981) has also contributed to understanding meaning management by relating it with leadership. According to this author, one aspect of leadership refers to promoting values and a worldview with reference to what a leader believes is important for an organization.

These concepts of legitimacy and leadership are relevant for understanding fully meaning management as one category of infopower. In the IS field, this requirement translates into the old adage that strategic and larger scale systems in general cannot be accepted with a greater rate of success without support of upper management echelons. This support is instrumental in ensuring that employees perceive a new system as legitimate. Note that the lenses of IS studies usually have not been tuned for capturing the aspect of meaning management, and so one can make just indirect inferences regarding the upper management's efforts invested in legitimizing systems. For example, the top management at Norsk Hy-

dro (Hanseth et al., 2001) supported the new ERP system, while support of the mid-level management was not as firm. The end results were mixed. In Sarker and Lee's (1999) study, top management did not engage into legitimizing the new systems and work organization via meaning management. The whole implementation effort failed.

In the system adoption process, the IS department or IS expert groups/individuals can engage in meaning management. In the utilities company Travica (2007) studied, the SAP group aired different explanations of annoying flickering of computer screens that were part of a new human resources management system. While different end-users had different understanding of the technical causes, all were convinced that the technical problems were impossible to solve at the time. In fact, this conviction did not correspond to the facts. By airing messages on various technical difficulties, the SAP group invoked a mass impression that the screen behavior could not be repaired. Indeed, the SAP group prioritized maintenance requests as it deemed it appropriate.

The infopower stemming from controlling data and meaning can also be associated with a position in communication networks. Examples include boundary spanners that serve as the interface between an organization and environments (purchasing and sales people) as well as various gate keepers like secretaries, and colleagues connected in various "loops" (see Aldrich & Herker, 1977). For example, administrators play a role of communication star that appropriates power characteristics captured in the network concept of centrality.⁴

Expert Power

Expert power is the category of infopower that refers to the capability of subject A to make subject B do something that B otherwise would not do, based on the A's command of knowledge that B depends on. Expert power is a potent resource of infopower. The well-known article on power types by French and Raven (1959) is generally credited for introducing the concept of expert power. The leads on expert power can be found in even older literature. For example, Thompson (1949) studied war airplane crews that depended on the maintenance staff for the reliable operating of the planes. Crozier's (1964) study of the maintenance staff in tobacco factories provided similar evidence. These workers were the only party capable of facing the uncertainty of machine breakdowns that would unexpectedly occur due to variation in the size of tobacco leaves, had the expertise necessary to repair the machinery running, and were irreplaceable in their roles.

Pfeffer (1981) also contended that the condition of being irreplaceable is necessary for expert power to exist. Several methods are used to achieve this status: no recording special knowledge, keeping comparable experts away from the organization, and using an exclusivist professional jargon. Mintzberg (1983) argued that experts are professionals have power that is not rooted in formal organizational authority but in self-coordination, teamwork, and mutual adjustment within non-bureaucratic organizational forms. Mintzberg emphasized that doing something others cannot do (similarly to facing uncertainty and being irreplaceable) is a condition that need to accompany to expertise if professionals are to wield power. Barley (1986, 1990) found that knowledge of operating computer tomography gave a power boost to tomography technicians over radiologists who previously enjoyed more power.

Conditions for exerting expert power could be seen in Markus' (1983) study. Corporate accountants had knowledge of accounting procedures that managerial accountants were no familiar with. When the new system was implemented in congruence with these procedures, managerial accountants could not keep the step. In IS research, IT-related expertise was conceptualized as the basis of expert power of IS

professionals (Markus and Bjørn-Andersen, 1987), but evidence is inconclusive (Hann & Weber, 1996). Bradshaw-Camball and Murray (1991) portrayed administrators of the hospital they studied as experts that enjoyed trust of employees and the Board with respect to financial matters (cf. Jasperson et al., 2002). As we discussed it at several places, the most salient category of the administrators' power was infopower of managing meaning. It is true that they also had legitimate power in financial planning. The study, therefore, indicates accumulation of different kinds of power of which expert power could be one.

At Google, expert power of software engineers is salient. These professionals have much of discretion and respect in conducting their dedicated research time (20% of work hours). At one point, a software engineer spent millions of dollars in two years on their project only to end it unsuccessfully. A top ranking executive stood in the professional's support and even delivered a public praise for a bold, creative effort. In addition, managers have a balancing rather directive role. The evaluation of work performance runs both down. Rather than just being evaluated, professionals also evaluate semi-annually the performance of their managers. Professionals appreciate technically competent managers who empower rather than micromanage, have a vision and strategy for a project team, and are able to facilitate career development. These criteria resulted from a careful investigation and massive analysis of data related to hiring, employee evaluation, and exit interviews. Management evaluation has delivered measurable benefits for Google. Some managers have found themselves in a contradictory position as their unfavorable evaluations from below contradicted the opposite evaluations from above. Congruent with nurturing expert power, managers strive to adjust to new methods of managing via formalized training. (Eideman & Eisemann, 2011; See Garvin, 2013; Hill & Stecker, 2010; Hill & Stecker, 2010a).

It is important to note that expert power can flow bottom-up, thus violating the traditional hierarchy of authority (legitimate power). As stated in the proposition 6 above, a secretary who is a proficient user of an IS may influence decision making of a superior who is lacking such technical expertise; for example the secretary can extract richer or poorer data from the system than his/her boss, and this can, in turn, influence a decision the boss will make using these data. How-to-do knowledge associated with modern IT is an increasingly important basis of expert power, which may be in tension with other types of social power. On the other hand, the possibility of gaining expert power by acquiring the knowledge of operating modern IT and IS extends the power base to employee groups with no formal authority (e.g., the clerical staff). Likewise, professionals can expand their knowledge base by acquiring IT skills. The price to be paid for IT-based expert power is in learning costs.

Based on the literature, it can be said that expert power has several interesting properties:

- It applies to both horizontal, upward, and downward interactions;
- It can coexist with other types of power and moderate their effects (e.g., A's legitimate power over B may not be wielded in the same way when B has expert power over A than when B does not have it);
- It necessitates both special knowledge and putting it in action (facing uncertainty), so that one proves to be irreplaceable.

New holders of expert power are arising with the advent of Big Data trend. New kinds of specialists emerge that combine computational, statistical, and mathematical competences. A salient such specialist is data scientist. New specialists for Big Data challenge infopower of IS professionals. A tension between the two groups is moderated by organizational designs allocating Big Data specialists in different ways.

Big Data operations can be organized into specialized units. General Electric (GE) assembled a Big Data unit with 400 professionals (Davenport, 2014). This is centralized design. Once exclusively a manufacturing company, GE is remaking itself into a software company that uses Big Data to optimize its own production processes as well as the production in other companies and industries (Markman, 2016). At the opposite end is decentralized design. Big Data specialists are allocated into business departments to support operational or strategic decisions making. This design has been tried at RTI International, a U.S.-based non-profit research institute that offers research, development, and technical services to governments and commercial clients worldwide (Gabel & Tokarski, 2014). As the senior management realized that the company's services need to engage Big Data in order to stay relevant, they involved organization members in deliberations over updating the company's structure. Challenges quickly surfaced. For example, moving a statistician from the statistics department to a new area of health data management collided with traditional perceptions of professional identity and career path. On the beneficial side, a closer alignment of new data practices and business needs was achieved.

The last attempted organizational design for Big Data designates a unit within a company's IS department for Big Data experts. Procter and Gamble has used this design. While bringing together the Big Data and IS brains may have benefits of competence combining, power implications can be challenging. The same applies to decentralized design. In contrast, centralized design insulates Big Data specialists from immediate power struggles. These are moved up to the executive level where CIO faces new entrants into the C-suite (for example, Chief Analytics Officer and Chief Data Officer). While expert power is most salient, the arena of social power is likely to host all the types of infopower discussed in this chapter.

In summary, from the resource perspective, infopower refers to the ability of subject A to make subject B do something that B otherwise would not do, based on B's perception that A has certain abilities related to informing agents. Infopower builds on several propositions: infopower is a social force/cause; intention is not a necessary condition for it; infopower applies to formal and informal contexts and different levels of analysis; it can flow up and down hierarchy and horizontally; and infopower exhibits both domination and autonomy aspects. Inspired by Giddens's (1979, 1984) work, the last proposition provides a philosophical backdrop to our concept of infopower. It implies that infopower is both a capability of subject to act and to accomplish one's will (autonomy, transformative capacity) and a structural constraint imposed upon subject (domination). The resource view differentiates between three types of infopower: data/IT control, expert power, and meaning management. Relevant literature for each of these and appropriate examples were discussed and the advent of Big Data as a new source of infopower noted.

INFOPOWER BEYOND RESOURCE PERSPECTIVE

Power related to organizational informing agents can be approached from a broader ontological perspective. The following discussion will cover ontologies based on premises of institution, symbol, and object (Figure 3). The argument will bring different artifacts to the fore, which can function as a transmission of power between social actors (institutional infopower), as a source of affordances that undergo symbolic transformation in cognition (symbolic infopower), or as an uncontrollable force that temporarily deviates radically from design and use intentions (actant's informing influence); refer to Table 2. Apparently, with the symbolic and actant approaches, the argument will reach beyond the scope of traditional sociology that locates power within the confines of structure and action.

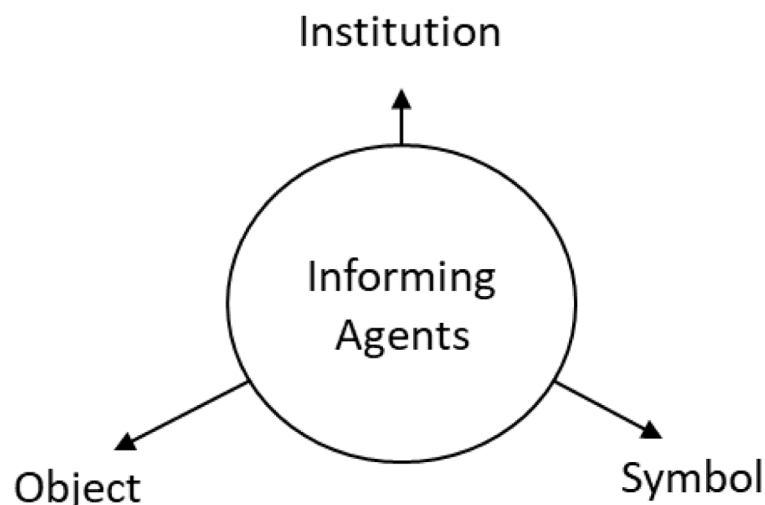
Technology as Institutionalized Power

The institutional theory is part of social ontology of technology (as discussed in Chapter 4). Although it is less encompassing than the structuration theory, the institutional theory is sometimes useful to invoke in order to emphasize that power is embedded in IS, knowledge and other informing artifacts.

The institutional approach looks into the patterns of social relationships and their diffusion. In general, institutions are stable patterns of social relationships, which have or exist through material manifestations. Law exists via court facilities and particular roles modeled into certain relationships; markets exist via physical or electronic spaces that contextualize the buyer and seller roles; and informing in organizations exists via IS and practices that juxtapose the roles of informer and client. Law, market and organizational informing are social institutions—patterns of relationships framed as social roles and their relationships. In the institutional view, IT and IS do not matter as functionality supporting work tasks but rather as an expression of particular social relationships. This perspective makes the drawing board for the concept of institutional infopower.

Berger and Luckmann (1966) contributed to the institutional approach. Following leads of Max Weber, the authors pay particular attention to a concept of role. They posited that an institution is nothing else but a “totality of roles” (p. 75). Extending this position to the domain of IS, we can identify certain types of ISes that prescribe roles for predefined kinds of users. Indeed, activities of system analysis and design start with defining actors or typical users. In UML methodology, these are literally called “actors.” These roles carry bundles of the work and power related assumptions regarding access and manipulation of data. For example, a certain ERP product defines “chief” supervisory roles as opposed to lower authority roles. In fact, an ERP software package can embed entire horizontal and vertical structure of organization. Implementing such a system means implementing a new organization. Any larger scale IS may be a transmission of the established power distribution. For example, a system for tracking and reporting expenses can replicate the entire hierarchy in charge of expense approvals. When such a system

Figure 3. Ontology of infopower



reveals the names of approvers, the real hierarchy featuring clerical staff charged by approval authority may appear surprising.

The origin of institutions that ERP systems impose comes from organizations and organizing methods that an ERP vendor chose to encode in its product. Sometimes these are called “best practices.” It follows, then, that the implementation of an ERP system imports roles and their relationships as prescribed by the ERP software vendors and a larger institutional binding they abide with. This results in *organizational isomorphism* in terms of overall organization. Power distribution is also affected, and, consequently, infopower. Indeed, the infopower setup in an ERP system models the distribution of social power. Therefore, diffusing power/infopower models via ERP systems can explain institutionalization of organization fields (industries, geographical regions).

Systems with a high level of automation can also embed power relationships. Weick (1990) argued that system designers could operate on diverse assumptions. These appear to resemble the classical dichotomy of management philosophies based on assumed personalities X and Y. If the human factor is considered unreliable and the system is assumed reliable, the system design would be more “directive.” In contrast, assuming a reliable, organized and learning-oriented user could lead to system design that is more “delegating.” (pp. 36-38). Therefore, Weick’s position supports the institutional view of power as well as our *leit motif* of duality of infopower. The autonomy of a system operator is system-determined. In principle, the operator has as broad and as deep infopower as the institutional role implemented in system’s design allows.

There may also be other systems that reflect social asymmetries. Organizations implementing the systems, in fact, plant the asymmetries into their own contexts. The heuristics for assessing a technological potential for institutionalization can use two dimensions—*system complexity*, and *system flexibility*. System complexity can be measured by the number of interacting elements, such as data objects, procedures, and system modules.⁵ System flexibility can be measured as the extent of possible changes of the system characteristics. The more complex and the less flexible a system, the more likely it is to reflect predefined power relationships. Large scale ERP systems are more complex and less flexible. Age of systems is an intervening aspect. For example, older database systems serving individual departments were less flexible than comparable modern systems. Permissions for accessing and manipulating data (in the IVO view, *infohierarchy*) were more difficult to set and change in older than in the newer database systems. The former ones would, then, be higher on the institutionalization potential than the latter ones.

From the institutionalization perspective, expert power is embedded in products. Products can blend in other dependencies as well. Expert knowledge is institutionalized in software products even if its creation cannot be traced to a clear plan or author. The open source movement can serve as an interesting example. The software developers in this movement make their products available for everyone, provided that the code users share the results of their work in the same way. Some noteworthy software emerged in the form of open source (e.g., versions of Unix operating system, several programming languages for it, and the Apache Web server). This amorphous, complex social movement, which appears as if it pulsates “on the edge of chaos” (Heylighen, 1996)⁵, may be conceived as a form of VO (Travica, 2005). An open source VO is loosely *aggregated*, electronically inter-connected, and having *cybernized* production processes and a *switching* membership. It also delivers such unique creations that can be characterized as *special products*. These products mediate power dependencies albeit in a tacit fashion.

Knowledge and the unplanned work of many developers making open source VOs embed various organizational and management assumptions in the combinations that can take by surprise even the developers themselves. Open source products establish dependences between IS experts and users, user

roles with different privileges, software processes that carry business processes and consequently between business process performers, public and private data, and so on. Since large corporate players entered the open source community, chances of infusing dependences between software components inside and outside the open source have increased. Consequently, some open source may necessitate commercial software for achieving optimal functionality. As the product of the peculiar VO form, software takes a life on its own similarly to the institutional character of market: while being a product of interaction of many actors, a market relates to each of them as an alien force which can even kill. A company adopting open source software is susceptible to infusing power into its fabric.

Being fixated on unveiling inconspicuous dependences, the institutional perspective is adept at explaining their sources. Rooting his analysis in political economy, van Dijck (2013) exposes corporate interest that shapes the world of social media. Owners of social media speak a benevolent language in which clients are called “communities,” customers “friends,” and phrases abound with references to sociality, such as common good, community, utility, sharing, you, consensus, and so on (pp. 64-5, 174). However, the author argues that the users’ need for connectedness is manipulated for corporate monetizing interest since the users’ behavior is continuously monitored and their profiles sold to advertisers that create personalized and behavioral marketing strategies. Ads are pushed onto users without much chance to opt-out. The connectivity functions of social media serve monetizing interest as well. Users are urged to connect with others via various connectivity functions social media systems support, and peer pressure is engineered via technology. All this increases the target base for advertising. Also, heavy users (at Facebook, people who have many “friends”) may be engaged by advertisers in brand promotions among their pers.

Van Dijck (2013) argues that company owners and system developers produce “agents and social forces” and that “they can exercise economic and political power to change or sustain existing hierarchies and deploy their technologies to do so” (p. 18). What users may consider their space is controlled by technological and commercial forces. The author further argues that “most of the normative stakes are hidden: buried in the defaults and algorithms of each platform’s interface design, in the filtering of users and content; in ownership strategies and governance policies; and last but not least, in business models” (p. 174). Therefore, social media systems wield power of corporate interest over masses of users who may be aware or not of these influences. Technology is the key conduit of power relationships.

In sum, the institutional character of infopower reveals itself in power relationship embedded in and reinforced by informing agents.

Symbol Infopower

Symbolic dimensions of interaction between people and technology are important for research occupied with cognitive phenomena and technology interacting with these. In IS research, Markus and Bjørn-Andersen (1987) argued that one aspect of power of IT professionals was symbolic—shaping users’ values and desires pinned to IT. Note that the concept of symbol infopower advanced here relates to meaning management as well. It will be argued that IS artifacts have a symbolic existence that is related to unique ways in which individual users experience IS. The IS artifacts include IT, procedures, and data.

Whereas an infinite array of symbols can be mapped, we are interested in those that have to do with users’ autonomy and dependence. These engender symbol infopower grounded in cognitive ontology (Table 2). To explore symbol infopower, one has to enter the inner world of mind, consisting of mental imagery, emotions, and connotative meanings. This is the domain *homo informaticus*. Symbol infopower

is as opaque as institutional infopower, although these demand different analytical optics—sociology vs. semiotics and psychology, respectively.

An IS can be a symbol of heaven, hell, and of an infinite range of things in between. IT experts may find a special joy in “hacking” the programming code, “playing” with new “toys” (software), and exploring vast cyberspaces of computer networks. A new system symbolizes progress, improvement, opportunity, increment in power of both the machine and user, and the like. More pragmatic but still proficient users may associate a system they regularly use with efficiency, dependability, and professionalism. But if a system implies a significant change in the organization of work and in infopower relationships, it can acquire negative connotations. Myers and Young’s (1997) case shows that health care professionals’ antagonistic attitudes toward introducing market principles in health care rendered a new IS to a symbol of “big brother” (p. 235). For these professionals, the system meant unfair treatment and threat to their status. Similarly, the doctors in Lapointe and Rivard’s (2005) study resisted a “significance” of the EMR systems. One summarized the antagonistic perceptions by saying, “their damned machine... we hated it” (p. 477). For the chief user group, the EMR systems symbolized nuisance, tediousness, time waste, and decline in professionalism.

The symbolist view of organization has been advanced by organizational anthropologist Czarniawska-Joerges (1992). It has been developing on its own and partly in conjunction with the cultural and communication views of organization (Gagliardi, 1996; Martin & Frost, 1996; Putnam et al., 1996). Czarniawska-Joerges starts with the premise that symbol stands for something else than itself and means something beyond itself. In other words, symbols have connotative rather than denotative meanings. Objects, acts, concepts, and linguistic formations can be symbols. Symbols stand ambiguously for a multiplicity of things, evoke emotions, and impel to action. The author posits individuals and groups manipulate symbols for the purpose of gaining and maintaining power. It is not difficult to recognize in these propositions the theme of meaning management.

The works of Gagliardi (1996) and other psychologists studying the problem of meaning are also relevant for our concept of symbol infopower. Gagliardi (ibid.) argues that “artifacts structure sensory experience and enlarge or narrow the range of behavior that is materially *possible*” (p. 569). He contends that it is difficult to separate function of an object from their meaning as symbols, and, hence, an object as a symbol has the “power” (quotes are original) derived from its “capacity of awakening sensations, feelings and reasons for acting” (p. 570). The author argues that symbols can connote almost anything that is or could be:

The stimulating and creative role of an inanimate symbol shows itself in a special way when it stands not for something else that exists, but for something else that might exist, in which case it is not a symbol of reality but a symbol for reality. (p. 570)

Following up Gagliardi’s line of reasoning, consider the endless debates among opinionated computer users, which flood corporate turfs, classrooms, professional meetings, and public discourse: the Mac vs. PC camp, Unix vs. Microsoft, CORBA vs. .NET, and so on. Proponents in each of the opposed camps believe that their favorite choice is superior because, among other things, “it gives you more power.” It is rarely clear what “power” means—functionality, usability, optimized use of system resources, an architecture that is more open to the user’s intervention, or some combination of these and beyond. When the PC and the Mac confronted each other in early 1980s, the programming-oriented users opted for the PC since they appreciated direct access to the DOS operating system and an opportunity to program the

machine. They rejected the Mac's architecture as being closed for manipulating the operating system and for programming. The Mac followers felt precisely the opposite: the programming opportunity bore no value proposition for them, and Mac was their ideal machine that relieved the user from looking under the hood. While, for the Mac users, the blank screen of PC has symbolized an inimical *terra incognita* offering no resources for survival, the same screen connoted a promised land of opportunities for the PC users. The antipode symbols referencing power—autonomy and domination—have viewed the backdrop to this brand confrontation.

In the example above, the symbol power has a group anchoring, which indicates a point of connection between the symbolist and the institutional view of infopower. Still, the group dynamic starts with individuals. The domain of symbols in individual cognition is immense. A particular IS can become a symbol (e.g., a module of an ERP system), and a bundle of ISES can be a symbol (e.g., modules of ERP serving different purposes). Particular aspects of a system can become a symbol, such as user interface or some detail of it. The informing artifacts can also be symbols, such as a book, a display, and concepts used in the context of systems design, adoption, and use. For casual and novice users, computer taken as a whole can pose as a symbol. Users may attribute an infinite array of meanings to these symbols, possibly connected with their emotional responses to the stimuli. The individual symbol making process is particularly apparent when the esthetical dimension is brought to bear. The shape, style, color, and materials used can make an impact. Notice how the shape, colors and materials of many computer brands are bland in comparison with alternative appearances as in Apple products and some laptop and smart phone brands. Blend industrial design is unlikely to be esthetically appealing. Contrary, esthetically pleasing industrial design may stimulate the affective response and the symbol-making process.

The domain of user interface is another good example of the role of the esthetical dimension, although it is more complex since other dimensions are also involved. Eye-pleasing screens may be an important point of attraction for users with a strong esthetical inclination. Initial attraction might develop into a feeling of happiness associated with familiar, comfortable places. Thus, the particular user interface and the system it belongs to become a symbol of such a place. In our analysis this means that the user interface becomes a symbol of autonomy for the given user. Still, since user interface provides the user's view of the system's functionality and data, the esthetical requirement is brought into a dialectical relationship with these two. All the dimensions need to support each other, because each of them succeeds only if the user interface as the whole is accepted. On the other hand, each dimension struggles for its own "turf" on the computer screen. The trade-offs game is in full motion. Different users may weigh differently esthetics as opposed to access to functionality and to data operations (data entry and display) a certain user interface exhibits. Here is the point at which the subjective factor intervenes. Whereas one user may attach the absolute value to the legibility and simplicity of the display of quantitative data, the other might feel bored by screens filled monotonously with Spartan tables. Symbols of autonomy and domination linger again in the background.

The domination aspect can take serious proportions. It can emanate from affordances that Gagliardi (1996) calls "malignity of objects" by which he means that "irreducible materiality and otherness of some objects constitute a radical challenge to subjectivity" (p. 570). Constraints on users can also emanate from informing artifacts. Recall the study of BPR by Sarker and Lee (1999). The terms used by the BPR implementation team to signify small fixes they delivered came to symbolize a threat to professional dignity and to individual security. These symbols reflected on the whole BPR project, which consequently turned into a symbol of mass execution.

In sum, the symbolist view illuminates important aspects of infopower by explaining subtle, affective aspects of human interaction with technology, which result in autonomy and domination effects.

Actant's Informing Influence

Can technology (any) be agency of power? This question asks if matter (object) *matters* beyond interests of social actors built into it and beyond symbolic transformations in user's psyche. Discarded as an illegitimate topic in organization theory and characterized as technological determinism (imperative) in the IS field, the question has been addressed in actor-network theory (ANT). The proponents of ANT have given an affirmative answer to this question (Callon, 1981, 1986; Latour, 1987, 1988, 2005; Law, 1986, 1991). The following is a brief look at ANT ideas in preparation for proposing the last modality of infopower in this selection—*actant's informing influence*, which is based on materialistic ontology (Table 2).

Actor-Network Theory

Proponents of ANT have developed a complex vocabulary. A central concept is that of *actor*. Actor must make a difference or it is not an actor (Latour, 2005: 130). Actor is both human and non-human, both people and objects (sometimes called *actant*). The pool of actants is indefinite. An actant may be an automatic door opener (Latour, 1988), scallops in the sea (Callon, 1986), an accounting information system or its hardware and software components (Law, 1991), a geographical information system, Internet standards and technologies, a document, and anything that becomes associated with other actants and with humans within actor-networks (Hanseth & Monteiro, 1997; Risan, 1997; Walsham, 1997; Walsham & Sahay, 1999).

By bringing together the social and the technical, ANT resembles the socio-technical approach. One difference is that neither the technical nor the social are givens. Rather, both reside in indeterminate actor-networks, understanding of which is an empirical question. This epistemological difference is coupled with a crucial ontological turn: technology as well as other objects are attributed the character of agency. Latour (1988) has made this point explicit by declaring that he does not share the social bias of traditional sociology but rather sees only actors—some human, some nonhuman, some skilled, some unskilled—that exchange their properties (p. 303). Further, he finds that preoccupation of sociologists with an “object-less world” is peculiar, since all of us are “puzzled by the constant companionship, the

Table 2. Infopower ontology

Ontology	Infopower or Informing Influence	Concept
Social	Institutional	Power relationships are embedded in IS and knowledge and shape work practices.
Cognitive	Symbol	Technology as object or a conception stands for (triggers, symbolizes) meanings that relate to user's autonomy or dependence.
Materialistic	Actant's Informing Influence	Uncontrollably functioning technology that radically deviates from design and use intentions and temporarily influences mind and action of the user.

continuous intimacy, the inveterate contiguity, the passionate affairs, the convoluted attachments of primates with objects for the past one million years” (Latour, 2005: 82-83). Much of human competences are built (“delegated”) into technologies (“non-humans,” or “lieutenants”), including the ways of using them; in return, technology “prescribes” social relationships. Therefore, objects *act* as people do and they “tie together parts of our social world” (p. 310). But in conceiving the character of technology, Latour’s position is less revolutionary. In an analysis of a door closer, he argues that the tool’s capability of *prescribing* human behavior is results from a designer’s *inscribing* the functions and uses into the door closer. Therefore, technology is still an inscription of the human and social.

Since objects prescribe human behavior, act, and tie together the social world, studying social relations without them is impossible. The ANT approach, therefore, intends to revise sociology’s traditional focus on relationships between people by including objects in the scope of study. In Latour’s (2005) words, one needs to replace sociology of the social with “sociology of associations” (p. 9). Epistemology of such sociology is formulated in *actor-network* analysis. Actor-network analysis seeks to identify a process of *translation* by which one actor promotes his interest and engages other actors (Callon 1981, 1986). Translation starts with a *problematization* step, in which a focal actor tries to pull other actors in purposeful action. (Callon 1986) The focal actor establishes their identities and links between them, and defines goals or some program as an *obligatory passage point*—a checkpoint that other actors pass or fail. At the following step of *interessement*, the focal actor tries to cut off links between network actors and outsider actors. The devices of *interessement* can be tools, texts, conversations, and other objects.

The step of *enrollment* follows after *interessement*. *Enrollment* refers to defining and coordinating role or “multilateral negotiations, trials of strength and tricks that accompany *interessements* and enable them to succeed” (Callon 1986: 211). Section, transaction, consent and physical means alike can be the ways in which enrollment is achieved. *Mobilization* follows when actors are rendered mobile: the actors perform. If previous steps were deficient in some respect and if new non-cooperating actors become involved, *betrayal* may result, and the network project fails. If the project succeeds, an actor-network is *irreversible* and returning to a previous step is impossible. Latour (1998a) argued how certain technical solutions used in the Paris subway made this technical system irreversible: in order to prevent railroad companies from taking over public transportation, the Paris government at the end of the 19th century decided to make subway tunnels smaller than the smallest coaches of the railroad companies. For decades to come, this *irreversibility* locked in certain actors, while locking out others.

Ontology of power in ANT follows from premises behind the concepts of actor and actor-network: since objects are members of actor-networks in which they make a difference, objects are power agency. Objects are “mediators through which inertia, durability, asymmetry, extension, and domination is produced” (Latour, 2005: 85). Power is “about the way in which objects are constituted and linked together” and it can be “stored” in objects (Law, 1991: 185). Law (1986) declared that hands “betrayed” an experimental researcher whom he studied. Latour (2005) argued that actant power is different than the classical causal force: “there might exist metaphysical shades between full causality and sheer inexistence” as “things might authorize, allow, afford, encourage, permit, suggest, influence, block, render possible, forbid” (p. 72). But at other places these stipulations leave little or no trace. Indeed, Latour (2005) asserted that traditional social science has given limited roles to objects, such as those of a material infrastructure, a mirror reflecting social distinctions, or a backdrop for human action (p. 84). And this is how Latour (2005) commented on Callon’s (1986) study on attempts of Normandy oceanographers to apply a new method of cultivating scallops:

Scallops make the fishermen do things just as nets placed in the ocean lure the scallops into attaching themselves to the nets and just as data collectors bring together fishermen and scallops in oceanography. (p. 107)

Latour (2005) insisted that that actor-network was a concept, not a thing, a tool for analyzing associations in the domain of study, or the “flow of translations” (pp. 131-132). This voluntary aspect of actor-network confirms the character of indeterminacy, which characterizes ANT in general.

In evaluation, while IS researchers began using ANT as a new interpretive framework (e.g., Hanseth & Monteiro, 2004), ANT still needs validation, ideally in comparative fashion, with the goal of determining a differential insight it adds to other qualitative methods. Some ideas regarding actant indeed resemble Gagliardi’s (1996) work discussed above. But the important difference is that ANT theorists eliminate the cognitive component from their analysis, thereby juxtaposing subject and object directly, or eliminating the differentiation between subject and object (object is subject). This is where the first weakness of ANT lies, as it is unclear what explanation it can provide beyond rudimentary materialism that science of physics deals with or beyond the institutional view (indeed, the ANT notions of enrolment, inscribing and irreversibility are cognate to basic ideas in institutional theory).

While the attention ANT has paid to technology as object is welcome, founders of the approach have sidetracked electronic technologies and particularly IT. When they get close to addressing IT, analytical depth is rather lacking.⁶ In addition, ANT proponents still need to demonstrate using ANT for predicting IS phenomena (IS design, adoption, evaluation, etc.) rather than just interpreting the past. But the most contentious area is the ANT core—ontology that equalizes physical things, humans, and other biological forms. It espouses arbitrary criteria for defining the scope of analysis. Determining the boundaries of an instance of ANT may be subjective since the world of associations is potentially limitless (“scallops *make* the fishermen *do* things;” fishermen’s nets “lure the scallops;” the hydraulic door closer “draws” human energy, and so on).⁷ Having expressed this critique, it is also to be noted that ANT contributes in emphasizing materialistic ontology (even though it appears blended with ideas from other ontologies) and in attributing technology with a more active role in social arrangements. After all, material existence of technology cannot be denied, which fact is overshadowed in exclusivist alternative ontologies. Is technology matter a sheer conductor of social relationships, or this matter matters only as it is appropriated in mind? Should we mind technology matter as such? These are legitimate questions demanding further theorizing rather than a sealed answer.

When Actant Acts

As long as the social character of IT design is identifiable, IT cannot be viewed as the object that acts out of its own volition. The IT object neither possesses transformative capacity, nor can it create a domain of autonomy subjugating the human in permanent dependence. Objects are often an inextricable part of the social world, but even if the objects manifest an “irreducible materiality and otherness” (Gagliardi, 1996), they are essentially just human design “inscriptions” (Latour, 2005). The institutional approach explains this well, even in the instances that are meant to prove domination of objects (the above cited Latour’s (2005) example of subway tunnels in Paris is indeed a good example of institutionalizing power of the Paris government over private transporters via design of subway tunnels). Even the savvy robotic products of artificial intelligence cannot conceal their human origin (Mico, 2011). Therefore, if an actant “dominates,” it is still just a conduit of another actor’s domination.

With rise of ubiquitous computing, however, data are automatically generated and processed at many locations. An example is the Big Data trend. New technical capabilities can compose pictures of the citizen, employee, customer, competitor and the like. These pictures then influence action of the government authorities, employer, seller, producer, and other informed parties. Although the automated composing process is not autonomous in its origins, the distance between its deliverables and designers can be significant. The same applies to open source products and Web services. The institutional content inscribed in technology objects is fogged due to a complexity on both the technical and developer side. IT and IS that result from such spontaneous, very flexible development processes may reflect only remotely intentions of the contributors. Complexity and randomness in the design process insinuate the actant character of resulting IS.

Technology can go awry, as in several cases of nuclear plant disasters. Perrow (1984, 1999) argued that unpredictable combinations of errors in complex technology amounted to a nearly unavoidable “normal accidents”.⁸ Of course, IT is part of control systems deployed in high-tech organizations and thus it is responsible for normal accidents. Or, consider the possibility of corruption of financial data by chance, within a database system or in transfer. Such errors can propagate through corresponding IS in hardly predictable ways, ending up in reports that drive decision making. Therefore, IS that run adrift from designer’s and user’s intention resemble an actant.

Complexity and randomness in IS design and prolonged, undetected errors in IS functioning constitute a scenario that is not covered by either the institutional or symbolic view of power. The term “actant’s informing influence” is coined to refer to this scenario. The concept borrows the label from ANT as well as the inspiration for materialistic ontology. But certain boundary conditions delineate this concept from attributing agency properties to the actant. The term “influence” limits longevity and the extent of informing effects. The actant influence is temporary as contrasted to stability of a power relationship. The extent is limited due to variation of the influence across individuals and dependent on cognitive states (e.g., a person’s thinking and feeling processes). In contrast, power involves a deeper dependence unaffected by chance variation. This ephemeral character likens actant’s informing influence to the concept of persuasive influence used in communication theory.

Actant’s informing influence may become increasingly important with an enlarging scope of automation and software-intensive systems used in “smart” buildings, city traffic regulation, hospitals, telecommunications, cosmic weaponry, and so on. Still, unless technology starts designing, maintaining and reproducing itself on its own, agency character cannot be attributed to technology.

Summary

The institution, symbol, and object were discussed as alternative ontological approaches to the resource view of infopower. In this broader ontology, the cognitive and technological informing agents can function as a transmission of power between social actors (institutional infopower), technology can undergo symbolic transformation in cognition (symbolic infopower), or technology can be actant that is distant or deviant from design (actant’s informing influence).

The literature background to each of these infopower modalities was elaborated, including a critical look at Actor-Network Theory.

AGENDAS AND BEHAVIORS OF INFOPOLITICS

This section completes the discussion of infopolitics by looking at the remaining two aspects—infopolitical agenda, and infopolitical fight/flight.

Infopolitical Agenda

Infopolitical agenda (informing agenda, infoagenda) refers to goals, strategies and tactics related to achieving and maintaining infopower as well as other political goals. Self-interest, including aggregations of it through deal making, is the most productive generator of infopolitical agendas. An infoagenda can have various goals. The most salient and frequent is to gain, preserve and enlarge infopower. Since infopower is often part of other power types, infopolitical agendas tie into larger political agendas of individuals and groups.

Markus' (1983) case cited above indicates infoagendas of two professional groups, which that played out during the process of implementing a financial information system (FIS). The corporate accountants (a new professional group) had an agenda calculated on changing accounting practices and they pushed for implementing new standards in design of FIS. In contrast, divisional accountants had the infoagenda of preserving the status quo. These two groups were possibly exponents of different management levels—the executive vs. middle level. Myers and Young (1997) exposed a hidden infoagenda of managers in a health care organization in New Zealand. In an attempt to compete more effectively for government-controlled funds, the managers pushed for implementing a system module for tracking time-based costing of services. This module was not included in initial system requirements by the management. Both managers and the steering committee that included clinicians maneuvered with this module throughout the development process.

Different infopolitical agendas and their associations with infopower can be traced in the study by Walsham and Waema (1994). They studied in a longitudinal fashion the strategies and various organizational aspects of a company in the British financial industry. The firm underwent two developmental phases. The first was characterized by the concentration of power in hands of the President and his executive team, "autocratic style of management," a proliferation of ISes with the focus on customers and short-term financial gains, and overall bottom line achievements. The second phase dawned with a new President, and was marked by decentralized decision making, participatory management, and unfinished systems development cycles. This case reveals relationships between infoagenda and infopower: the former is in function of the latter. In the first phase, infopower was centralized, and the President directly influenced systems development (he had a significant experience in both the professional and IS domain). His infoagenda was directly in function of centralization. He abandoned committees, thus silencing multiple voices in the systems development cycle. This resembles the micropractice of disqualification (Deetz, 1992). Also, he would tell bluntly his team and IS managers what he expected from them, and would not take a "no" for an answer. Diametrically opposite, a new President in the second phase attempted to change radically the power distribution and organizational culture. He shared infopower with other managers. He also championed a new infopolitical agenda indicated by the inclusion of employees in creating IS strategies.

In summary, infopolitical agenda (infoagenda) refers to goals, strategies and tactics related to achieving and maintaining infopower as well as other political goals involving informing agents.

Infopolitical Fight/Flight

Infopolitical fight refers to the struggle for achieving one's infopolitical agenda. Another name for fight is conflict. A fight always has a target—opponents that are perceived to stand in the way of achieving one's own agenda. Infopolitical flight refers to negotiations and coalition making that aim at achieving one's infopolitical agenda. Infopolitical flight involves aligning of self-interest between individuals. Large groups can engage in flight behaviors.

The literature cited above provides evidence on infopolitical fight and flight. The study of American local government organizations by Danziger and colleagues (1982) indicated that power holders engaged in infopolitical flight in order to influence design of new computer-based systems. The Markus (1983) study identified fight between financial and management accountants over data flows, accounting standards, and report content. The Zuboff (1988) study revealed opposed agendas and fights between groups and individuals, which revolved around control over data and IT. The hospital case by Bradshaw-Camball and Murray (1991) showed how the management of meaning staged by the top administrators spilled into the realm of infopolitical fight. This included the labeling of the Ministry of Health with pejorative and ironical terms.

Furthermore, the Norsk Hydro case (Hanseth et al., 2001) shows that infopolitical fight can take place between different executive and mid-level levels of management. The fight erupted over different agendas—one pulling toward infocentralization, the other away from it. The Sarker and Lee (1999) study revealed a variety of mutually incongruent infoagendas and corresponding infopolitical flights and fights (the president vs. vice presidents, these two vs. employees, and planning team vs. employees). Lapointe and Rivard's (2005) study unveiled flight and fight behaviors between doctors, nurses and administrators, which erupted with the deployment of new EMR systems.

In summary, infopolitical fight behavior refers to the struggle for achieving one's infopolitical agenda, while infopolitical flight refers to negotiations and coalition making that aim at achieving one's infopolitical agenda. Ample evidence supports these concepts.

A CASE OF INFOPOLITICS

This last section in his chapter will demonstrate aspects of infopolitics in a case of festival organization in Canada. Although the case organization is rather low-tech, the case demonstrates well the concepts discussed in the chapter.

The festival organization, which is code-named "Pavilion," participates every year in a summer festival. It usually faces about two dozens of competitors. Each of these is organized similarly, as a hybrid of voluntary organization and small business. The Pavilion's staff consists of volunteers, and there are no paid positions. Although it is a voluntary no-profit organization, Pavilion's goal is to make money for supporting community needs. This economic driver likens pavilion to a small business. Pavilion sells a genuine show program, home-cooked food and retailed drinks during the festival period. In the rest of a year, the members work on preparing these offerings.

Clan Infopolitics

Pavilion had gone through two phases in its development—Clan Era, and Teams Era (Figure 4). Each can be explained from the stance of infopolitics.

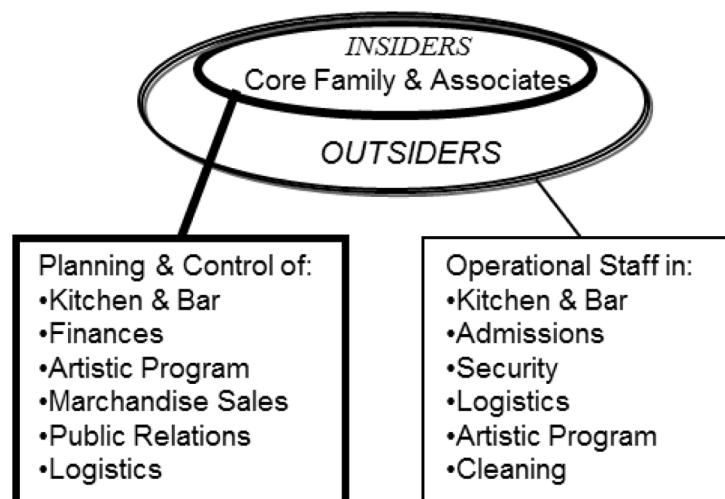
The Clan Era was characterized by the domination of a group dubbed “insiders” and depicted in Figure 4. Insiders consisted of a biological family and its associates. The family used to run the Pavilion as a family business: the mother led the food preparation function, the father controlled finances, and the son supervised the artistic program and other key operations. The associates had say in some important pavilion functions, such as merchandise sales, and logistics.

Juxtaposed to the insiders were the outsiders. They provided hands for the pavilion functions, having little influence in decision making. These were the operations of kitchen and bar, admissions, security, and performing in artistic programs. This organization can be characterized as a simple form typical for small entrepreneurial organizations (Mintzberg, 1979). It was flat, centralized, and lower on formalization. Personal influence, agreement and improvisation compensated for the lack of formal rules and regulations.

The insiders liked to run the Pavilion based on their experience. The operations were tracked via a paper trail inaccessible to outsiders. There was almost no strategic documentation. There were no manuals on how to organize certain pavilion functions, manage relationships with inspectors (sanitation control, fire protection), or to manage volunteers. There were no lists of suppliers or organized records on revenue and expenditures. Loose as it was, this data management was coupled with an animosity toward computers. Indeed, this was a staple of the clan infopolitics.

Any proposal to introduce computers in the Pavilion would be vigorously turned down with the argumentation: “We survived without computers so far, why use them now?” Consequences would surface in difficult recalls of past solutions and events. Knowledge loss was apparent, as indicated in lengthy meetings in which the attendees coped with the question, “How did we do it?” In agreement with Ouchi’s (1980) propositions, IS were not a priority in the clan organization, as it neither tracked organizational performance nor adhered to clear procedures.

Figure 4. Political setup of the pavilion in the clan era
(Adapted from Travica, 2005)



The clan infopolitics faced a challenge when a new supervisor emerged from the outsider echelon. A new comer with a socially prestigious status, this person came to power due to opportunistic circumstances. He managed to develop a good rapport with insiders, who did not perceive him as a threat to their position. However, soon after taking over, the new supervisor mobilized a team of capable and willing outsiders. Lulled in a feeling of invincibility, the insiders approved the appointments.

The new leadership focused on revamping the organization of Pavilion, quality of service to be delivered, and finances. But most of these initiatives fell on deaf ears of the insiders. However, the fresh thinking appealed to an increasing body of volunteers. The new leadership was effective in demonstrating “transformative capacity” (Giddens, 1979, 1984). It gradually built its referent power (French & Raven, 1959), based on demonstrating professional and personal qualities. A growing group of reform-minded bubbled up around the new leadership.

At first instinctively, the insiders began fighting back the reformers. Their usual vehicle was to *disqualify* outsiders by reminding them that they missed competence for dealing with organizational and management issues (cf. Deetz’s, 1992). But instead of engaging others in an apprenticeship relationship, the insiders kept a tight lid on their knowledge. The new supervisor had to beg, cajole, and offer counter-services to get a piecemeal advice. Even details of electrical installations in the Pavilion building were guarded as personal knowledge. This monopoly over knowledge was guarded by the practice of *topical avoidance* (Deetz, 1992). When asked for help and advice in public, an insider would readily switch the topic and offer some palliative advice, such as, “Do not worry, things will be done in due time.” In other words, the new leadership was at the receiving end of expert power of the insiders. This monopoly gave the decisive stamp to the infopolitics of the Clan Era.

Over time, the insiders consolidated their resistance into a staunch opposition. But this did not deter the reformers. The new leadership introduced computers wherever these could perform better than paper trail. For example, spreadsheet software was used for tracking expenses and income. Also, communications within the supervisor’s team were based on email, while some other formal communications utilized paper reports and memos. The new leadership made some progress in introducing an email infoculture that allowed for documenting decision making processes. This move inadvertently closed off the loop for insiders, as many of them were computer-illiterate.

The factions clashed in yet another arena of infopower that is charted by the management of meaning. While the insiders talked publicly about Pavilion as “hospitable home” and “family place,” the outsiders countered by labeling the contemporary Pavilion “tight ship” and “underground.” Speaking of Pavilion as it could be, they preferred the terms “business” and “economic enterprise.” These opposed vocabularies indicated opposed infopolitical agendas. Their public displays in meetings would usually recruit supporters on both sides and sometimes result in discussion impasses.

By the end of the first year of new leadership, improvements were registered in financial performance, cost control, fund raising, recruitment, planning, and operational scheduling. Still, the old power circle was not broken, although it suffered a deep crack. Insiders maintained a firm grip over the main profit center (food operations), and resisted at almost every step in both the strategic and operational domain.

Teams Infopolitics

In the following Festival year, Pavilion moved into a Teams Era. The supervisor who started changes under the old regime continued his tenure. A complete revamping of Pavilion’s leadership and organizational design swiftly followed. Pavilion was moved to rented facilities located in an affluent neighborhood.

Table 3. Trajectory of infopolitics in Pavilion

Clan Era	Teams Era
<i>Infopower</i>	
- Insiders command expert power by monopolizing knowledge on organizing Pavilion; - Insiders control operational records; - Insiders use methods of disqualification and topical avoidance. - Outsiders show transformative capability and strive for referent power, while being subjected to expert power of insiders. - Insiders and outsiders clash for managing meaning of “Pavilion.”	- Knowledge of new environment, modern data management and computers makes the power basis. - Transformative capacity demonstrated and expanded by creative action of teams.
<i>Infopolitical Agenda</i>	
- Insiders’ interest is to preserve the status quo in the distribution of data and knowledge - Outsiders’ interest is to overturn it. - “Pavilion” spun as “hospitable home” and “family place”	- Outsiders’ goals involve an overall modernizing of the Pavilion’s informing agents. - “Pavilion” spun as “business” and “economic enterprise.”
<i>Infopolitical Fight and Flight</i>	
- Outsiders fight against insiders’ limited sharing of data and knowledge, and opaque data management. - Rejection of computers and IS.	- Open communication channels and team spirit prevail. - Acceptance of computers for records management and communication.

The simple organization of Pavilion was dismantled with the introduction of new team-based functions and a vertical differentiation. Each functional team had its leader handpicked by the supervisor or his closest co-workers. Team leaders were responsible for assembling the volunteers on their teams as well for organizing and managing operations. Team leaders reported to the supervisor on an as-needed basis.

Owing to the experience accumulated and records saved in the previous year, the knowledge monopoly of the insiders was eradicated. Unfamiliarity with the new facilities was the final blow into insiders’ monopoly. Knowledge sharing increased, access to organizational data expanded, and functional teams became new form of intelligence where learning through collaboration was the way of life. Therefore, new infopower was distributed rather than concentrated in a center. Teams demonstrated a significant transformational capacity that brought about unprecedented changes in the strategy and operations of the Pavilion.

The leadership aggressively pushed for enlarging IT support. The management of financial data was completely overhauled, various electronic reports were created and dispatched via email, a Website for marketing purposes was developed, and email became the communication channel of choice. Gone were the infopolitical fights with the former insiders, which used to drain volunteers’ energy. Instead, the Pavilion members joined in a flight around shared goals. The fight around managing meaning of what “Pavilion” disappeared as well when the members agreed that Pavilion was to be run as a business. Better performance in the informing domain was paired with bottom line improvements. The revenue grew over 2.5 times, while the gross profit/revenue ratio nearly doubled, in spite of the location switching costs.

What does the epilogue of this case look like from a fifteen-year distance? Most of the reformers decided to establish a new cultural association, while the old timers resurged and revamped their favorable organization. The Pavillion split into two separate organizations.

In summary, the case of Pavilion demonstrates that infopower was based on controlling informing agents (knowledge, data, meaning, and IT). Infopower was first concentrated in hands of few—the insiders of the Clan Era. In the following Teams Era inaugurated by reformers, infopower was distributed among functional teams and it included electronic IT as its basis. In the Clan Era, infopolitical fights and

opposed infoagendas between insiders and reformers made consequential components of their differing infopolitics. The clan infoagenda rejected electronic IT, while the infoagenda of reformers embraced it. The lack of technical expertise effectively excluded the clan regime from the power distribution and Pavilion management.

SUMMARY

This chapter discussed informing politics (infopolitics), an important aspect of IVO. Infopolitics was defined in terms of power, agendas, and flight/fight behaviors, which are related to organizational informing agents. The phenomena of infopolitics were tracked back to the relevant literature in the fields of information systems and organization theory. Infopower, the central concept in infopolitics, was defined from resource perspective in terms of the ability of subject A to make subject B do something that B otherwise would not do, based on B's perception that A has certain abilities related to informing agents. Further, general assumptions behind theorizing on infopower were discussed. One of the assumptions, Giddens's (1976, 1979, 1984) dialectics of autonomy and domination, was elevated to a philosophical backdrop to the concept of infopower; this was termed *duality of infopower*.

Manipulative communication techniques (Deetz's, 1992), which may go unnoticed in organizations, were discussed and their relationships with infopolitics demonstrated. The discussion expanded to a three-member categorization of resource-based infopower: data/IT control, expert power, and meaning management. In addition, alternative ontological views were proposed based on the premises of institution, symbol, and object. It was argued that IS could embed social power (institutional infopower), pose as symbols of autonomy and domination (symbol infopower), and drift from designer's intentions (actant's informing influence).

Infopolitical agenda (infoagenda) was defined in terms of goals, strategies and tactics related to achieving and maintaining infopower, and infopolitical fight was defined in terms of a struggle for achieving one's infopolitical agenda. Infopolitical flight was referred to negotiations and coalition making aiming at achieving one's infopolitical agenda. These concepts were traced to the relevant literature. The chapter concluded with a case that demonstrated concepts of infopolitics.

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ENDNOTES

- ¹ The part on Deetz's repertory of micropractices was written by Dr. Branko Kovacic from the University of Hartford, USA, who is expert in organizational communication.
- ² *Meaning denial and plausible deniability* is another name for "strategic ambiguity" (Nonaka and Takeuchi, 1995). But see the discussion on instrumentation of this method for knowledge management purposes that may yield beneficial outcomes at the macro-organizational level.
- ³ Curiously enough, Giddens' sophisticated theory starts with a lexical definition in the case of power. In the beginning of his second capital work, Giddens (1984) cites Oxford English Dictionary's definition of agent as "one who exerts power or produces an effect" (p. 9).
- ⁴ There seems to be no apparent good way of integrating power concepts from theory of social/communication network with those from organization theory and from the IS field (specifically, with the concepts of infopower discussed in this chapter). By the absence of "good way" we mean that power concepts from network theory cannot be related to power concepts in the other areas on the one-to-one basis and in the mutually exclusive fashion. For example, *centrality power* may be conceptually likened to both *expert power* and *management of meaning*. Measurement issues pose even larger problems. Some sort of relating power concepts across the board, however, would be desirable because network analysis may tap into deep, often clandestine aspects of power by concentrating on identifiable social aspects, such as communication links, and an actor's position within a network.
- ⁵ Complexity can be defined by a lack of symmetry or by the fact that no part of a complex entity can provide sufficient data to actually or statistically predict the properties of the others parts. Complex organization can be analyzed by using two basic dimensions—distinction and connection. Distinction corresponds to variety, and it leads to disorder, chaos or entropy. Connection corresponds to interdependency of parts, and it allows for predicting the features of unknown parts from the knowledge of known parts. Complexity sits between extremes of order and disorder, while having characteristics of both. Complex organization exhibits neither perfect disorder (which can be described statistically through the law of large numbers), nor perfect order (which can be described by traditional deterministic methods). In other words, complex organization exists "on the edge of chaos" (Heylighen, 1996). My concept of system complexity can be understood as a subset of Perrow's (1984/1999) concept of interactive complexity, which includes the technology's provisioning of many control parameters with possible interactions, unfamiliar and unintended feedback loops, and indirect and inferential sources of informing.
- ⁶ Latour tends to examine simple technologies in his arguments, such as the hotel key or the automatic door closer. The later device is used in his 1988 article that may be a good and undoubtedly entertaining introduction to ANT, although some of the terminology used there was not retained later on. Consider the lively world of skills, knowledge, organizational purposes, economic, political and moral order Latour portrays by analyzing the hydraulic door closer. A door with a hydraulic door closer mounted on it sets apart a building wall from that of a tomb, immensely eases circulation in and out of a room, and regulates the temperature inside the room and keeps its content contained. The door allows for easy entry of visitors, while unnoticeably borrowing a bit of their energy for powering the automatic closing action. Tedious manual labor is eliminated along with politics of labor relations associated with this labor.

Furthermore, the door closer prescribes a certain ways of using the door. For example, the entry is easy if the door is pushed lightly by an adult of average physical characteristics, while very small and very old persons are “prescribed out.” The *prescriptions* are a consequence of a designer’s *inscribing* the functions and uses into the door closer. Thus, provided that the maintenance is performed properly, the automatic door will reliably perform the inscribed useful action—do the “right thing,” perform a morally correct act. We only become aware of a whole bundle of complicated, manual operations or skills that the automatic door closer substitutes for when the door “goes on strike” (malfunctions). Therefore, in the ANT view, this simple device acts visibly by performing several physical and social functions.

Latour (2005) criticizes traditional sociology by claiming that the former does not treat an installation of a new telephone switchboard as a social act, which it is in his sociology of associations. In the IS field, Latour’s position is far from innovative. Or here is another example: “The British Empire is not only ‘behind’ Lord Kelvin’s telegraph experiments, it is also given a reach, a faster reaction time, a durability”... The Empire is “made to exist by telegraph wires.” (ibid., p. 108). Again, what Latour posits is merely an ordinary proposition or hypotheses in IS or communication research.

- ⁷ Using ANT logic, a rabbit has a power over a cabbage when eating it because the cabbage would not expect to be eaten; the wind has power over a leaf when moving it from stillness to wave; a rock that a cyclist accidentally hits and which destroys his wheel has a power over the wheel and the cyclist who now has to walk back home; electrical current has a power over the computer circuitry for moving it from the idle to a working state; this physical fact has power over the computer’s operating system as it now has to work; the operating system has power over application software that it can automatically activate; application software has power over the user since the user may have to accomplish his tasks in unexpected ways the software prescribes...

And relations can be read in the opposite directions as well. The cabbage has power over the rabbit for making him eat it, although the cabbage is badly polluted; the leaf has power over the wind by blocking a free passage for the leaf; the computer has power over electrical current for consuming it; the user has power over application software as he activates it ... The context for each of these examples could be some actor-network, thus fulfilling the ANT requirement. ANT proponents may discard these examples as unduly caricatures, but such a denial would not contribute much to resolving ontological and epistemological challenges of ANT.

- ⁸ According to Perrow’s (1984, 1999) Normal Accident Theory, complex technology (understood as a bundle of work tasks and material technology) is always vulnerable to failure. Just because a certain technology has not failed in the past does not mean it never will. This uncertainty is unavoidable, and so we live with the permanent risk of technology accidents, including rare catastrophic breakdowns. A position that emerged partially in opposition to this theory is called the theory of High Reliability Organization or of Organizational Mindfulness (Weick, Sutcliffe, and Obstfeld 1999). It stipulates that organizations can mitigate normal accidents if they deploy certain strategic and tactical methods.

Chapter 7

Infoprocess

ABSTRACT

This chapter explores the concept of infoprocess, which is defined in terms of interrelated informing activities that deliver an outcome to a customer. The concept of infoprocesses involves aspects of data, cognition, and their intersection that results in information. Concepts of process in various disciplines are examined, including two approaches relevant for IS research: business process reengineering (BPR) and business process management (BPM). An analytical framework focused on process design and performance is elaborated. Decision making is then discussed from the process perspective and big data impacts on it are examined. A process-centered organization and its technology are explored. The second part of the chapter focuses on processes in the virtual organization. Its various forms are discussed, including the ecosystem. Finally, challenges of the time aspect of process are explored. A note on digital transformation and IoT ends the chapter.

INTRODUCTION

This chapter is about understanding organizational informing agents and their organizational context from a process perspective. This perspective is akin to the *systems theory* (general systems theory, cybernetics, etc.) although still distinct. Systems theory is a parent to IS field and has made a significant impact on organization theory. IS cannot be thought of without invoking systems thinking. Although this thinking has not been used as persistently in organization theory, it certainly has a significant place in the broad repertory of organizational views. From the general systems perspective, organizations are understood in terms of interrelated parts that work together to produce certain deliverables.

Organization theory and the IS field, however, are much less congruent with regard to the *process approach*. In the IS field, which roughly splits into a technological camp and a behavioral camp, process thinking has many implementations. For example, in the area of systems analysis and design, an organization is analyzed in terms of interconnected tasks creating a particular deliverable, that is, organizational or business process (the term procedure is often used in practice, although process is usually a larger whole than procedure). Systems analysis leads to identifying the place for technological support to the process in the form of IS. A computer-based IS consists of software processes that automate parts of or

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entire business processes. development the process approach is focused on programming and software processes. And recently promoted IS strategies, such as business process reengineering (BPR) and business process management (BPM), exhibit a resolute process orientation.

In contrast, organization theory has not treated process as a particular view of organization, but rather implied it as part of the systems view of organization. A notion of process is engaged, but only at the macro-organizational level. Organization is conceived as a process of transformation of inputs (materials, labor, money, informing content) into outputs (a service or a physical good). This premise has then been adopted in various instantiations of the systems view interested in the relationship between organization-as-system and its environment (e.g., the contingency and ecological approaches). Various assumptions have been coupled with the systems view, such as Darwinian evolution. For example, the adjustment of an organization to its environment is conceived as a process of differentiation of organizational structure in order to become isomorphic (to match) with the complexity of the environment (Lawrence & Lorsch, 1967). The process paradigm has been influential in other disciplines as well, such as philosophy and theology.

This chapter is about the process approach as part of IVO. After discussing general concepts of process, the attention will focus on business process and then on the central topic—infoprocess. If business process is a set of activities that transform some material and/or cognitive inputs into outputs, then infoprocess refers to this cognitive segment. Infoprocess can be a sub-process, such as controlling of manufacturing quality, where measurements of processed material products are taken and processed into production parameters. The quality control sub-process belongs to a larger production process along with the product assembly sub-process. Assembling a product obviously has to do with physical matter, and therefore is not an infoprocess. The merit of detecting infoprocesses at the sub-process level opens up the space for IS. In principle, infoprocesses are transferable into software to various degrees. More transferrable are data-intensive infoprocesses. The less transferable infoprocesses include activities at a higher cognitive level (perception, memory retrieval, thinking including decision activities, etc.).

Infoprocess can also cover an entire business process. An example is decision making underlying planning. Another example is the planning process that, in addition to decision making, involves sub-processes of research, analysis, and negotiation. The merit of looking at a business process as an infoprocess is in focusing on cognitive complexity of inter-related data, information (meaning), and knowledge as well as in profiling a role for IS.

The infoprocesses approach is particularly important for understanding spatially dispersed organizations, such as the virtual organization. These organizational designs are paramount in the age of globalized business. The more an organization can move into the domain of infoprocesses, the more it can disperse its processes globally. The infoprocesses approach also enables a focused, effective manner of managing e-commerce.

The concept of infoprocess was initially introduced in the discussion on information. Chapter 1 discussed the fundamental infoprocess by which knowledge which in the human brain transforms external data into information (meaning). This initial concept will be expanded in this chapter. The discussion will then move to design and performance of infoprocesses. Applications of the process approach in infoprocess-intensive organizational designs (process-centered organization, virtual organization, and the mobile enterprise) and in e-commerce will be examined. Finally, some undesirable consequences of the manage focus on processes will be discussed in conjunction with concepts of time. Remedies will be addressed as well.

THEORIZING ON PROCESS

The fundamental ideas concerning process in general lie in systems theory (general systems theory, cybernetics, complex systems, etc.). Ludwig von Bertalanffy (1968) placed an emphasis on the part-whole relationship in thinking of the character of process and its relationship with system (Table 1).¹ More recent concepts from the field of cybernetics have highlighted dynamic aspects of process (action and changes that run in succession) and generalized the notion of process to the universe. German sociologist Niklas Luhmann (1995) built on ideas of self-maintaining systems, which had been developed by Maturana and Varela (1980). Luhmann also conceived process as a succession of events and suggested that process time was irreversible, forward-running. If the predetermined succession of steps changes, the process changes too. Luhmann contended, however, that process had structure, which could be manipulated to allow for reversible time.

Some philosophers and theologians have dealt with process ontology. The following explanation of self characterizes the worldview of “processists”: “One’s self just *is* the complex process *composed* of those various physical and psychic experiences and actions in their systemic interrelationship” (Stanford Encyclopedia of Philosophy, 2004). According to this source, in philosophy and theology process is conceived of in terms of a sequence of successive stages; it is complex, dynamic, and exhibits time cohesion and unity. The list of process philosophers and theologians includes Heraclitus, Leibniz, Bergson, Peirce, William James, Whitehead, Charles Hartshorne, and Paul Weiss. These philosophical ideas give rise to challenging questions about the relationships between process, structure, action time, and technology, which are yet to be addressed in the IS field.

In study and management of organization, the advent of process approach was in the 19th century North America and the work of Frederick Taylor. He was occupied with design of task steps in sequences that would maximize task efficiency. Barnard (1938) wrote about “executive process” as an approach to management akin to art based on the sensing of organization as a whole. In Europe, Henry Fayol theorized about a systematic use of resources to the best interest of enterprise. After World War II, William Edwards Demming applied statistics and process analysis in controlling product quality in manufacturing. This led to Total Quality Management and Kaizen methodologies, which advanced the process approach. In organization theory, however, the notion of process, however, has never grown into a full-scale approach. Process ideas were used in modeling various management and organizational phenomena, as hinted above and further listed in Table 1.

In the 1990s, process concepts were revamped in association with modern IT. The migration of business documentation into electronic format accelerated, and data transfer and communication capabilities expanded owing to computer networks. IS for enterprise-wide data management were developing, allowing for electronic processes to extend across an entire company. All this gave rise to a theory and practice of business process reengineering (BPR) (Hammer and Champy, 1993; Davenport, 1993). Another application of the process approach was coordination theory (Malone et al., 1999). Subsequently, and partly in contrast to the radical re-organization advocated by BPR, a more evolutionary process approach emerged usually called business process management (BPM).

BPR and BPM are extensions of the process-focused venue in the IS field. Systems analysis and design discipline, an import from software engineering within computer science, has been taught in IS programs in business schools for quite some time. But it did not generate academic research until parts of it were incorporated in design science, which emerged around the turn of millennia. Another stream within the process approach originated in Europe under name “soft system methodology.” It is focused on

applying systems thinking to political aspects of organization and “human activity systems”, particularly in problematic situations, inclusive of IS-related ones (Checkland, 1981; Checkland & Poulter, 2006).

Process Approach in the IS Field

From the perspective of information systems analysis and design, process and system are two faces of the same phenomenon. Both are conceptualized in terms of interrelated parts that work toward achieving a common informing-related goal. The difference is that the parts of a system are diverse and can include processes (procedures) of transforming data, along with data stores and data flows. Or, in the object-oriented approach, system parts are classes and objects that incorporate data and processes of transforming data. In contrast, parts in a process are sequenced “steps” that are to be taken in order to achieve the output of a process. Thus, the notion of system invokes a more static view, while the notion of process invokes a more dynamic view. The difference resembles the difference between structure and action. However, following the principle of systems hierarchy in general systems theory, a system can be viewed at different levels. For instance, a system can be seen as an entity embedded in its environment. This way, the whole system is “collapsed” into one process that transforms environmental inputs into outputs. This is an additional reason for treating process as system. This system is active, performing a transformation function, which is explicated in Pall’s (2000) definition (Table 1).

Table 1. Process concepts in various disciplines

Perspective	Concept of Process
Process Philosophy, Stanford Encyclopedia of Philosophy (2004)	Process is a sequence of successive stages.
Cybernetics, Principia Cybernetica (1991/2013)	Process is an action, which we see as a sequence of constituting sub-actions, spatially limited, that transforms inputs into outputs; an ongoing change progressing through stages, which, on a smaller time scale, appear as objects. Everything can be seen as a process.
Pall (2000)	Process is a system in operation to produce an output of a higher value than that of the sum of its inputs. (p. 285)
General Systems Theory (Bertalanffy, 1968)	Process is a part of system since “a living organism is an aggregate of a great number of processes.” (p. 139) ¹
Theory of Autopoietic Systems; Luhmann (1995)	Process is a succession of events that runs forward in time that is irreversible (pp. 42, 355); a sequence of structural changes (p. 356).
System Analysis & Design	- Process is a procedure of transforming data by a set of sequenced steps. From the perspective of environment, an entire IS is a process. - Process can be automated, semi-automated or manual.
Business Process Reengineering/ Management	- Process is a structured, measured set of activities designed to produce a specified output for a particular customer or market. (Davenport (1993: 5) - Process is a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer. (Hammer & Champy, 1993: 35)
Organization Theory	- Technology (as means to the end) can take form of continuous process (Woodward, 1965); - Executive process is the sensing of whole organization and the situation to it (Barnard, 1938); - Rational decision making is a process of intelligence, design, and selection (Simon, 1947); - Knowledge is created via a social process of conversions between tacit and explicit knowledge (Nonaka, 1994).

Harmon (2007) provided a helpful mapping of process research since the 1980s. He has categorized numerous management and technical research streams by using a criterion of focus. The resulting categories are: (a) process improvement (TQM, Six Sigma, Lean Six Sigma, and Capability Maturity Model); (b) organizational performance and process redesign (Porter's Value Chain, BPR, Balanced Scorecard, Business Process Redesign, Process Frameworks); and (c) process automation (various software products, including ERP and CRM). (Harmon, 2007: 18)

Looking at organizations as collections of processes, the process approach is interested in process efficiency and effectiveness. Roots of this approach can be identified as early as in the work of Frederick Taylor in the 19th century. In the 1950s, Demming (1986) applied process thinking in the domain of quality management in manufacturing. He warned that managers should avoid a tempting shortcut of monitoring merely "numerical goals" rather than ongoing production that is supposed to realize the goals. In the IS area, Strassman (1985) proposed an "administrative ratio" as a measure of productivity of clerical (office) work. He expressed the ratio as N/N_b , where N is the number of task steps in a given organization, and N_b is the number of steps in a benchmark organization. The author suggested that this ratio could be used to control for "information bloat"—an unproductive extension of clerical work, which new IT could trigger. His recommendation is similar to the process rationalization or optimization associated with the process approach. Implications of "information bloat" are as relevant today as ever. The problem of IT productivity paradox is one of the striking examples (see the discussion in the chapter on infoeconomics). The more recent trends of Ubiquitous Computing, Big Data, and The Internet of Things persistently increase the volume of various data. When these fall on a fertile ground of bureaucracy, the "information bloat" is likely to resurge.

The value proposition behind the process approach states that a business process must deliver value to its customer. Pall (2000) stipulates that this value must be bigger than the simple sum of the values of process inputs. In his conceptualization, the customer value segment draws on negotiation, communication, and commitment between the customer and process supplier. In all variants of the process approach, "customer" is conceptualized broadly: this can be anyone within the organization as well as various trading partners outside organizational boundaries.

Another interesting point refers to holistic thinking that a "reengineered organization" may deploy. Hammer argued that taking the perspective of a "big picture" amounted to a revolution in management, organizational performance, organizational design, and cognition. An oft-used example of process was order fulfillment. This process "produces value in the form of delivered goods for customers" (Hammer, 1996: 5). The process typically comprises several tasks (steps, or sub-processes). In one view, these can be the processing of customer order, processing customer's credit, production, inventory, purchasing materials if inventory is insufficient, picking and packing the goods, and shipping goods.

Hammer stressed that a process could create customer value only if the end result (delivery of goods) has got accomplished. For this to happen, the process must function as a whole. Taken individually, none of the tasks create value for the customer. Therefore, if one takes this broader perspective, it is possible to understand better what it takes for a firm to perform successfully. For example, one may realize that some tasks are unnecessary or employ too many people, unnecessarily long delays elapse between tasks, errors in communication between co-workers and managers occur, nobody understands how tasks fit into a larger hole, and so on.

By taking the process perspective, process problems become visible and can then be corrected. In contrast, a narrow specialization is a relic of a classical division of labor dating back to the time of Adam Smith and the Industrial Revolution. The main drawback of this division of labor is the atomizing of

work and expertise as well as workers' limited understanding of production and organization. The task of the process approach in this respect is to promote process leaders and operator-generalists. These can run more efficient processes that deliver value to the customer. Examples include the process of issuing credit at IBM Credit Corporation (as previously mentioned, labor and processing time are significantly reduced with a new aggregate process resting on a database system); Ford Corporation (accounting of parts purchasing redesigned around a new database system); and redesigning order fulfillment, product development, product service, and other processes that belong to the primary activities in the value chain (Hammer & Champy, 1993; Hammer & Stanton, 1995).

Theorizing on business/organizational processes discussed so far yields several propositions:

1. An organization is a system that consists of processes, and therefore process is a key organizational aspect (Figure 1 depicts this proposition).
2. A process is a workflow (or interlinked procedures) that includes a number of steps (tasks) – some physical, some data-related, some mixed (Figure 2). A process has a certain start and end step, while the steps in between transform data and matter from the inputs at the start to an output (deliverable) at the end.
3. Process layout or composition is one aspect of process design; other aspects include process-sub-process hierarchy, coordination between process steps, complexity (e.g., the number and relationships between the steps, and the extent of decision points and loops), and flexibility (variation in process execution). Figure 7.3 depicts process flexibility by juxtaposing routine and strategic processes (more discussion is in a later section).

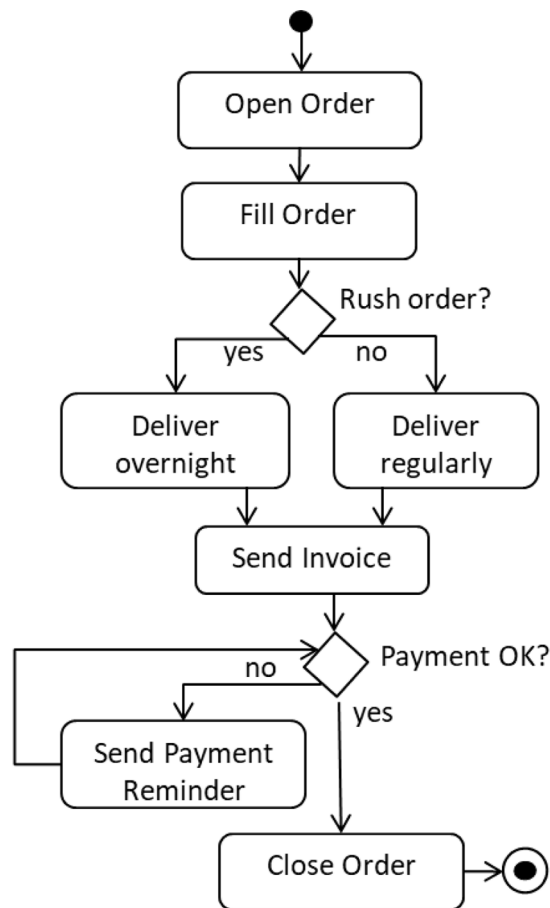
A process can cross departmental and organizational boundaries. The process in Figure 3 runs between department of sales, delivery, and accounting; if the carrier is another firm, the process is inter-organizational as well.

4. The output of a process or a deliverable serves a process customer or user, whether outside or inside an organization. In the Order fulfillment process, the delivery department can be an internal

Figure 1. Organization in the process view



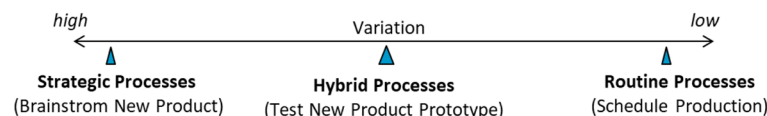
Figure 2. Order fulfillment process



customer to the sales department, and the buyer organization is the external customer to the whole process.

5. The customer evaluates the process deliverable, and this evaluation represents customer value—one measure of process performance. In the example analyzed, a prompt delivery of requested products could measure customer value.
6. Process performance can be also by execution time, costs incurred, quality of deliverable, and any other parameter of management interest (of course, some of these can overlap with customer value).
7. The process view requires holistic thinking beyond the familiar task/job-based organization and new type of professionals (process performers, managers, and champions).

Figure 3. Process flexibility continuum



8. A process can rest on computer-based IS; pre-electronic data may coexist. The Order fulfillment process in Figure 2 may involve systems for processing customer orders, accounting, communication, or EDI.

The first five and the last assumption define the process approach as an analytical method applicable to any organizational design. Assumptions 6-8 indicate a particular managerial philosophy and a manner of organizing that is staked on the process approach. This discussed in the second part of this chapter.

Summary

The idea of process has philosophical underpinnings and generally implies the notions of actions or stages and succession. The process approach to organization focuses on the flow of work from a start to an end point, at which a particular customer is supposed to have a value delivered. The process approach can be understood as an analytical device applicable to any organization as well as a particular organizational design that is based on processes. The BPR approach is often coupled with the introduction of ERP systems that centralize data management and reconstruct business processes. The radical character of BPR/ERP approach has been challenging on several counts. Its failures and criticism have led to a more evolutionary BPM approach.

In summary, the idea of process has philosophical underpinnings and generally implies the notions of actions or stages and succession. The process approach to organization focuses on the flow of work from a start to an end point, at which a particular customer is supposed to have a value delivered. The process approach can be understood as an analytical device applicable to any organization as well as a particular organizational design that is based on processes.

CONCEPT OF INFOPROCESS

Infoprocess (short for “informing process”) refers to interrelated informing activities that deliver an outcome to a customer. Informing activities make part of many organizational processes and sometimes are the exclusive content. The fundamental informing process introduced in Chapter 2 is that in which data are transformed in human mind into meaning (“information” in the IVO framework). As discussed earlier, knowledge is the key agent in this transformation. Other cognitive aspects discussed in Chapter 2 can also be understood in process terms—perceiving, memorizing, retrieving memory, thinking, feeling, and learning.

The concept of infoprocesses also involves a data aspect. Data reflecting business operations and entities are collected, stored, moved, and transformed. Most of these data processes translate directly into IS. The fundamental informing process connects data processes with the system user (or in more general terms, the process performer); it is an intersection of cognition and data. The fundamental informing process kicks in at every decision step that is performed by people within a process. In processes involving IS, the fundamental informing process runs every time the system user interprets the system output.

Figure 4 depicts a model of these propositions. This model is consistent with the conceptualization of informing agents (Chapter 1). To differentiate between the process levels, infoprocess is called “business infoprocess.”

Familiar instances of business infoprocess are decision making and managing of knowledge. Decision making design evolves with the technology aspect. Currently, Big Data technologies are increasingly making a difference in the decision making business infoprocess.

Figure 5 shows a Big Data process model for decision making (BDDM model). The BDDM model builds upon the well-known rational decision making (Simon, 1947/1997; more on this further below), which is somewhat amended. In particular, the first step is new (Recognize Big Data Need), premised on the fact that the Big Data trend is still new and requires changes in organizational culture. Therefore, matching Big Data potential with practical decision making needs is still a standing task for many firms. Both managers and business analysts are involved in this step. Once a Big Data need is identified, the control flows to a data scientist for analysis and design of an analytical solution on the fly (step 2 in the BDDM model).

The Big Data intake is one role of Big Data systems. A continuous collection of data of various types and from various sources is performed (step 3). Another role of Big Data systems is to build predictive models (step 4), which is an instance of machine learning (a system discerns a pattern in a dataset and then uses it in further searches). The data scientist examine a predictive model. This usually happens in a loop with a Big Data system until the scientist gets satisfied.

Upon a predictive model delivery, a manager can make a decision regarding the system output. This is where another decision point surfaces within the process. The decision point following step 6 may initiate a loop back to the data scientist (step 5). Therefore, optimizing a fit between data and machine-

Figure 4. Composition of business infoprocess

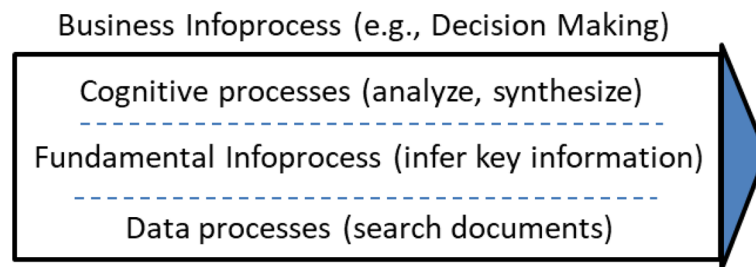
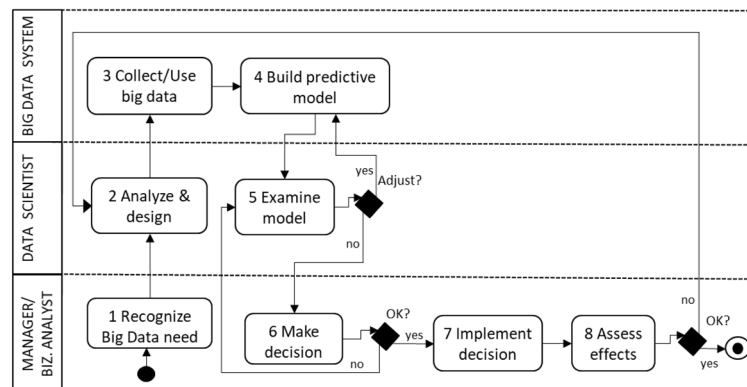


Figure 5. Big data decision making process



built predictive models unfolds in a recurring fashion. Otherwise, the manager accepts the model and so-based decision. This closes the decision part of the process, and then problem solving steps ensue. The manager implements the decision (step 7) and then assesses its effects (step 8). The process can still go back to the drawing board of the data scientist (step 2), if the decision effects are unsatisfactory.

The BDDM model should support understanding standard business objects in a new way. Thinking about and making decisions about the customer is an example. In the traditional retail, customers would be tracked on product purchases by using a relational database systems. E-commerce (the business-to-consumer segment – B2C) introduces changes. Although the customer is invisible to the merchant, the customer's online behavior is traced (search terms used, pages visited, screen icons clicked, time spent, etc.). Also, customer interests are automatically matched for the sake of product cross-selling. Data warehousing and data cubing or mining supplement the relational database querying on the analysis side. With Big Data, the customer picture is even richer, as various data sources and data types are used, and non-relational databases and machine learning systems deployed. (See the discussion on Big Data-based modeling of customer in Chapter 1.)

Knowledge management follows a cyclic process model, drawing on the work of Davenport and Prusak (1988). The process depicted in Figure 6 starts with the generation of knowledge and ends with the evaluation of the knowledge in use, which is performed by management—the process customer. An infoprocess can also be a sub-process in a business process. In that case, other sub-processes can be physical (processing of matter) or also informing in character (an example of this mix is the customer order process in Figure 2).

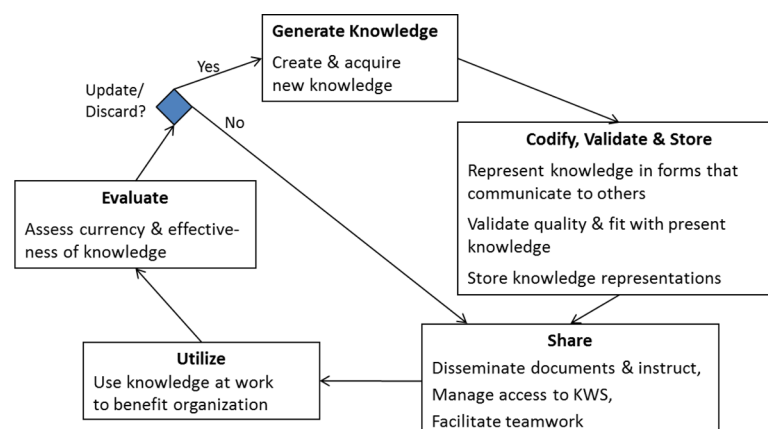
An infoprocess, as any business process, can be analyzed from design perspective. Process design determines process performance. These important topics are discussed in the following sections.

Process Design

Design of a business process, which is fully or partially an informing process, can be represented with several dimensions: composition, coordination, complexity, flexibility, and technology (Table 2).

Process composition refers to the design (arrangement) of process steps (activities and decision points) and their relationships representing process flow. The order fulfillment process in Figure 2 contains

Figure 6. Knowledge management process



seven activities and two decision points, connected via flow lines. To understand process composition, one needs to ask certain questions: Are all the steps accounted for? Do the steps that are defined make a correct process? Can the process as it is composed deliver the intended outcome? The knowledge management process in Figure 6 contains one decision point that determines if the whole process starts again with knowledge creation, or the existing knowledge will continue being shared and utilized. Usually, this decision is just mentioned in the literature rather than punctuated as in this diagram. However, a complete representation has to emphasize it since it stands for an important deliberation that potentially is a sub-process in itself (as is any other step shown in the squares).

Coordination is about the functional fit of process steps. Do all the steps equally contribute to the end-result of the process? What are the dependences between process steps? These questions probe into the coordination aspect of process design. For example, if a company's R+D function creates superb knowledge but its sharing suffers, then the sharing step does not contribute to the expected economic deliverables to the extent of the first step. An important coordination side concerns dependency between process parts, which is discussed in a section below.

Process flexibility refers to the extent of variation in a particular process. If there are alternative flows in a process and the end-result can be reached via different paths, the process exhibits flexibility. The more the alternative versions of the process, the more flexible it is. The customer order fulfillment process (Figure 2) has two versions, depending on the mode of delivery. More discussion is in the section further below.

Finally, processes can be analyzed with regard to their complexity. Several aspects determine process flexibility, such as its scope measured by the number of activities, decisions and loops involved, and the depth in terms of the number of sub-process levels. In Figure 5, the step following knowledge generation is of a higher complexity; also, the sharing step alone contains three sub-processes that raise its complexity as well as of the whole process.

Process Coordination

The concept of process coordination draws on the work of several authors. Georgopoulos and Mann did the pioneering work in conceptualizing and measuring coordination (cf. Price and Mueller, 1986). These authors studied the level of organizational unit and conceived coordination as an operational capability

Table 2. Process design dimensions

Design Aspect	Concept	Test Questions
Composition	Process steps and their relationships	Completeness and correctness of steps?
Coordination	Functional fit of process steps	Do all steps equally contribute to the process deliverables? Dependencies between steps?
Flexibility	Variation in a process	Alternative steps? How many process versions?
Complexity	Process scope and depth	Administrative ratio? Number of sub-processes? Number of loops and their nesting?
Technology	IT/IS and other technology integrated in process	What is the contribution of IS/other technology to contribute to the process deliverables?

of working toward accomplishing objectives of both the unit and the entire organization (see Table 3). Lawrence and Lorsch (1967) also looked at the unit level in studying coordination, but they focused more on structural aspects in support of coordination (e.g., liaison units). In this early research, an enterprise was seen as a system or process, and the capability of its parts to work toward accomplishing common objectives was conceived as coordination.

Thompson (1967) approached coordination from the perspective of interdependence between tasks. He created three-item taxonomy of task interdependence—sequential, pooled, and reciprocal (Table 3). To manage sequential interdependence on an assembly line, one must plan the work (tasks) and schedule performers that will work at the same, passing the results of their work to one another. With pooled interdependence, the coupling of tasks is very loose. Such is the case with the organization of banks, where bank branches perform tasks in parallel, almost independently from each other; as a whole, they still deliver a package of banking services for their clients. For this reason, coordination methods are not demanding: the application of standard procedures and formal rules and regulations suffices. Reciprocal interdependence implies complementary activities. An example is teamwork. Coordination of team members requires a mutual adjustment of them as a method of coordination.

According to Thompson, coordination methods are cumulative. For example, members of a systems development team have to adjust not just to each other, but also need to play by rules/procedures and to plan/schedule their work activities. Sequential interdependence requires rules/procedures in addition to planning/scheduling. Pooled interdependence is the least demanding since rules/procedures suffice for its coordination.

Authors of *Coordination Theory* also conceptualized coordination in terms of managing interdependence (Malone & Crowston, 1990, 1994; Malone et al., 1999, 2003). But they focused on resources as the basis of interdependence and related coordination directly to business process. The concept of resource is rather broad, including technology, time, and task outcome. Three modes of interdependence have been identified: sharing, fit, and flow.

Sharing interdependence is based on utilizing the same resource by several tasks or activities. One can manage these activities in several ways, including the first come/first serve technique and managerial order. Let us take a database system as an example. In pessimistic locking of database records, the database transaction that first accessed certain records will put a hold on the records and run itself to the end before other competing transactions will get access. Alternatively, certain users can be assigned exclusive access privileges.

Flow interdependence means that a resource is utilized task by task in a sequence. This process can be timed (*prerequisite coordination*), as when higher level management cannot get reports from a system before the lower level management completes their work in a database system. Placing of a resource

Table 3. Concepts of coordination

Author	Coordination Concept
Principia Cybernetica (1991)	The act of organizing something.
Georgopoulos & Mann (see Price & Mueller 1986: 108)	The degree to which the subunits of an organization operate according to the requirements of each other and of the total organization.
Thompson (1967)	Management of task-based interdependence
Malone et al. (1999)	Management of resource-based interdependence

can manage a flow (*accessibility coordination*), or a resource use can be prioritized on a value that a resource user delivers to a customer (*usability coordination*).

The concept of fit interdependence is not based on the notion of taking but putting. This happens when multiple tasks contribute to producing a resource. An example is the database transactions that insert data they are authorized for, thus contributing to maintaining the currency of data objects.

All this theorizing on coordination contributes to understanding coordination as an aspect of design of business process and infoprocess in various contexts. Here are some examples. Linearity and parallelism are applied in design of software processes (sequential vs. parallel computing). The previous discussion showed how GDSS can transform sequential interdependence between decision makers into parallel interdependence. Cognitive processes IVO studies engage several modes of coordination. Perception precedes learning and knowledge (sequential interdependence), but as soon as sense data are received, memory starts facilitating the perception process (perception and memorized knowledge get reciprocally dependent). Also, senses engaged in perception work in parallel.

Moreover, Porter's (1984) model of value chain is an enterprise-level process in which primary activities sequentially depend on each other for an economic value to be delivered as the final outcome. If the end-product of the enterprise process is product design, then there may be other modes of coordination involved, such as mutuality between R+D and marketing. From the resources perspective, the sharing mode is always sensitive since it includes competition. Furthermore, in the knowledge management process (Figure 5), particular management attention needs to be given to coordinating generation of knowledge and knowledge sharing with regard to financial resources. Managers can allocate money based on historical experience or bidding of the R+D unit vs. IS department, which can be tied to projected contributions of the contenders to the bottom line. Either management method is likely to have significant implications on the knowledge management process.

Table 4. Interdependence modes and management

Interdependence	Management Method
Thompson (1967)	
<i>Pooled/Parallel</i> A → B →	Rules and standard procedures
<i>Sequential</i> A B → →	Planning and scheduling
<i>Reciprocal</i> A ↔ B	Mutual adjustment
Malone et al. (1999)	
<i>Sharing</i> → A → B	First come/first serve, managerial decision, budget, bidding
<i>Flow</i> R → A R → B	Timing, placing, customer value
<i>Fit</i> A → R ← B	Contributing to common resource

Note: A and B are tasks/activities, R is resource.

Process Flexibility

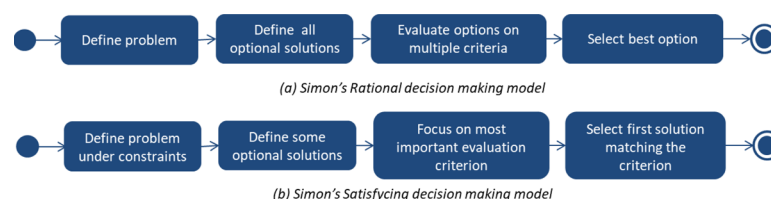
It is easier to think about processes as something that has transpired in the past than as something that will happen in the future. This is true even for routine processes, such as purchasing operations. Although a prescribed set of steps may be clear, it is difficult to predict all possible details of this process when it will be performed. Minor variation would not affect the process deliverable, but sometimes exceptions can even undermine process completion (e.g., dramatic changes in the environment of the purchasing organization). Still, the foresight perspective illuminates the process good enough so that it works most of the time.

However, the tractability of processes diminishes with a macro-level analysis, less routine processes, and longer timelines. Only a hindsight perspective can explain in process terms that which transpired. For example, it is difficult to say what organizational transformation would be like in more precise terms, even if one has a detailed understanding of the given organization. Even rationally constrained practices can exhibit a visible discrepancy between the plan and reality. An example is the IS development. For a long time, the work on developing systems followed project principles and a “waterfall” methodology. The work included system planning, business and system analysis, system design, software development, system installation, deployment, and its maintenance during productive use. But with more dynamic business and technological developments, the length of waterfall development process increased the risk of system obsolescence at the rollout point. In response, alternative system development methodologies aiming at faster development have emerged. Based on them, a system is built incrementally piece by piece, and development activities are executed repeatedly. Planning is more flexible and reduced to shorter periods, such as the day in the Agile methodology. While rapid methodologies shorten the development time, the development process is harder to predict (e.g., the number of iterations and timing). Therefore, software development, traditionally considered a highly rational process, becomes fuzzier in composition and coordination aspects, and above all—more flexible.

Process flexibility is important in decision making as well (an infoprocess *par excellence*). A process of rational decision making based on Simon’s (1947) normative model defines several steps (sub-processes), which over time have been labeled as problem definition, optional solutions creation, options evaluation, and selection of the best solution. The steps are fixed, and some flexibility may exist at the sub-process level (for example, informing sources used in defining problem may be adjusted to the problem character); see Figure 7a. Similarly, Simon’s satisficing (“good enough”) decision making in Figure 7b implies invariant overall design and allows limited flexibility in the steps (e.g., defining problem may vary regarding the given constraints).

In contrast, Lindblom’s (1959, 1979) description of decision making in public organizations (an evolutionary, “muddling through” model), could be represented as a more flexible process (Figure 8). An

Figure 7. Simon’s models of decision making process



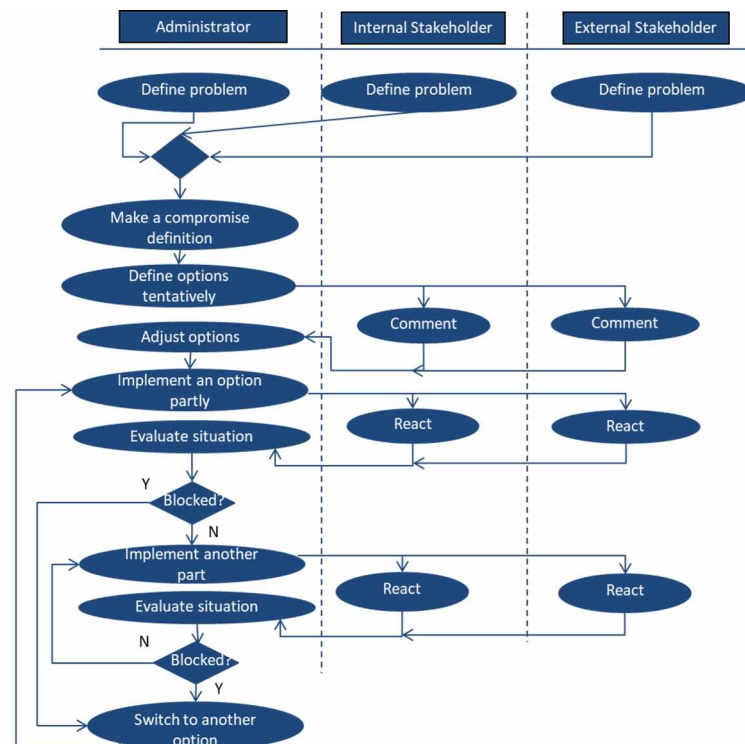
administrator cannot make a decision without other stakeholders (internal and external). It may not be clear in advance who precisely and how many of stakeholders. Both defining of problem and of optional solutions varies from case to case. The precise composition of the overall process cannot be predicted. Indeed, it is not possible to know in advance if the process will be ever completed. If it will, the final outcome is usually unpredictable at the outset.

Flexibility varies with the level of process analysis. In the case of knowledge management process shown above, some steps should be more flexible (e.g., knowledge generation) than others (e.g., knowledge codification). Furthermore, variation is often desirable in the input steps of a process. Data may need to be entered from different sources. Such is the case with various reservation systems (hotel, travel, tickets, etc.), where the customer should have convenience of using different methods (a Website, cell phone or other mobile device, the landline telephone, etc.). Another example is the big data environment, where inputs to decision making come from many sources. For example, predicting a future sell price in a regional energy market may need to account for historical list prices of various energy suppliers, demand figures and bid prices of customers, actual sell prices, seasonal trends, and any other source of a potential value. The input side of this process should be kept open.

Process Complexity

Process Complexity is a design dimension focused on the scope and depth of infoprocess as well as any business process. Process scope refers to the coverage (“the process footprint,” colloquially) measured

Figure 8. Lindblom’s evolutionary decision making



by the number of activities and decisions. Decisions may lead to loops (repeated sets of activities) that, if multiplied and nested excessively, can significantly raise complexity. One way to ponder the scope is by deploying the previously discussed administrative ratio (comparing the number of steps with a benchmark).

Process depth refers to the hierarchical dimension of a process by assessing the number of sub-processes. The deeper a process, the more complex it is. Figure 9 depicts customer relationship management as a deep process. For example, the marketing sub-process can involve several sub-subprocesses, such as customer profiling, market segmentation, brand management, advertising, and marketing campaign. The community of interest sub-process can involve creating of a community via social media, managing the relationship with the community, leveraging the community, and so on.

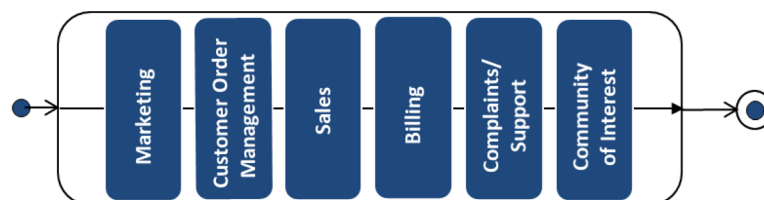
The rational decision making process based on big data may include extensive research in defining a problem and optional solutions because multiple informing sources are likely to be involved. Therefore, the start of the process is marked with complexity. Harmon (2010) proposed a three-level taxonomy of process complexity with these grades: simple, more complex, and very complex. Examples of these are manufacturing line, equipment repair, and product development. A simple process contains sequenced activities and some decision points; a more complex process includes branching and more decisions; and a very complex process includes ad hoc sequencing, heuristics and guesses. In contrast to less complex processes, a very complex process is hard to impossible to automate, suggests the author. It is to be noted that such a process resembles Mintzberg's (1994) concept of emergent strategy that gets shaped in unpredictable ways. As opposed to deliberate or intended strategy, emergent strategy develops when an organization takes a series of actions that with time turn into a consistent pattern regardless of specific intentions. It follows that a very complex business process include a learning sub-process, which is an infoprocess.

The complexity as well as other aspects of process design are measures of technical rationality. The process complexity caused by structural, political or other conditions, which does not translate into the customer value, is an indication of process problems. Bureaucracies may contain very complex, even convoluted processes due to departmental and turf barriers rather than logic of process optimization. The IVO framework supplies directions for this line of analysis (more discussion below).

Technology

Various technologies may be integrated in a business process so that they represent a separate design aspect. Since the focus here is on infoprocess, it is interesting to examine IS as a design aspect. Analysis should look at the contribution of IS to the process deliverables. The key aspect is system functionality that supports process activities and decisions. It is a system's "footprint" in a given process. Technologi-

Figure 9. Customer relationship management process



cal characteristics, such as those of the IT deployed, computer networks, user interface, and databases translate into process design.

Some process approaches assign a key role to IS. The case in point is BPR. In BPR, IS determine other design aspects. For example, the customer relationship management process in Figure 8 can be entirely rested on an ERPS. If so, design aspects of the CRM process are reducible to ERPS design. Alternative process approaches balance IS with other design aspects. The case in point is BPM, which addresses process automation at various levels rather than presuming automation to be a total solution.

Process Optimization

Both the process approaches (BPR, BPM) and organizational development approaches (e.g., lean, six sigma, kaizen, etc.) insist on process improvement. One way of improving processes is by optimizing process design. Technical logic and management intervention should lead optimization endeavors. With regard to process composition, a process should contain correct and necessary activities and decisions, and be complete (Table 5). The process purpose and process customer must be clear. In other words, the analyst must clearly answer the question, what exactly is the process of interest? Sometimes, a process contains mixes steps from what really are different processes. An optimization intervention should eliminate such ambiguities.

But it can be challenging to think out of box and realize that a process is broken even if it executes. Nonetheless challenging is to define process steps at the same level of hierarchy or granularity. Some steps could be too detailed (belonging to a sub-process), others too abstract (belonging to a super-process). Optimizing should level off all the steps. Technical logic leading to these ends can deploy different methodologies, such as value stream mapping, kaizen techniques, flowcharting, and process diagramming used in systems analysis and design.

As for process coordination, an optimization approach should focus on the contribution of process steps to the process deliverable. The contribution can be assessed in terms of timing and costs. Modes of coordination applied should also be scrutinized. Translating sequential dependency into parallel often improves process design and performance. Resource-based dependency of activities should also be examined. This effort may result, for example, in reduced wait times for a shared resource or in better cuing of activities that draw from the same resource.

In optimizing process flexibility one needs to start by differentiating routine from non-routine processes. Appropriate space for variation in process steps should be created when flexibility is needed

Table 5. Process optimization

Design Aspect	Optimization Directions
Composition	Correct and necessary steps, and process completeness
Coordination	Examine contribution of crucial steps, think parallelism, examine resource dependencies
Flexibility	Manage appropriate variation
Complexity	Reduce waste, simplify
Technology	Improve and increase utilization of IT and other technology. Contributions to optimizing design aspects above.

for achieving intended process deliverables. In contrast, variation should be limited and controlled in predictable standard processes.

Process complexity can be optimized by reducing and driving out waste and by simplifying. Waste refers to odd elements, such as duplicated activities (a form of redundancy). Entering the same data over again is an example of redundancy. Poor quality data is also a waste. In extreme cases, a whole process can be waste. Another venue to follow is simplification. From the IS perspective, an unnecessarily complex process deploys an excessive volume of IS resources, which are usually duplicated and perform in sub-optimal roles. The lean methodology can be instructive in managing process complexity.⁴ In North America, process optimization has been critical in the health industry. While challenges abound, there are success stories (Grabau, 2011).

Finally, support of IS and other technology systems can be optimized by improving and increasing their utilization. Another optimization direction is in the contribution of IS to optimizing process design and certain performance aspects, such as the speed. Notable historical examples include a purchasing management system at Ford where, with aid of a new IS, the process complexity was reduced and process coordination improved. Process design, in turn, influenced process performance and the performance of the larger organization, which is discussed in the following section.

Process Performance

Process optimization is a necessary condition for a process to perform well. Process performance can be measured on:

- Purpose accomplishment – does a process deliver what it is expected and to what extent
- Cycle time – total process time or the period between the process start- and end-point
- Costs – tangible and intangible
- Customer value – what the customer deems important (e.g., quality, utility/price, delivery time, etc.).

In the example of Ford cited above, the optimized process precipitated cost savings from a manifold reduction of the staff and earnings from reduced cycle time. Another well-known example is Walmart's network, which connects Walmart stores and distribution centres with the retailer's suppliers. The network enables just-in-time replenishment of shelves in Walmart stores. Cost efficiencies accrue and the average volume of sales and resulting revenues hold high. Therefore, better performing processes show up in indicators of organizational performance.

As discussed in the previous section, technology and in particular IT in its systemic deployments have a chief role in process optimization. It is functionality of IS that matters for optimizing process composition, complexity, coordination, and flexibility. Optimized process design further influences process performance. But non-functional characteristics of an IS also affect process performance in a direct manner. Faster computers and higher bandwidth networks reduce the cycle time of processes. More usable user interfaces save time as well. And so on.

Relationships between IS and process design and performance are represented in the BPM model depicted in Figure 10. The model also indicates the influence of process performance (e.g., reduced cycle time) on organizational performance (e.g., savings on labor). Organizational performance can also be assessed in terms of income size, quality of service, and accomplishment of specific goals (effectiveness).

These relationships chart the domain of infoeconomics, which is discussed in Chapter 8. Students of “IT value” have promoted similar ideas regarding a detection of effects in investing and using IS at an intermediate level (Chan, 2007).

The following discussion will illustrate them on the case of Telco. Figure 11a displays a customer relationship management process in Telco, the telecommunications company introduced in Chapter 5.

The columns (“swim lanes”) in the diagram represent the marketing department, three technological actors including a customer relationship management system (CRMS), and the customer. This process exhibits a sub-optimal design. First, the purpose of the process is insinuated by the initiating actor, marketing professional—marketing campaign. However, there is also a competing start point on the customer side, which indicates that the purpose is the management of customer orders. Another ambiguity in the process composition lurks behind the question, who is the customer to this process? The marketing professional does not know if the change in customer history is a result of the marketing campaign, since a customer places an order regardless the campaign. Therefore, the process does not serve the marketer. The process sinks in CRMS, which serves the salesman. Therefore, the process does not serve the customer either. The purpose ambiguity is paralleled in process composition problems. The process steps

Figure 10. BPM Model of IS influence on process design and performance

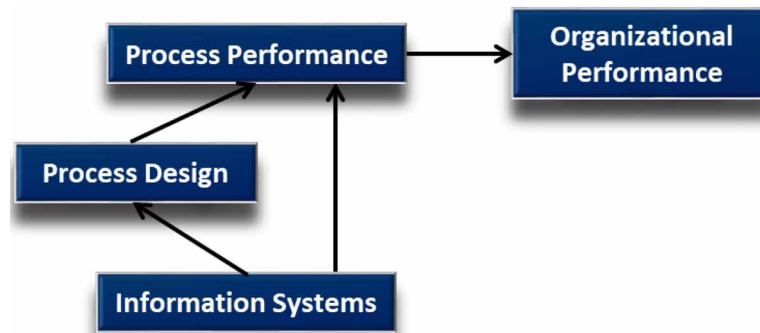
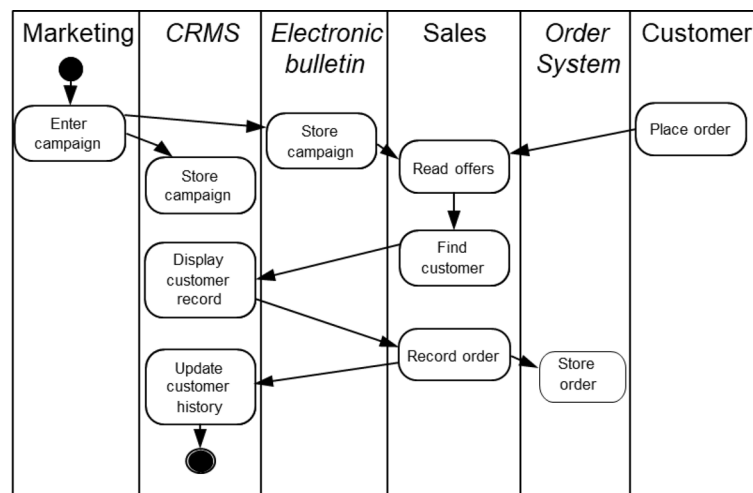


Figure 11a. Sub-optimal customer process at Telco



belong to different operations rather than a consistent domain. There is also a flow error in the CRMS swim lane: the activity “Store campaign” is a black hole (output is missing). Finally, the mobtel vendor is entirely excluded from the process.

The problems of ambiguous process purpose, customer, and composition are aggravated by weaknesses in process coordination. It is impossible to determine clearly the contribution of process parts to the end deliverable when this one is not clear. The black hole activity is clearly not contributing as it is excluded from the process flow. From the resource dependence perspective, utilization of CRMS is limited since some campaign activities do not use it but an alternative resource—the electronic bulletin. The customer ordering also does not utilize CRMS resource. Indeed, there are three IS resources involved in the process (CRMS, electronic bulletin, and System X for customer orders). This fact translates into excessive technological complexity. Overall, Telco’s customer process as-is exhibits significant problems in composition, coordination, and complexity. This process is not optimized.

Process optimization is a result of process analysis, thus reflecting a future state, or process to-be. The first step in optimizing this process would be to define the purpose and the customer. In the as-is process, the marketers and salesmen perform in different tasks—campaigning vs. customer order management, respectively. These are two different processes that should be separated. Figure 11b shows an optimally composed marketing campaign process. The eliminated parts belong to a separate customer order process (not shown). The deliverable of the marketing campaign process is a campaign caused change in the company’s customer history, and the process customer is the marketer. The new process contains some new activities, placing the salesman in an active role that contributes to marketing campaigns. The flow of the process is improved, all steps contribute to the deliverable, and the utilization of CRMS is increased, while redundancy in IS resources is eliminated.

In principle, all design aspects affect process performance. All the examples cited above demonstrate this (Ford, Walmart). Telco’s as-is process does not perform well because its design is sub-optimal. The cycle time (promote-to-sell) is hard to measure due to the ambiguous start point. Costs are inflated by the deployment of three IS resources, and the utility/cost ratio of CRMS is sub-optimal due to its severely limited use. The customer value is ambiguous and rather miniscule for the marketers. In contrast, the to-be marketing campaign process brings up performance improvements across the board.

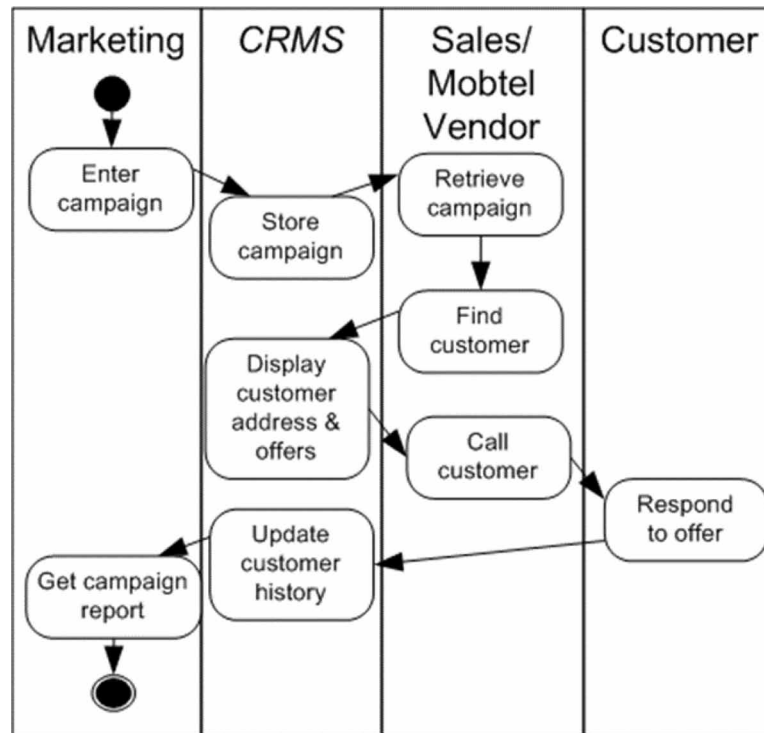
In summary, business process/infoprocess can be analyzed from the perspective of design. Design aspects are composition, coordination, complexity, flexibility, and technology. Process optimization is about improving process design that affects process performance, which further affects organizational performance. IS show up in process performance via the IS influence on process design and directly via the systems’ non-functional characteristics. Process performance influences organizational performance. The case company exhibits a sub-optimal as-is process, which can be improved into a to-be marketing campaign process. The process of decision making with Big Data has a specific design.

The discussion will now turn to the relationship between process approach and organizational forms or designs.

Process-Centered Organization

Hammer (1996) placed business process at the nexus of organization in his concept of *process-centered organization*. Such an organization is “reengineered” around optimized processes. It is less hierarchical or flatter. Since processes cut across functions, these companies are capable of moving from management’s classical focus on discrete tasks to the whole tasks create, i.e., process. The object of management

Figure 11b. The to-be marketing campaign process at Telco



is process, not people, budgets, and individual department (ibid., p. 80). New management frames roles of “process owner” and “process coach.” Workers are “process performers.” Former specialists turn into generalists. This transformation of work roles is achieved through training, process thinking, and support of IT/IS. Some redistribution of power between managers and workers takes place in this context.

The concept of process-centered organization is driven by technical rationality. A process-centered organization can be seen as an IT-inspired technocracy with rationalized processes and a labor force that fits these—process performers who are capable of thinking and acting beyond traditional limits of task. The technocratic character of a process-centered organization is manifest in the ultimate criteria for its design, including IVO aspects—process efficiency. Switching to “pipeline management” requires abandoning a natural inclination to rule a familiar turf, which is associated with “silo management.” Worker roles are also bent out of shape as a generalist orientation suppresses specialization. This transformation has connotations of using IT for the empowerment of workers as in Zuboff’s (1988) informed organization. In the context of narrowly defined work roles and education, this amounts to a case against *deskilled* work, which a modern technocratic approach advocates.² The approach is different from classical technocratic approaches (e.g., that of Frederick Taylor) in countering the traditional preoccupation of management with control at the micro-management level. In the process-centered organization, managers as coaches have to relinquish some power and concentrate on monitoring parameters of process performance.

Business Process Reengineering

Business Process Reengineering (BPR) professes a radical transformation of organization. A process-centered enterprise can be seen as one result of applying BPR. In research, BPR is closely connected with the topic ERP systems. In practice, ERP systems have often been treated as a necessary condition for BPR. These systems have been touted as the vehicle of turning organizations around the process perspective. Since the ERP system, as any IS, works with data, it follows that an enterprise rested on an ERP system can be seen as a composition of electronic infoprocesses.

ERP system (or just enterprise system) refers to a large-scale IS that covers multiple departments or domains of operations. The origin of ERP system is in systems for planning materials in manufacturing companies. Modern ERP systems can support business and strategic planning, resource planning, production activity planning, customer relationship management, sales and operations planning, scheduling, product configuration, accounting and financial management, cost management, engineering, human resource management, and supply chain. With addition of a data warehouse, ERP systems can support executive decision making in large enterprises.

ERP systems can centralize data management, providing common definition of data entities across organizational functional departments. In this respect, ERP systems may add value to organizational performance by offsetting costs of a silo approach in which departments manage data separately from each other, often using disparate IS. This enterprise-broad perspective allows for thinking about business processes regardless of department boundaries. In principle, process designer can model processes with optimization goals in mind—reduce time and tangible costs, maximize a value for the process customer.

Process design may extend into the environment, to involve business partners within a supply chain. These effects can materialize only between organizations with compatible designs capable of overcoming departmental boundaries. In addition, process management may require new positions (process manager, driver, etc.) and a supportive redistribution of authority. Some firms have succeeded and managed to make internal adjustments in the direction of ERP re-engineered organization.³ However, change costs and failures are also remarkable.

ERP systems are complex, and their implementation is difficult. The technical side is complemented with challenges of re-organization around new processes. Indeed, an ERP system is bundled with BPR. Technology and processes are sold together. Due to these complications, historical failure rates across different industries have run from 50%-80%. A concerted effort of many organizational actors is necessary for a successful change. The conditions for success include careful planning, managers' buy-in and push, teamwork, slack resources, careful selection and management of a vendor, technical background, organizational learning, and appropriate organizational structure and culture.

In practice, new process design does not start from scratch but rather endorses the processes encoded in ERP software, which ERP vendors claim to represent "best practices" in an industry. Deviating toward custom processes requires changes in the source code—an expensive option since the price of software updates cannot be spread over a larger user population. In essence, the adopting organization learns by imitation how to organize processes. This may represent a technological path to institutional isomorphism (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). While becoming equally efficient, some organizations may lose the competitive edge based on their original processes.

In addition to these challenges, the BPR/ERP approach has received criticism from various perspectives. Davenport (1995), one of the early advocates of the approach, criticized it for dropping the human factor out of sight. The critique of Galliers and Swan (1999) pinpoints the aspects of adopting ERP sys-

tems. This adoption should be viewed as a particular kind of process, argue the authors. This process is complex, iterative, and circular. The complexity comes from interplay of cognitive, social, and technical factors. Cognitive issues involve the interpretation and use of data, and formalized and tacit knowledge in connection with inter-subjectivity. The process of implementing an ERP system is an instance of an innovation process that progresses through “episodes,” which are highly context-dependent and hard to imitate. The authors argue that the BPR approach overlooks this whole milieu, and trades a clear-cut, rationalized, linear process prescription for the real challenges.

Business Process Management

In reaction to revolutionary organizational changes required by BPR, a more evolutionary approach of business process management (BPM) has emerged. It professes a systematic attention to organizing around the process paradigm and a continuous management and improvement of business processes (Hammer, 2012; Wong, 2013). BPM assumes that any work could be improved by treating it as a process (Davenport, 2010). The process improvement as an overarching goal of BPM should account for the requirements coming from the organizational environment (Trkman, 2010). IT and other technology are typically assumed to be important elements of BPM but not an exclusive driving force.

In the IVO view, BPM can be framed through the relationships between infoprocess, on one side, and infoculture, infostructure, and infopolitics, on the other (Figure 12). The problematic customer process at Telco company discussed above, resulted from the pressure of the company’s traditional infoculture centered around department-focused data management and IS. Blockages to smooth flow of data across the enterprise were never removed. Rather, both the sales and the marketing department preserved their infocultures—bureaucracy and person, respectively. Congruent with this, the infostructure has been characterized with a high infofragmentation between the two departments and a lack of formalization in customer data (what data to collect and who does it).

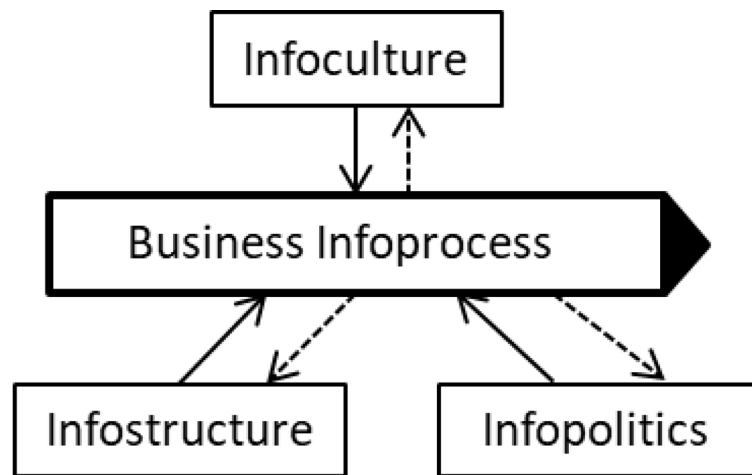
Infopower has also shaped the customer process at Telco. Marketing and sales managers had been engaged in a prolonged fight. Unable to fit CRMS to marketing needs, the marketing management withdrew support to the planned system development and pushed for alternative solutions. The CRMS data gradually impoverished and the system could provide just a very limited service to marketers. In effect, CRMS failed to bolster expert power of a marketer who would chose to stay with it rather than move to alternatives. This historical trajectory led to an infopolitical agenda of systematic downgrading and overt opposing of CRMS. Such chocking infopolitics eventually shaped the marketing campaign process into a convoluted form.

BPM has a growing international following, including some of the former advocates of BPR (see vom Brocke & Rosemann, 2010). BPM fits with the process approach as an analytical method applicable to any organization. Most of the discussion in this chapter applies to BPM. Inspired by long-lasting goals of organizational improvement, the BPM paradigm warrants a lasting interest in the process approach to organization. The remaining sections are devoted to discussing the role of process approach in advanced forms of organizing.

Virtual Organization

The process view is powerful for understanding and managing the virtual organization (VO). VO is a temporary association of various constituencies (individuals, groups, firms, etc.) that come together in

Figure 12. Shaping of business infoprocess



order to harness swiftly a sudden market opportunity and deliver a “virtual product” instantaneously and customized to customer demands; VO deploys “a sophisticated information network and computer-integrated production processes,” and exhibits “permeable and continuously changing boundaries” between supplier and customer and an “amorphous structure” (Davidow and Malone, 1992). The process emphasis of VO is also apparent in the paths by which it comes onto being. Organizational virtualness emerges in sourcing operations rested on electronic channels (Venkatraman and Henderson, 1998). Buyers create VOs with suppliers they switch to in a continuous search for better deals (Mowshowitz, 1994, 1999).

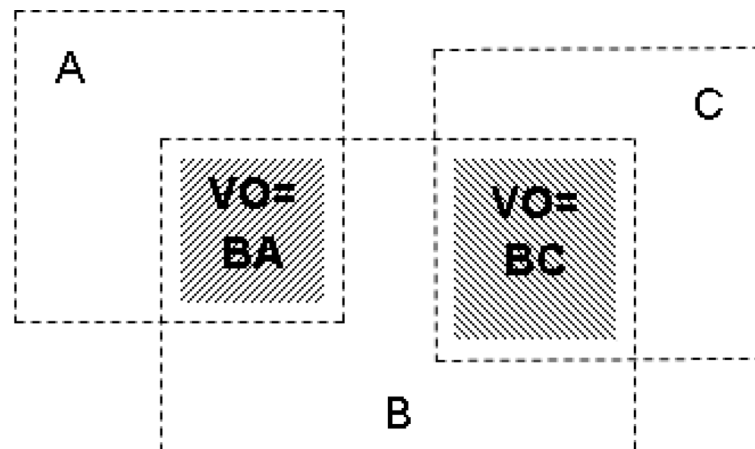
VO is a spatially dispersed organization, but not every dispersed organization is virtual. There needs to be an accumulation of characteristics and capabilities for a VO to exist. These are Cybernization (a capability of existing in electronic space), Anchoring of electronic means in the organization, Aggregation (electronic networking among VO members), capability of Switching VO members, and Interoperability in technological and social domains. All this enables a VO to deliver a special product that no single constituent of a VO can make on its own (Travica, 2005).

The special product (innovative, complex, unique) results from joining forces of VO members. In particular, this includes merging competencies and sharing technological infrastructure, R&D, risk, and costs (Goldman et al., 1995). Figure 13 depicts VOs that organization B creates with organizations A and C. For example, company B has no production facilities and it creates one VO with a manufacturer A, and another with a manufacturer C at the same time. Or, B is a buyer organization that creates a VO with supplier A, and later switches to a VO with supplier C. In these VOs, B and its partners make their boundaries permeable by interpenetrating each other’s IS spaces.

It follows from these propositions that VO is crucially dependent on electronic processes, or more precisely, infoprocesses. These surface in the switching between different suppliers, computer-integrated production processes, and inter-organizational networking. The topic of VO has attracted much of research attention (see Putnik & Cunha, 2008). Recent developments in the industry of IS services are conducive to escalating virtual organizing. Cloud computing (Cloud) is the case in point.

Cloud is a business model for renting out a new generation of IT and IS services by specialized firms (Cloud vendor) to organizations in various industries (Cloud client). There are different levels of service.

Figure 13. Virtual organization



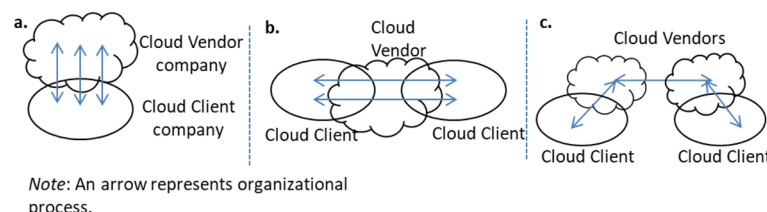
Infrastructure as a Service is the basic Cloud, which contains physical computers, virtual machines, data storage, virtual local area networks, and firewalls. Cloud vendors supply these services out of their facilities that are accessible via the Internet and private networks. *Platform as a Service* provides resources for software development, data-bases, and server computers. *Software as a Service* is the most complete Cloud service of hosting entire IS by the Cloud vendor. Cloud covers accounting, customer relationship management, human resource management, resource planning, Web content management, and other domains.

As IS operations move to the Cloud vendor, the Cloud client makes its boundaries permeable and the Cloud vendor functions as a part of the Client organization. Data keep flowing between the Cloud client and Cloud vendor as within a single organization. This results in one form of VO as depicted in Figure 14a. On its part, the Cloud vendor builds multiple VOs with different clients, as it is depicted in Figure 14b. Cloud clients can also be interfaced by their Cloud vendors (Figure 14c). In this model, the broader VO includes Cloud vendors.

The process perspective is indispensable in constructing and managing effectively these new forms of VO. Interactions between the Cloud vendor and client can be defined as a set of infoprocesses and then controlled for the quality of deliverables, costs, and timing. Infoprocess can also serve as the unit for pricing. The global expansion of Cloud services engenders possibilities for global VOs.

Evolution of VO is also manifest in ecosystems. Biological ecosystems are fresh water, marine, forest, prairie, desert, etc. Living organisms in any ecosystem depend one each other and on the shared physi-

Figure 14. Cloud-based virtual organization



cal environment; they co-evolve. A metaphor of ecosystem is used in business to refer to an economic community of interdependent, co-evolving producers, suppliers, customers, competitors and other stakeholders, which has one or more companies in the leadership role (Moore, 1996). All the elements of VO discussed above hold in the case of ecosystem. It must be electronically linkable into a network, interoperable, switchable regarding the membership, and able to deliver a special product (a good or service).

Pagani (2013) empirically investigated ecosystems among broadcasters in Europe and the United States. This industry has gone through remarkable technological transformations – analog TV, digital TV, and multifunctional digital platforms. Pagani was particularly interested in identifying points of value creation and of control and assumed that a significant value can be created by assessing the worth of relevant knowledge residing at different points in the network and arranging its transfer to other points where it is needed. Based on research findings, she established two newer kinds of ecosystems that are capable of delivering innovative services. One is loosely coupled network gathering digital TV channels, application service providers, telecommunication network owners, and IT vendors. This sort of network (that is, VO) evolves quickly (i.e., is highly switchable) as the opportunities for reconfiguring resources and members loom large. Even more interesting is the multisided platform. Centered around a potent corporation, this organization is focused on interactive services. For example, a major computer gaming producer creates an ecosystem (possibly multiple VOs) with game developers, middleware providers, Internet service/telecommunications network providers, and users. Pagani (2013) suggests that a digital business strategy is a necessary driver behind these new organizational forms.

It is important to note that interoperability of the ecosystem-rooted VO is essential for the existence of this organizational form. It plays out through informing processes at different levels (data, higher level, business process level). Deliberate and emergent digital business strategies are staked on such interoperability. The multisided platform VO bridges industries (mass informing, entertainment, popular arts, show business, telecommunication) and lends itself to an interesting research topic and practitioners' domain.

Virtual Life

A broader notion of virtualness is connected with the study of various social entities and settings, such as identity, relationship, community, country and world. The big picture representing a unified view of these different settings may be framed as virtual life. It can be differentiated down to the individual level, relationship, community, organization, country, and world. This proposition is represented as the Tree of Virtual Life depicted in Figure 15. Note that the Tree of Virtual Life is based on the criterion of hierarchy of social settings in contrast to discourse that labels all these settings indiscriminately as “virtual communities.”

The virtual identity has to do with personal representations in the cyberspace. Such a representation may involve avatars and can drift from a physical person to different degrees (see Kaplan et al., 1989). Much attention has been focused on the advent of false identity connected with fraudulent acts. Business-related virtual identities are pragmatically motivated, as is the case with the avatars representing the collaborating party, negotiator, salesman, and customer.

The virtual relationship is a purposive extension of virtual identity. Virtual identities can relate for the purposes of business (e.g., customer-salesman negotiation, consulting one-on-one), education (instructor-student), intellectual services (librarian-library user), spiritual services (priest-believer), health care (doctor-patient), romantic relationships (partner-partner), entertainment (gamer-gamer), and so on.

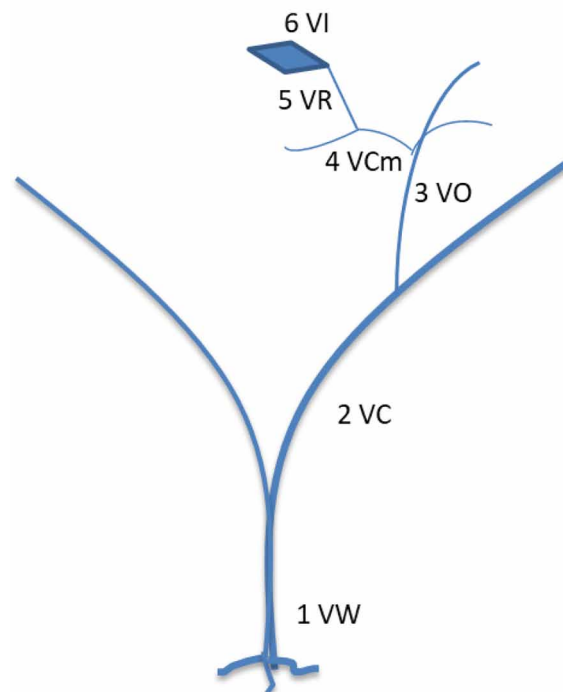
The virtual relationship gathers geographically dispersed people with shared motives in a defined cyberspace. The concept of community implies a looser structure than the organizational. There can be different kinds of virtual community depending on the motive, such as interest and role playing (Kaplan et al., 1989). For example, a virtual community may emerge around some existential motives, such as surviving in harsh winters or in homeless condition. A virtual community can also morph among online gamers attracted by role-playing entertainment.

Virtual organization was already discussed above. But as an offshoot on the Tree of Virtual Life, VO inherits some new characteristics. VOs house virtual relationships in the domains of business, education, health care, and so on. Anchoring of virtual relationships in the organizational context and interoperability of the parties involved are important aspects. In the service sector, the VO context includes clients.

The virtual country aggregates various entities in the administrative, cultural, economic and other social domains. For example, the processes of obtaining citizenship and banking with own currency may be afforded. As a landless grouping of people, the seeds of VC are engendered by refugees and displaced people, governments that award citizenship without physical immigration, and multinational and transnational corporations that appropriate prerogatives of nation-state (Frey et al., 2013). Technological binding of these institutions (websites, blogs, communication systems) can give rise to VCs.

The virtual world (VW) is the highest level of virtual forms aggregation, thus represented as the trunk in the Tree of Virtual Life. A VW includes virtual countries (VC), organizations (VO), communities (VCm), relationships (VR) (all at branch levels), and virtual identities (VI) at the leaf level. Relationships between avatars may not be sufficient for emergence of VW experience; interaction between avatars and

Figure 15. Tree of virtual life



objects may be needed for experiencing virtual space and place (Saunders et al., 2011). Second Life has been subject of extensive research into VW particularly from the marketing perspective.

Process analysis is indispensable in understanding virtual life forms. At the minimum, there has to be some formative process for each form. In addition, a virtual life form exists through some key capabilities that should be formalized as processes. For example, a VR exists through communication processes between virtual identities, a VCm exists through discussion and collaboration processes, VC through administrative and identity maintenance processes, and VW through commerce and political processes. The process approach could give more scrutiny to research on virtual life forms and help to determine these beyond subjective feelings of immersion and belonging expressed by gamers.

Electronic Commerce Organizations

Electronic infoprocesses are crucial in organizing electronic commerce (e-commerce). In business-to-consumer (B2C) e-commerce, process thinking is critical on the front-end of an e-commerce enterprise, which faces the consumer market. Clear infoprocesses with defined ends need to underlie interaction between a consumer and an online store (Web storefront). Examples are infoprocesses of company presentation, product promotion, selling, and consumer profiling. These front-end processes extend or connect to back-end processes behind the Web storefront. Designers and content providers of a Web storefront need to ensure that the fundamental infoprocess functions. This means that design of menus and the content of pages communicate to various groups of users. Otherwise, they delude themselves that they are “providing information” while no information is really elicited in users’ mind (Travica, 2011).

B2B e-commerce, the larger and economically more important segment of e-commerce, is the primordial domain of inter-organizational infoprocesses. Buyer and seller firms connect directly via EDI and other systems, or via electronic marketplaces (e-markets, also known as electronic hubs, net market makers, butterfly markets, and exchanges); see Figure 16. The e-market is an Internet-based intermediary that uses various market-making mechanisms to mediate transactions among businesses (Sawhney & Kaplan, 1999). An e-market can be more or less balanced with regard to buyers and sellers, graphically resembling butterfly wings (“Butterfly Market”), or with uneven numbers of buyers and sellers (“Lopsided”).

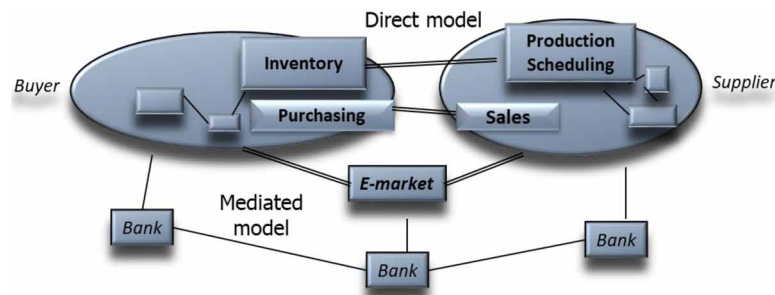
Electronically linked to the e-market, sellers and buyers perform infoprocesses embodying business transactions—presenting supplies and demand, ordering, paying, and tracking delivery. Separate infoprocesses connect the e-market with buyers, such as loaning and other financial services. Well-designed and performing infoprocesses are the key to successful B2B e-commerce. Upgrades of IS and computer networks are the chief area of process optimization.

In summary, electronic infoprocesses sit at the nexus of B2B and B2C e-commerce. Technology is the main venue of process optimization in e-commerce.

Process and Time

An organization conceived in process terms may appear rigid, imposing tedious order and a diktat of time. The execution of process is usually mapped against a timeline, and cycle time is a crucial measure of process performance. These invocations of time for control purposes are much used in management, and organizational members (managers including) can indeed feel a pressure of time. Here implied concept of time is *calendar time*. But this is just one of its concepts. It will be argued that time can be

Figure 16. Business-to-business e-commerce



viewed from different stances—cultural, scientific, technological, and psychological. Collisions between these concepts are responsible for time pressures associable with organizational processes as well as for problems of process effectiveness.

The management preoccupation with calendar time and economizing with it is indicated in an elaborate vocabulary. Examples are “cut down on task time,” “reduce lead time,” “shorten concept-to-cash time,” and “compress product cycle time.” The work must be done “now,” or better yet, “yesterday.” The intention of economizing with time is often implied in the request for speed. In reference to IS, the vocabulary gets equally elaborate. Computer code-generated instructions are prepared for execution during *compile time*; data processing runs in infinitesimally small fractions of *run time*; data change states in *real time*. But all these are units of calendar time—a standard clock ticks in every computer. In contrast, there is time pertinent to computer technology.

Technological time is measured by a computer clock that ticks in any computer along with the calendar clock. The computer clock generates rapid pulsations of electrical impulses that power computer operations. This creates a faster-paced time that determine how many millions software instructions can be of executed in a second of calendar time. A variant of technological time applies to technological progress. This is the time of a historical process that delivers technology innovations. Time units are determined by the advent of major innovations. For example, the Murphy Law regulates that capabilities of micro computing technologies double in period of 18 months. Other computer hardware and software and individual vendors may have their own timing, and not necessarily so regular.

Ethic groups and nations have developed different *cultural concepts of time*: linear vs. circular, forward running vs. static, and slow vs. fast time (Hampden-Turner & Trompenaars, 1995). These apply to the historical process, which is likely to be understandable just on hindsight. For example, Asian cultures have been associated with the circular time in contrast to Western cultures of linear and forward running time (Hofstede et al., 2010). A variant of cultural time applies to organizational cultures. Although the same notions of trajectory, dynamics and speed apply, the cultural and organization culture beliefs about time are not identical.

Sciences have created scientific concepts of time. For example, there is a concept of space-time that brings together Euclidian space with time concepts adjusted to particular theories. A distinguished creation within this venue of theorizing time is Einstein’s theories of relativity. Finally, there is a *psychological concept of time*. It can be defined as a subjective feeling of passing or succession of stages (day happenings, succession of day and night, changes in life of a living being, etc.). Psychological time adds

to the characterization of *homo informaticus*. When something is happening or changes, an observer may imply a calendar timeline to it. But psychological time is a distinct concept for at least two reasons.

First, psychological time often “runs” slower or faster than calendar time. When one is dissatisfied with an hourly accomplishment, one may feel as if less time was available; and the opposite is true as well. The same period of calendar time usually feels longer when one experiences misery than pleasure. Second, a person can even experience “timelessness” when being deeply immersed in an activity, as implied in Csikszentmihalyi’s (1990) theory of flow. In absence of clear frame of reference, the feeling of passing (i.e., time) vanishes. A neon sign that is continually switched on and off may be perceived as if existing in a prolonged present time. However, changes in a background sky would make a natural process a frame of reference, which in turn could impart a perception of time to this monotone switching. This may be so because both the general concept of process and that of psychological time refer to succession of stages.

The variety of time concepts suggests that time holds a distinguished place in human intellect. Such a variety is paradoxical in light of the fact that time has no physical existence (say, in contrast to space). In Popper’s (1994) philosophy of the worlds we attend to, time is not located in the first world (the physical world), but in the second world (the mind) and the third world (the products of human mind). Time concepts are human creations invented for the sake of organizing daily life, society, developing science and technology, and rationalizing history. Most of the concepts of time have nothing in common. Still, different concepts are confused, as when scientific relativity of time is explained by examples pertaining to psychological time.

A significant practical problem emerges when psychological time collides with other concepts. Calendar and technological time can be perceived as too fast when IS and organizational changes are introduced. As a consequence, one feels overwhelmed by the pace of changes. Being under constant and strong pressure to produce, perform, and meet deadlines represents a stressor causing occupational (job) burnout (Corey, 1996)—a disparity between the demands of the job and individual capacities. A possible facet of the burnout phenomenon is that slower psychological time gets in a collision with faster calendar and technological time. One instance of this is known as “information overload.” Essentially, data are supplied too fast in reference to subjective feeling of an acceptable pace. When a burnout erupts, it is a problem both for the affected individual and the home organization. Understanding psychological time as part of individual capacities can be a step in managing the burnout. The next step would be to pace work processes in a way that is more adjusted to the individual’s psychological time.

Differences in cultural concepts of time surface in international business or in migrations of labor force. Variation in cultural time leads to misunderstanding in using everyday time-related terms, such as “now,” “tomorrow,” and “past.” Problems in communication reflect on business processes, such as negotiation and collaborative production. Acknowledging differences in cultural time is necessary for managing the misunderstanding and the related processes. As for time in organizational cultures, occupational groups or departments can have their own accustomed assumptions about time. When applied to IS changes, this time aspect belongs to infoculture. The issue is already addressed in Chapter 5 in connection with the metaphor method of investigating infoculture. One of the research questions reads, when should the IS change?

The study of company called Utilities, which struggled to adopt an HR system, revealed an infoculture split over this question. ERP technologists believed that the technological progress should determine the timing. Business people maintained that the pace of ERP system development should have been more moderate, so that system modules could get properly finalized and users allowed time for learning the

new system and related processes. As technological time was imposed at Utilities, most users felt that the company tradition was violated. This indicates a collision between the users' and technologists' concepts of time. Some users argued that they were "trampled by the computer." This indicates a collision between technological time and psychological time. As result of these collisions, the process of adopting the HR system suffered. However, by taking the perspective of these differing time concepts, management could be able to define the system adoption problem in a manner conducive to effective solutions.

In summary, the concepts of process and infoprocesses imply time. There are different concepts of time and their collision may lead to people and process problems in companies. Understanding these can help define process problems in a more effective way.

Extensions of Process Focus

The process focus has recently expanded to with the notions of digital transformation and the Internet of Things (IoT). AS brief discussion on each follows.

Digital Transformation

The term "digital transformation" is sometimes cited in conjunction with "disruptive technology/innovation" and at times as an intended replacement for it. A formalization of the concept is missing since it originated in the IT industry. It is usually emphasized in the trade press that deploying trendy IT alone without having business ends in mind makes an incomplete concept of digital transformation. Organizational product strategy as well as a change in organizational design are cited as necessary complements to technology change.

Technologies for digital transformation usually include Cloud, mobile, analytics, IoT, social media, and AI. Although different surveys with different samples have identified different business targets behind digital transformation, it is possible to see an overlap. One is the emphasis on business process improvement. This means that the process focus, which started with business process reengineering and business process management, is being continued. Therefore, digital transformation is significantly about process improvement, with a visible emphasis on customer-facing processes. Thus, the focus is on marketing, such as customer experience. For example, analytics may help improve customer intimacy, while social media may improve customer touch points.

Another emphasis is on porting IS operations to Cloud computing providers. This target actually concerns the evolution of changing systems architecture (overall design of organizational IS) and infrastructure (physical system solutions regarding software, hardware, databases, networking, etc.). Of the infrastructural focus are also the goals of improving cyber-security and a general level of digital technology (digitization), which are sometimes also cited in management surveys on digital transformation. It is to be noted that these goals do not automatically imply business strategic goals. The fact that the chief providers of Cloud services also produce some of the other technologies linked to digital transformation may have implications that merit the attention of researchers and practitioners.

The Internet of Things

IoT is the driver behind process automation. Put another way, the scope of data infoprocesses is scaling up. IoT refers to sensors and various computing technologies that are connected via TCP/IP-based system

interfaces. Examples include the electrical power grid in which meters track variation in consumption and transfer these data to a system that aggregate data and analyze consumption trends; functioning of aircraft engines is measured by sensors and the data is submitted to a system for testing variation from standards and failure prevention; manufacturing machinery is monitored in a similar way; sensors in passenger cars report the state of vital car parts to a car dealer's database and analytical system; automatic readings of patient's vital statistics are transferred to monitoring stations to ensure the doctors' timely decision making; and so on.

Boos and colleagues (2013) proposed a framework for managing an electronic supply chain of medical drugs. The supply chain involved a drug manufacturer, pharmacy, whole seller, and patient. The authors focused on the sharing of the accountability and control tasks between IoT and human actors. From the infoprocess perspective (refer to Figure 4), the basic level in this supply chain is the data infoprocesses that are carried out automatically via IoT. A key data infoprocess automatically verifies a drug based on RFID tagging. This could include a simple identification of a product. Deeper automated checks would include the product composition, handling procedures, and regulations. The next level refers to informing the human actors involved – a transformation of data into meaning/information in the human actors' mind. In the authors' framework, this is indicated by focusing on training of human actors. This next level is the actors' cognitive infoprocesses of perception, thinking and learning, to say the least. Here, an actor perceives an issue, retrieves his/her memory, and infers what the system can or cannot do, or is/is not doing. All the three levels constitute the business infoprocesses of accountability and control, which the authors studied conceptually. They suggested that a human actor's capability of satisfying accountability demands should correlate with control over an IoT system. In contrast to constraining control by a single standard, which some IoT proponents advocate, these authors suggested that the decision should be made by designers of a particular IoT system and the involved stakeholders.

In the broader health sector, IoT is combined with both mobile and analytics technologies to establish "smart health" (Kang et al., 2018). IoT-enabled smart devices allow medical organizations to carry out preventive care, diagnosis, and treatment at any time and place. One such system the authors cited was able to deploy a cardiovascular monitoring device for continuous tracking of patients' heart rhythms. Then, the readings are sent to the patient's smartphone via Bluetooth, and the phone forwards the measurements to a physician in scheduled intervals. Also, real-time health monitoring is combined with analytics and artificial intelligence (AI) to support the doctor's and automated decision making. Technologies for IoT, analytics and AI bear a potential to radically transform infoprocesses in the health sector.

SUMMARY

This chapter explored the concept of infoprocess. The discussion started with exploring a concepts of process in various disciplines, and a common thread was identified in the idea of succession of stages. Process is sometimes used interchangeably with the term system, and modern cybernetics holds that everything can be seen as a process. In the areas of management and IS, perspective of business (organizational) process has been very influential. Examples include systems analysis and design, BPR, and BPM.

The discussion proceeded to infoprocess (short for "informing process") that was defined in terms of interrelated informing activities that deliver an outcome to a customer. Informing activities make part of many organizational processes and sometimes are the exclusive content. The concept of infoprocesses involves aspects of data, cognition and their intersection that results in information. An analytical frame-

work that applies to business process and infoprocess alike was elaborated. It included two essential segments—process design and process performance.

Process design includes aspects of composition, coordination, complexity, flexibility, and technology. Process performance was discussed in terms of process time, costs and customer value from process. Process design determines process performance. Better performance can be achieved by optimizing a process on each design aspect. The process of decision making with Big Data was also discussed.

Ensuing discussion turned to Process-Centered Organization in conjunction with ERP systems and the BPR methodology. Challenges of BPR were examined and a contrasting BPM approach was sketched (most of the chapter's discussion applies to it).

In the second part of the chapter, attention turned to the role of process approach in advanced forms of organizing. The virtual organization (VO) was first discussed in its different forms including the ecosystem. This discussion expanded with exploring virtualness at large and proposing a model labeled Tree of Virtual Life. Next, discussion turned to some potential perils of the process approach, which were framed as a collision of different concepts of time. A note on digital transformation and IoT ended the chapter.

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ENDNOTES

- ¹ Ludwig von Bertalanffy, the founder of General Systems Theory, drew on various research traditions, including biology, physics, cybernetics, and elements of information theory (e.g., Shannon & Weaver's (1949) model of communication). Bertalanffy took note of the applicability of system ideas in organization theory as well. These and ensuing ideas from systems theory (e.g., that of Varela & Maturana, 1979) have made a strong impact on both IS and organizational theory. Examples include the concepts of system, environment, input, output, process, information, feedback, self-regulation, homeostasis, open/closed system, requisite variety, systems hierarchy/system decomposition, and autonomous self-maintaining systems.
However, it is interesting that Bertalanffy (1968), did not define formally process in his seminal work. However, the author used this term probably nearly as frequently as "system." Particularly interesting is Bertalanffy's proposition regarding the role of process in open systems. For example, he argues that "the primary order" of a living organism is in life processes—exchanges of matter between organism and its environment (see *ibid.*, p. 141). An open system is like "fuel spending itself continually and yet maintaining itself" (*ibid.*). Open systems are subject to entropy as closed systems are: they can import negative entropy from the environment, which results in reducing entropy in the system. Therefore, the process of exchange between the system and environment (e.g., the process of metabolism in a living organism) maintains order in the system.
These ideas may resemble the usual thinking about the role of information in an organization: interpreting environmental data reduces disorder (uncertainty) in the organization. However, one should note that Bertalanffy prefers to keep Claude Shannon's information theory confined to the domain of technical systems for message transport, for which purpose it indeed was created. Bertalanffy pointed out that applications of information theory outside this domain had been "unconvincing," and that one of the major problems was the relationship between information and organization (p. 22). This expectation that information may be used as a measure of organization resulted from the fact that information theory defined the concept of information by "an expression isomorphic to negative entropy in thermodynamics" (*ibid.*).
- ² Hammer proposes that studying principles from engineering and computer science can teach students to become holistic thinkers (Hammer, 1996: 233-237). This method is supposed to help develop "big picture thinkers," people who are able to see pieces of a whole in their interconnectedness. One may argue that liberal arts education can mold holistic thinkers as well. Technical rationality of a process-centered organization needs to be balanced with equally demanding "people's issues," such as political considerations, technology adoption, and organizational change. Keeping all these categories in mind certainly qualifies as big picture thinking.
- ³ For example, in a discussion on implementing ERP in spatially distributed organization, ERP is seen as an enabler of changes to processes and "organizational models," while one company is said to have adopted a "process-based organizational structure" (Markus et al., 2000).
- ⁴ The lean methodology draws substantially on analysis of business processes. It looks both at the physical and informing side of business process. In analyzing to-be state of a process, lean inspires on eliminating waste in terms of unnecessary steps, redundancy, wait times, defects, flow quality, etc. Lean reaches beyond the process perspective, supplying a plethora of analytical techniques. For example, it instructs to focus analysis on particular items, such as unused human potential, inventory, transportation, motion, and overproduction.

Chapter 8

Infoeconomics

ABSTRACT

The chapter discusses economics of informing or infoeconomics, which refers to costs and benefits of informing agents and to their contribution to organizational performance. Controversies questioning contributions of IT/IS to productivity (IT productivity paradox) and to competitiveness (IT commodification argument) are discussed. Several methods of assessing costs and benefits of informing agents are proposed. Assessing benefits from IT/IS, data, and knowledge is challenging since their impact is usually not immediately visible. The challenges have become more pressing with the data analytics and big data trends. Several research cases are used to demonstrate relationships between IVO aspects and infoeconomics. It is argued that a business process management model and balanced scorecard methodology are reliable guides for study and management of infoeconomics. The implications of big data and cloud computing on infoeconomics are discussed throughout the chapter.

INTRODUCTION

Economics of informing, or infoeconomics for short, refers to the part of organizational economics that intersects with organizational informing agents. This part of organizational economics is influenced by IS, knowledge, wisdom, and the management of organizational data. Infoeconomics has a benefit and a cost rubric. Another useful stance is that of organizational performance, which can be understood in terms of efficiency (productivity expressed in tangible measure of money, quantity, and time) and effectiveness (the accomplishment of any significant goal formulated in organizational plans, strategies, and management or professional realms).

Infoeconomic analysis is focused on the contribution of informing agents to organizational performance. Such an analysis takes into account other IVO aspects discussed in this book. This IVO slant differentiates infoeconomics from studying the sheer relationship between organizational performance and IT. The domain of infoeconomics represents a manager's test bed for the payback from data, knowledge, information (in IVO, the meaning outcome of interpreting data), and IT assembled in IS.

The cases presented in the preceding chapters carry infoeconomic connotations which this chapter will explore. The discussion will start by looking at some general and controversial issues of evaluating

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economic effects of IT/IS, which have occupied academic and management discourse. The discussion will proceed to exploring IVO-based measures of efficiency on the organizational level. Next, relationships between infoeconomics and other IVO aspects will be demonstrated by taking a look back at the topics of previous chapters and the case organizations. The infoprocesses perspective will be emphasized as particularly important for practical purposes. The escalating trend of renting IT and IS services will be addressed in the end of the chapter.

Efficiency Puzzle

Researchers in the United States have for long been occupied with evaluating economic effects of information technology (IT) and resources. Research has targeted two domains—operational and strategic effects, the former was concerned with efficiency (productivity) and the latter with broadly defined effectiveness (accomplishment of organizational goals—financial and others). Efficiency analysis is the topic of this section.

Two levels of productivity analysis have been used: (1) macroeconomic (an economic sector, such as manufacturing or services; e.g., Roach, 1989); and (2) microeconomic (the level of a firm or of a firm's unit; e.g., Brynjolfsson, 1993). Researchers have usually correlated some measure of organizational output (e.g., a figure on financial return) with some measure of "IT costs" (e.g., the total spending for computer software, hardware, facilities, training, etc.). A historical premise behind implementing IT and IS was that these were vehicles for working faster and for completing more work with same or less hands. The background of this premise can be located in the manufacturing and other branches of technology. The premise's genealogy can be traced back to the era of industrial revolution and inception of the science of economics, both originating in Great Britain. The essential idea is that an investment in new technology pays back so that a worker can produce more pieces of something within a unit of time. This happened with the transition from manual to machine-supported work in the industrial revolution. The efficiency rationale maintains that the same should happen with IT.

Early studies of efficiency attributable to IT were microeconomic. They delivered well-known cases, some of which have identified a contribution of IT to efficiency in particular organizations. For example, the customer service process at Otis Elevator was found to be faster owing to the use of devices for automatic tracking of functioning of the elevators the company installed on customer premises. Similarly, American Hospital Supply Corporation's network (a precursor to technology for B2B e-commerce) enabled a quicker and labor-saving sales process. Interestingly, this fact did not show up in the efficiency equations due to a high cost of technology. The real benefit was in the rubric of effectiveness because the company differentiated its sales process to be more convenient for customers; over time, this resulted in an increase in the company's market share.

Other early studies detected *cost avoidance* as the major efficiency benefit. For example, a new database system at Radio Corporation of America helped in handling an increased volume of operations, while the company did not have to hire more workers for the respective operations. Over time, cost avoidance turned to be a convincing proof of microeconomic productivity associated with IT/IS. A variant of the cost avoidance effect has been that the headcount increases but not proportionally to the volume of operations. Another option is that labor costs increase due to some other driver (e.g., the existing workers get a higher pay for doing a more sophisticated work) but, again, the increase is smaller than the additional pay for new hires that would be needed for handling more work with the old technol-

ogy. This sort of thinking extends to date, an example being the rationale for BPR. However, in the late 1990s macroeconomic analysis seriously challenged the IT productivity argument.

The challenge of IT-related productivity became known under the term “IT productivity paradox” used by Roach (1989) in his seminal article. The paradox is attributed to the white collar sector, which is data and information-intensive (e.g., financial, insurance, and media industries). Capturing the period of 1970s and partly 1980s, the argument has it that the increased spending in IT had not correlated with productivity of white collar sector, which remained near stagnant. Indeed, the background of the paradox is in productivity studies of Robert Solow, the Nobel Prize winner for economics. He laconically summarized his findings by stating that a computer age can be seen everywhere but in the productivity statistics. Therefore, the IT productivity paradox suggests that IT has been unable to increase efficiency in the work based on IT and even more broadly. A debate between the proponents of IT productivity argument and the proponents of the paradox stretched over years.¹ (see Attewell, 1994; Brynjolfsson, 1993; Brynjolfsson & Hitt, 1998; Brynjolfsson & Saunders, 2010; Roach, 1998, 1991).

While the productivity paradox camp has been extending a list IT failures to boost productivity, the productivity camp criticized methodology and a lack of social analysis taken by its counterpart. The methodological argument is staked on the nuances of productivity measurement that fails to account for specifics of IT (e.g., IT cannot be treated as manufacturing technology since it does not transfer its accounting value directly to the final product). Another line of criticism focuses on the macroeconomic approach that averages productivity measurement across organizations: at the macro level, an organization’s gains may be canceled out by another organization’s losses.

The social argument advanced by the IT productivity camp is quite elaborate, ranging from the thesis on historical learning through changes in work characteristics to mismanagement. The historical learning thesis suggests that firms need to learn how to deploy IT in more productive ways by changing their organization rather than applying new IT to the existing organization. Historical analogies with other technologies are usually cited as a proof (King, 1996). Another angle of analysis focuses on trade-offs between quality and volume, which are enacted by new IT (Attewell, 1994). For example, new IT allows for better formatting of documents and other changes that boost up the quality of work but may use more time, thus not increasing the productivity on this task. In addition, given the increasing data processing capabilities, performing more of the informing work, in terms of volume and refinement, is a constant possibility. Consequently, productivity gains related to old informing tasks and processes can be annihilated by addition of new ones. Management is partly responsible for these losses, if it passively accepts such outcomes.

For example, a new reporting module based on spreadsheet functionality is introduced. With this system upgrade, an analyst can complete the task within a half of the previously needed time. If the 50% time saving is actually utilized, what does the do with the surplus time? Some options are: (1) do nothing for real but convey an impression of working; (2) continue working on the same task by improving the format of the report; (3) switch to a new task that follows from and expands the existing task, and (4) switch to an old task sitting in the cue. Only option 4 delivers a productivity gain: the 50% time cut is turned into a 50% productivity gain. Contrary, option 3 eats the potential productivity gain by introducing unnecessary work, option 2 increases only the quality of work (which may or may not pay off), while option 1 is a total waste. What happens in reality depends much on management and the analysts’ initiative. Obviously, productivity improvements may never materialize.

One can certainly add more points to the above explanation of the ambiguous relationship between IT/IS and productivity. System design certainly matters, and particularly so in the segment of user inter-

face that provides access to data and system functions. The poorer the design is, the longer the learning period and smaller the output during that period; the know-how retention rate may also suffer. Another impediment to productivity, which could work independently or in conjunction with the design factor, could be the pace of IS change: a too rapid rate of change may work against productivity. Software vendors bear considerable responsibility, including the producers of standard off-the-shelf software. To push up revenues for competition reasons, the vendors tend to put software products through unnecessary changes, thereby imposing learning costs and a productivity loss on the user side. An example was the massive, unwelcome changes of the user interface in the Microsoft Office 2007 software. In a scrutinized analysis, care must be taken with regard to the levels of analysis by asking the question: To what extent the above management shortcomings at the microeconomic level do influence the productivity figures at the macroeconomic level?

The discussion above points to possible solutions to the IT productivity paradox, starting at the microeconomic level. The first message is that IT in general and particular IS have to be actively managed toward productivity goals rather than left to chance. Another message is that management needs to concentrate on the process side of organization, rather than looking abstractly just at the correlation between organizational inputs and outputs. IVO uses both of these messages.

Questioning Competitive Advantage

Starting remarkably in the 1960s, the influx of electronic/digital IT into a wide world of organizations was hailed with high expectations. The enthusiasm became a trend over time, marked by the landmarks of “data automation,” “paperless office,” “artificial intelligence,” “personal computing,” “networking,” “ubiquitous computing,” and so on. Computer came to be viewed not only as a substitute for extensive labor, but also as a technology for accomplishing strategic goals that improve competitiveness. Thus, IT was touted “a strategic weapon.” While this line of thinking reaches our days, dissent has also been voiced. Doubts in the strategic value of IT add to the unresolved productivity paradox.

A vocal criticism came from Carr (2003), who argued that IT has become commodity. In essence, he argued that new IT became abundant and affordable. Therefore, IT lost the properties of scarce and exclusive asset, which according to theory of competition, bring competitive advantage. IT became an ordinary technology as is technology for delivery of electricity. Commonly available things are commodities accessible to most of consumers. Consequently, costs of the IT as commodity are the costs of doing business rather than the investment in the competitive edge. Opponents of the commodification argument have countered by calling attention to a continuous historical process of advancing IT, which generates ever new opportunities. Therefore, early adopters can still gain a competitive advantage. Others have argued that IT cannot bring a competitive advantage on its own—what matters is how IT is managed. Hence, variation in use and management can still engender differences across companies, even in the case of using the same kinds of IT. The opponents also deny Carr’s historical analogies between IT and past technologies.

It can be argued that the commodification argument characterizes well some aspects of modern IT. In particular, some kinds of IT or IS may push toward organizational isomorphism rather than differentiation. An example is transaction processing/reporting systems that track operations and generate standard reports (basically, databases complemented with queries and reports). These systems have been around for decades. The late 1980s saw outsourcing of these systems. Owning gave way to renting, and the trend has continued through application service providers and to modern Web-based systems offered

as the hosting service and Cloud computing. During the 2010s, the range of Cloud services expanded to include many types of IS, including the historically mission-critical systems for executive decision making. There has been a matching, growing demand on the corporate side, and Cloud services have become a legitimate part of IS infrastructure and the digital transformation trend (as discussed in Chapter 7). Equalized accessibility of Cloud services reiterates the commodification argument.

ERP systems may also resemble a commodity since they usually support standardized organizational processes that vendors advertise as “best practices.” Usually, organizations opt for standard solutions because these are cheaper and better supported by vendors (indeed, vendors usually recommend such solutions). But the downside is that processes encoded in ERP software may wipe out process specifics that did represent elements of competitive advantage in a particular company. If ERP systems made organizations similar to each other, an ERP system resembles a piece of confection for a mass consumer market, thus a commodity. And yes, the ERP system is also part of Cloud offerings.

In a critical examination of this argument, the fact is that even the commodification-prone systems meet differing organizational contexts. Let us focus on ERP systems. Three facts are of interest: (1) ERP systems can be implemented with different system scopes and reporting capabilities across organizations; (2) change management associated with ERP systems varies across organizations; and (3) ERP systems for larger companies are still expensive rather than being universally affordable. These points apply whether an organization owns an ERP system or rents it as a “commodity.” As for the first point, one should note that variation in implementing ERP systems springs from the scope of business processes moved onto an ERP platform. Covering the financial area and budget only provides apparently much narrower data management capabilities than covering most of the business functions from purchasing to sales. This difference results in different capabilities for executing integrated data management. Enter the differences in custom reports drawn from data warehouses that can address specific decision making needs in a particular company. This is where ERP systems can truly demonstrate their benefits, or the lack thereof. Organizations achieve different degrees of success in this respect. All this variation is likely to result in the different informing and organizational outcomes.

The second point is based on ample evidence that adoption of ERP systems into routine use is rather a challenging endeavor. The failure rate of 50% indicates clearly difficulties of change management associated with ERP systems. These facts imply that an ERP system is far from being a piece of confection that makes every consumer look alike. Or in technological terms, plug-and-play methods do not apply to ERP systems. Change management is the key to the success with ERP systems. Paradoxically, the neglect of management aspects insinuates a “silver bullet” (or plug-and-play) approach in which technology regardless of other factors automatically makes the difference. When technology was expensive and rare, the magic wand of technology was expected to work. Now that the wand is universally available, the magic is gone. Finally, the third point to be made is that ERP systems are far from being universally affordable. Large implementations demand levels of investment that still just select companies can afford even in rich economies. Thus, technology is still expensive.

The commodification argument is also missing a historical character of technology, organizations and society. For example, electronic transacting between business partners has a long tradition that started in the 1960s with private data networks and EDI/EFT systems, and culminated with B2B e-commerce enabled by the Internet, e-hubs/markets, and purchasing, sales and production systems linked among organizations. Supply chains have changed with these developments, and industries that have led these trends may have not been at the same competitive level as those that lagged behind. Testing of this proposition could include comparing supply chains in car manufacturing and grocery retail with supply chains

in furniture manufacturing and health care delivery. Comparisons of specific industries' productivity across countries would be another interesting research direction.

Finally, as it is the case with any technology, the key to gaining advantages is in the manner of using contemporary IT. A car could be just a costly utility if used only for leisure purposes as opposed to going to work as opposed to utilizing it for money making via ride sharing/hailing. Or take the example of today's analytics systems. These provide a potent basis for decision making in this complex world. Still, it makes a difference how exactly these systems are operated, and how they fuel particular decisions ultimately being up to the decision maker. Comparative advantages arise from these differences, reminding us again to abandon the silver-bullet approach and engage technology in a creative manner. If even strategic IS become as accessible as any commodity, the commodification argument should remind the user to aim at using these IS at a beyond commodity level.

In sum, while pointing correctly that various kinds of IT are no longer rare and may precipitate isomorphic effects, the commodification argument pushes this change to an extreme in order to deny any competitive advantage associated with IT. By doing so, the commodification argument fails to realize that implementation of technologies varies in dependence to system design and management, that certain technologies are still expensive and thereby not universally affordable to own or rent, and that historical developments keep reproducing leaders, followers and fallouts at the macroeconomic level of analysis.

Assessing Costs and Benefits

Assessing costs and benefits of data, knowledge, IT and IS is the subject of infoeconomics. Infoeconomics is part of organizational economics (microeconomics). The discussion about the IT productivity paradox above indicated a need for advancing measurement. The following discussion will propose new measures that employ IVO logic. Some methodologies applicable to other organizational assets may be useful for this purpose, while keeping in mind specifics of organizational informing agents. The level of analysis is pegged to process. In other words, organizational tasks, transactions or operations are viewed as infoprocesses. The cost side is discussed first.

The Informing and Technology Costs

The following discussion will propose some new cost measures based on IVO logic. Consider this simple example: What is the cost of an email transaction? The cost is a sum of informing cost (IC) and technology cost (TC). That is,

$$\text{Cost (C)} = \text{Informing Cost (IC)} + \text{Technology Cost (TC)} \quad (1)$$

IC refers to the price of work time that people engaged in a communication episode do expend: time for message creation on the sender's side, and the time for reading and interpreting the message on the receiver's side. In general, IC refers to costs of work involving cognitive informing agents (knowledge, data). TC denotes the cost of email system incurred in the communication process. Let us look first at the IC item.

IC in formula 1 varies with the type of task. In a simpler example of routine work, IC for a data entry task applied to a computerized IS would equal to a usually standardized, predictable figure (e.g., the time expended multiplied by a standard hourly rate for this task). The standard rate (expressed in some

currency) is determined by a standard time for data uptake (via reading, listening, watching) and for recording the data (i.e., entering electronic data). In contrast to this routine task, IC of the email task is less predictable. The message creator needs to spend some time on thinking about the content and the form fitting the email system, and the data recording time (typing a message) may vary significantly across email users.

Consider IC of a knowledge use process (ICk). ICk can be expressed via the cost of learning plus the cost of deployment:

$$\text{ICk} = \text{Learning Cost} + \text{Deployment Cost} \quad (2)$$

The learning item in formula 2 may refer to expenses of formal professional education or of self-learning. The latter could be approximated via opportunity costs; these are especially clear in service industries depending on billable hours as the source of income. Economy of scale applies here since the more frequently the acquired knowledge used, the smaller its cost per use instance. Therefore, the average cost of knowledge use (ICk') can be calculated as:

$$\text{ICk}' = \text{Learning Cost} / \text{Number of Knowledge Deployment Events} + \text{Deployment Cost} \quad (3)$$

Furthermore, the Deployment Cost (DC) in formula 2 refers to costs of recall and implementation:

$$\text{DC} = \text{Recall Cost} + \text{Implementation Cost} \quad (4)$$

A recall from memory can take some time or be effortless and happen in "no time." The same applies to knowledge implementation. If one needs to retrieve knowledge representations from a KWS, then recall costs boil down to retrieval costs. In this case, the Implementation Cost is usually bigger than zero because the retrieved content needs to be interpreted, understood and then applied to the problem dealt with.

In practice, however, IC and ICk are usually not viewed separately from the cost of organizational task, if such pricing indeed is applied. For example, an email-intensive operation is likely to be priced if a customer service is based on email, but otherwise may not be priced. If no such pricing is applied, task costs are buried in job costs. The corollary is that many facets are taken for granted and that rough approximations replace precise measurement.

The TC item in formula 1 can be calculated in different ways. As already mentioned, the simplest method is to take the investment and operational costs and average it over some period of time (e.g., the benchmark amortization period). Then, calculate the product of this term and the number of units expended in a particular task/operation:

$$\text{TC} = \text{Average cost of system's use} * \text{time units expended} \quad (5)$$

This calculation of TC costs is similar to *activity based costing* (ABC) used in manufacturing (Kaplan & Burns, 1987). The intention is to relate process costs to direct use of IT. ABC allows for differentiating between uses of the same piece of hardware (e.g., a PC) in different ISes (e.g., the same PC can be used also in several ISes, such as decision support, office automation, etc.). This is an improvement

over traditional accounting which would simply break down the TC equally to all the systems involved, thereby calculating indiscriminately technology costs as overhead (indirect costs).

Organizations usually do not look analytically into costs as expressed in the formulas above. IC, ICk and DC are not separated from labor costs and TC are approximated as part of fixed costs. This blurs infoeconomics in particular and organizational economics in general. When an infoprocess is IT-intensive, it is unclear if a certain productivity outcome is due to a technology cost, costs of informing aspects, or some extraneous factors. Such methods constitute a meager basis for management. Management is not better advised in the case of infoprocesses supported by low technology, and this has a ripple effect on planning technology improvement: the less one understands the real costs of an infoprocess, the less clear are the potential benefits of advancing technology.

The expansion of renting Cloud-based IS services has simplified the cost accounting for IT. Depending on the pricing model, there are fixed costs that are ready-made for entry in the debit rubric. However, there are also variable costs that can be hard to predict. One instance of this is the sophistication of analytics services that Cloud vendors use as the item in pricing formulas. As the software for these systems improves, its price tends to go up.

In summary, the cost side of informing agents can be advanced to a more analytical approach by pegging costs to a specific task or infoprocess and differentiating between the cognitive and technological cost sources.

Benefits from Informing Agents

The benefits side of infoeconomics should also be approached from the process perspective. Such a granularity is inherent to IVO and it has been recognized in the relevant literature as an alternative to abstract correlational studies on IT-related inputs to financial outputs at the organizational level (Chan, 2007). The discussion, therefore, is going to match infoprocess costs discussed in the previous section with tangible benefits of infoprocess deliverables. For example, costs of informing agents involved in a communication process are to be squared with the value of the process deliverable for the process customer, such as a contribution of a communicated content to the work of the informed party. The value-added has to be measureable in objective and tangible terms.

In the case of change in informing agents, benefits of the communication process can be expressed in more tractable metrics of process performance discussed in Chapter 7, specifically in time and cost savings. The problem is thus somewhat reduced, as one needs to understand the relationships similar to those established between IS, process design, and process performance. But the customer value dimension still needs to be addressed. However, it will be argued here that this dimension is not easy to measure in any case.

At the outset, it is worth-noting that cognitive informing agents challenge the cost principles applying to physical goods. For example, law of diminishing returns may not necessarily apply. If data and knowledge are treated as a production factor (rather than bundled in a “technology” rubric), adding new data about the problem and solution domains may result in better-informed decisions. Similarly, studying new software development methods may improve a software product under development. Therefore, increasing data and knowledge as production factors (while other factors are kept constant) can indeed lead to increasing returns that, in these examples, are measured by the quality of designer decisions and the final software product (provided these are backed by tangible metrics). Quantitative tests are congruent (e.g., Maddison, 2005; Wells, 1997).

But it is also possible that this causation does not materialize. Pouring more of problem/solution-related may confuse the informing process, and so the data are discarded in the end. For instance, the new informing does not fit with the decision maker's knowledge and thus is filtered out. There is even a graver possibility of falling back into the diminishing returns trap, if the decision maker accepts such new, unfitting information and gets distracted. The same applies to new knowledge in the process of software development. More data can result in confusing information, and more information can result in confusing knowledge. These are consequences of the spiral of uncertainty discussed in Chapter 1. Therefore, a declination of informing agents from classical economic principles is just a possibility that necessitates a careful contingency modeling.

Getting back to the problem of assessing the value of infoprocess deliverable, it is apparent that the method of directly transferring value usually does not apply. A deliverable of infoprocess is part of work that may generate economic value only in a delayed fashion; for example, a communicated content assists in problem solving, which is part of a service sold. Because of this indirect involvement in income generation, the contribution of informing agents to the revenue accruing from the service sold cannot be simply built into the pricing model by the method of value transfer of traditional organizational assets (manufacturing technology, land, labor, etc.). Focusing on cognitive informing agents brings equal challenges.

Take the case of organizational data in the form of documentation on products, markets, employees, finances, and so on. Proponents of intellectual capital theory characterize this documentation as the organizational asset of goodwill. A more certain return from this goodwill may apply only when a certain part of the documentation is applied to a clearly defined task and results in effortless informing. For example, the value of suppliers' address list can be assessed by the price a purchasing manager would be willing to pay in the market for such a list when placing regular monthly orders, while not having access to the equivalent list in his company. This logic parallels the classical utility function in economic theory. However, utility function becomes less reliable in other conditions. For example, the purchasing manager may be willing to pay more for supplier addresses when demand for his company products surges. Diametrically opposite to these scenarios, the documentation rests unused and no value can be attached to it. Notwithstanding cogent arguments of the intellectual capital proponents, gauging the value of documentation is perplexed by significant variation due to situational factors.

How much value can be placed on the meaning inferred from data? The assessment may depend on the familiarity with consequences in a familiar situation. For example, the value of retrieving a top-ranked customer from a sales database in the process of creating a marketing campaign can be valued by the return in new orders placed by the customer after the campaign. However, if the information learned is not a direct answer to a precisely formulated question, then its consequences are usually unknown in the present. The value of new information can hardly be established in foresight but rather in hindsight, after applying what is learned and realizing beneficial effects. Organizations know this when they collect documents and records "just in case" these might be needed one day. This retroactive valuing is an inescapable social and cognitive constraint. These constraints may be alleviated with help of experience and decision support systems for simulation and forecasting.

The problem of assessment in less familiar situations is practical as much as theoretical. Gill (2009) has assumed that "a utility model that fails to accommodate task unfamiliarity and learning processes would be sterile indeed for purposes of understanding the motivation to inform and be informed" (p. 231). He proposed that goal-setting theory of motivation may serve for adjusting utility function. In the case of new tasks, "perceived value of informing" could be assessed according to its contribution to

the performer's progressing toward goal achievement. While subjective variation is inescapable, Gill maintains that it can be reduced over time as the task is repeated and valuations become more stable. However, in the case of highly unfamiliar and learning-oriented tasks, utility of informing is inherently subjective, prone to framing issues and cognitive biases. With increasing familiarity with the task, this case may evolve toward the new task case.

Valuation complications extend to knowledge. The aspects of both indirect and delayed impacts and retroactive realization apply to knowledge as well. Therefore, only when a service or good in which knowledge is "built" is completed and eventually sold, one can reason about the value of knowledge. Likewise, realizing monetary benefits from a newly learned cost saving method is possible only after successfully applying the method. Proprietary knowledge in employees' mind and represented in KWS can be assessed on their contribution to revenues. But the value of professional knowledge applied from human mind to a work process is less assessable in monetary terms, although it is assumed to be necessary. For example, nuanced knowledge of account auditing may just be approximated, say, by a monetary loss resulting from corresponding ignorance. Nevertheless, these theoretical possibilities are still challenged by the retroactive character of valuation.

Even more complicated and less susceptible to evaluation is the contribution of knowledge to informing. When information is conceived in process terms as a result of knowledge-based processing of data, then no information exists without knowledge. Of course, knowledge of interest in this analysis is professional (rather than general), and it is applied to business data. According to utility function, an investment in learning new knowledge, while other production factors as well as data and IT are kept constant, may result in increasing returns. New knowledge can make a difference in informing that, in turn, can lead to improvements in problem solving, products and revenues.

Although the worth of knowledge seems certain, when looked from this perspective, the expression of it is not so. The problem extends the above cited difficulties in valuing the meaning. Valuing knowledge that makes an actor "see" in some data apparently useful information that evades others is usually bypassed. A more extreme variant of this case is when wisdom, which is understood as accumulated and intuitive experience, is the agent of data processing. A wise problem solver may show no cognitive effort in resolving professional puzzles that are entirely inaccessible to others. If such wise acts are evaluated at all, it is done by irregular valuation methods exercised by supervisory authority. In traditional human resource management, regular valuations of professional knowledge are rendered to approximations built in static "job qualifications."

The discussion so far has indicated problems of estimating benefits (pay-offs) of informing agents. Characteristics of their organizational impact obscure a clear-cut infoeconomics at the time when, paradoxically, informing agents are so pervasive. Roach (1998) captured this well in the following statement:

The breakthroughs of the Agricultural and Industrial Revolutions were all about sustained productivity growth in the creation of tangible products by improving the efficiency of tangible production techniques. By contrast, the supposed breakthroughs of the Information Age hinge more on an intangible knowledge-based product that is largely the result of an equally intangible human thought process. (Italics added.)

Dealing with the problems and possibilities of valuing knowledge, meaning, and data has become more pressing with the increasing volume and types of data, raising pressures to sustain competitiveness and growth, and opportunities engendered by technological trends of data analytics and of big data. Rather than confronting these issues, theory either scratches them in a tentative manner or neglects

them altogether. Knowledge assets may hypothetically play a role in purchasing behavior of investors, as intellectual capital research advocates (Edvinsson & Malone, 1997). The argument has it that investors tend to value higher firms with an intellectual potential that may engender innovation and, in turn, higher demand for their products and larger revenues. Consequently, investors push up demand for stocks of such firms, and higher demand increases the firms' market value. Even if the above model sustains economic cycles, however, valuing of knowledge from the perspective of intellectual capital is very general in character rather than applicable to reality of an ongoing flow of business.

By topical orientation, information-focused research may be more expected to contribute to resolving the valuing problems than research that is fixated on technology. The respective institutional binding in North America corresponds to schools of information vs. the management information systems programs residing in business schools. However, traditional, simplistic conceptual bounds tend to blind research lens for phenomena inside cognition. Consequently, benefits of informing are typically out of picture.¹

In summary, assessing benefits of data, knowledge, information (meaning), and IT is more challenging than assessing their costs or assessing the benefits of traditional organizational assets. Since the core production processes usually do not run on IT, the idea of value transfer onto the final product does not apply in principle, although it is usually approximated according to certain industry standards. The assessment of benefits from meaning (information) is even more challenging since it often depends on the familiarity with the effects of using it (established once experienced, or known only in hindsight). While proprietary knowledge is susceptible to benefit valuation, other forms of knowledge present serious valuation difficulties.

Matching Costs and Benefits

Methodologies for formal economic analysis of costs and benefits assessment beyond standard financial methods are lacking. Analysis of some IT/IS usually correlates their fixed and variable lump costs with some measures of financial returns at the organizational level, such as cost savings, cost avoidance, and earning figures. Costs and benefits of cognitive informing agents as discussed above are usually not scrutinized. At best, they are indirectly included in assessments of paybacks from IT or IS, or in evaluations of payoffs from knowledge management projects (e.g., patent management and corporate instruction).

From the macro-organizational perspective, the support role informing agents play in organizations points to cost savings and cost avoidance as the most prominent benefits of informing agents. Cost savings accrue from eliminating cost of labor via automation. The BPR literature offers convincing examples in this respect. Cost avoidance refers to avoiding labor costs that would apply if new IT/IS is not introduced while the volume of business increases. Cost savings and avoidance also apply to non-production tasks performed as part of business. These can be *transaction costs* resulting from product search, negotiations/contracting, and monitoring execution of a deal (indeed, these are infoprocesses). Automation can speed up these activities and make them less labor-intensive, that is, it can reduce the corresponding transactions costs (see Malone et al., 1987). A good example is B2B e-commerce.

A buyer looking for raw materials can quickly search the Internet for vertical portals (e-exchanges), and save on transportation and communication costs. Downstream savings can further be made on negotiations, loan seeking (some e-exchanges offer loans as part of their services), and on monitoring order fulfillment. In other contexts, cost savings and avoidance can show up in the category of agency costs as well. More knowledgeable process performers, working in a well-designed process necessitate less

supervision, and thus principal cost. BPM and BPR are premised on these possibilities. Any scrutinized test of savings should control for spurious variables that can invalidate results (Radhika & Hartono, 2003).

From the cost perspective, prudent analysis needs to be comprehensive rather than limited to accustomed cost lists. If one makes permanent savings on labor (which is what these cost saving/avoidance methods are ultimately about), one has to pay for technology that makes this possible. What are the total long-term expenses to sustain? This question calls for looking at the entire life cycle of a piece of IT or an IS—*life cycle costs* or the *total cost of ownership* (TCO). TCO aims at exhausting all recurring costs (including overhead costs and the IS staff pay) and capturing hidden costs. The last category can be quite extensive, including the a price of organizational change associated with system deployment, system down-time, costs of system recovery due to security breaches, expenses for disaster preparedness, system infrastructure testing, quality assurance, and depositing computer hardware according to specific environmental laws.

IVO matches costs and benefits of IT, data, knowledge and other informing agents in a particular way. Each IVO dimension directly impacts infoeconomics. Since these dimensions emanate from the intersection between informing agents and organizational aspects, it follows these dimensions indicate the impact of informing agents on infoeconomics. A particular place belongs to infoprocesses since these intermediate between infoeconomics and other dimensions. These relationships are depicted in Figure 1. It also shows that infoeconomics influences organizational economics. All relationships are discussed below, by way of summarizing an expanding the discussion in preceding chapters.

Homo Informaticus and Infoeconomics

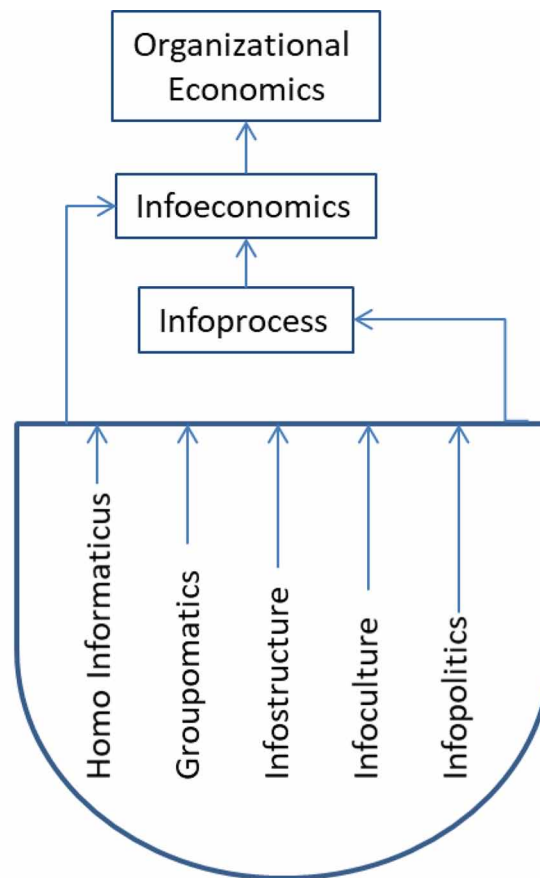
Cognitive processes performed by the homo informaticus (discussed in Chapter 2), which intervene in information making, knowledge deployment, and decision making, have their price in time. Memory is limited in volume and content, perception is prone to illusions, and thinking is susceptible to biases. These limitations factor in the price of cognitive processes partaking in work. Satisfaction of informing needs also has a price. Transaction costs capture one part of it. But a cost estimator should account for a total time and effort for getting informed and not only for the cost of search through the sources of informing.

Decision making engages extensive cognitive resources of the homo informaticus. A monetary price applies to every decision making model discussed in Chapter 2. Decision processes entangled in an infinite loop (discussed in Chapter 7), normally incur a higher execution cost than those with a finite end. Decision making with help of Big Data and machine learning bears hidden costs tied to an unpredictable number of iterations of data entry and model making (Chapter 7). But the picture may change when the result of decision making is considered. It might turn out that, paradoxically, a decision making process without a definitive ending costs less in terms of organizational consequences than a decision from an alternative decision making process which causes a damage to an organization. Cognitive biases, limited research, infocultural habits, groupthink and inescapable infopolitics can leave their mark on the quality of a decision made in a “rational manner.”

Groupomatics and Infoeconomics

Groupomatics makes a significant impact on infoeconomics. Certain characteristics of the homo informaticus have a particular relevance, such as cognitive styles (Chapter 2). Team members’ cognitive styles mix determines the cognition of a team that, in turn, reflects on the team’s work capabilities and results.

Figure 1. Relationships between infoeconomics, other IVO aspects and organizational economics



More or less efficient and effective work has ultimate economic implications. For instance, the effective group memory can reduce costs of knowledge recall or reduce a memory loss that would otherwise show up in the quality of teamwork. Given the communication-intensive character of group work, communication costs in their various tangible and intangible items are always to be planned and monitored with care. While tangible costs are apparent in the expenditures referring to work time and communication systems, intangible costs may be hidden. A poor communicator may harm the socio-emotional side of a team, with eventual repercussions for work results. Deeper understanding of communication complexity beyond the simplistic conduit model (“the transfer of information between a sender and a receiver”) creates more adequate lenses for studying group communication as well as managing it toward beneficial ends.

The uncertainty and ambiguity plaguing the teamwork and GSS has a high impact on infoeconomics of work groups and, in turn, on the infoeconomics of a company based on group work. Adoption and uses of IS are much more complicated in the group than in the individual context and the outcomes are often difficult to predict. Costs and benefits can therefore tend toward the desirable end or in the opposite direction. The distributed group context scales up the challenges of this uncertainty. More research is necessary to overcome fatalistic GSS management (management provides the best resources available and then cross fingers and wait to see what happens). In case of GDSS, research needs to expand understanding of system benefits beyond the quantitative, easily measurable output.

Infostructure and Infoeconomics

Infostructure also influences infoeconomics in a major way. As discussed in Chapter 4, infohierarchy (the extent to which data and IT are vertically distributed) is a necessary condition for management hierarchy. Costs of securing the depth and breadth of data access proportional to a given management rank therefore are the costs of maintaining social hierarchy. Benefits of proper infohierarchy are quite convincing: access to appropriate reports and records infuse a life force in management function, such as control and decision making. IS may increase the benefit cost ratio by driving costs down while maintaining the accustomed benefits. But for this to be realized, the underlying infoprocess has to be changed.

Consider an expense reporting system serving tens of thousands of employees in a corporation with a usual extent of hierarchy (say, up to ten levels of approval). Via the system, the employees report travel and purchase expenses to managers, who control and approve the expenses in a self-serve fashion. If the system merely automates the former paper trail, the time on task each of the process performers spends may remain constant. More likely, the time will increase for many in the early adoption phase when the acquisition of system use skills takes extra time. Sheer waste can even occur because the missing or wrong inputs create loops between different levels of approval, which previously did not exist. Opportunity costs can loom large for the entire corporation. If the design and other usability issues inflate the time expenditures, costs of the maintained infohierarchy overshadow the benefits on a longer run, even if new benefits of centralized control and minute auditing of expenses are accounted for. In addition, the break-even point in the financial analysis of the system becomes uncertain. In contrast to this scenario, reducing the complexity of the reporting infoprocess before designing the system would preclude some costs. New costs can also be controlled by implementing system functions that supplant human checks.

The convenience of any place/any time data delivery can be measured by the IVO dimension of infodispersion (the number of locations at which organizational IT and data are stored for operational use) this convenience comes with a price for data storage and transfer. Edge servers for storage must be deployed (whether owned or rented), and network costs for the transfer between the storage and clients absorbed. Global systems, such as Gmail or social media can conjure up an image of highly dispersed storage. As storage costs may follow a south-bending curve, the pay for the bandwidth, as part of network costs, remains weighty.

While social media are a prime example of the benefits accruing from high infodispersion, other potential benefits of these depend both on the particular systems deployed and the specific users involved. But if the users' benefits are not taught beyond sheer entertainment and viral marketing, the customer value proposition formula is incomplete. Such a formula should also account for the users' costs. If a benefit of staying connected with acquaintances comes with higher time costs (a long loading time of web pages, excessive visual content, extensive supply of trivial text, and imposing of unwanted tasks), the users may start looking for alternatives. To work as a management guide for a longer period, the infoeconomics of social media has to complete the cost/benefit analysis underpinning the formula of customer value proposition.

Costs of infoformalization (the extent to which written rules, procedures and instructions on handling data and IT are extant) must be covered regardless of the price, in order to enjoy the benefits of orderly data management, and organizing and sharing of knowledge. In contrast, infofragmentation (the extent and modes of dividing data and IT on the department, job, task, and process basis) should be carefully sized to avoid perils of structural and process anomalies demonstrated in the case of Telco. The same applies to infocentralization. If it is unnecessarily high so that it chokes cognitive abilities of the homo

informaticus and professional capacity of organization members, then such infocentralization turns into a liability. Contrary, as discussed in Chapter 4, a decrease in infocentralization may contribute to increasing organizational performance, that is, to better infoeconomics.

Infoculture and Infoeconomics

Developing and maintaining *infoculture* is a delicate emergent process. It can be costly whether the business need is to protect privacy of client data (as in law firms), innovate knowledge that is life force (chemicals, pharmaceuticals, consultants, the software industry), craft IS that are indispensable for doing special business (as in e-commerce), or just perform a solid management of organizational documentation. New IS appear a resilient cost generator when they collide with the existing infoculture; Chapter 5 demonstrated this fact on examples and cases. If computers can engender a “cultural isolation” (Deal and Kennedy, 1999), what is the price of this undesirable infocultural change? Still, beneficial changes in infoculture—both of a planned and opportunistic character—can occur with new IS. Understanding them is a step in weighing benefits against costs pertaining to a process of infocultural change.

Each of the infoculture categories discussed in this book has its infoeconomics. Costs must be paid to achieve the expected benefits whether the infoculture is predominantly that of role/bureaucracy, matrix, clan/power, fiefdom/person, team, family, market, or knowledge. The salient cost category depends on the infoculture type. For example, in the role/bureaucracy infoculture, investments must be made in securing the form of and access to documentation (infostructure costs), while in the matrix infoculture the need for combining principles of teamwork and hierarchy require investments in double reporting lines and in GSS. Whereas the variety of individual choices may be a technology price booster in the fiefdom/person infoculture, the clan/power and family categories allocate most of the costs to personal communication. Team infoculture generates costs of knowledge diffusion and of GSS supporting autonomous teamwork. As for knowledge infoculture that continuously facilitates the entire knowledge management process, overall higher costs than for other infoculture categories are required. But knowledge infoculture also pays higher dividends.

Infopolitics and Infoeconomics

The relationship between infoeconomics and *infopolitics* is less salient. Prolonged infopolitical fights cited in Chapter 6 can certainly be weighed in opportunity costs. However, pricing infopower is less sensible. Resonating with the opaque disposition of social power, costs and benefits cannot be associated directly with infopower but rather with its consequences. The moduses of infopower make a difference in the gain or the loss rubric only after infopower is wielded. Expertise-based influences or a lack thereof exerted in the processes of system planning, design and development have far-reaching economic consequences. The festival organization discussed in Chapter 7 exhibits both the costly and beneficial effects of expert power and of data/IT control. Meaning management, another modus of infopower, follows the same infoeconomics: the manipulative administrators in the hospital study appropriated an extra budget for their hospital (the beneficiary) and generated an extra expenditure for the public health ministry (the cost payer).

Infopower emanating from social media systems may cause intangible costs on the user side, which can propagate to tangible costs on the owner's side. Failing to perform a balancing act between attracting and exploiting communities (van Dijck, 2013), user masses can experience disempowerment and turn

away. Business models of social media face the challenge of users' power that rests on "the ability to exercise competent choices, grounded in their understanding of competing and even conflicting incentives and motivations" (p. 63).

Infoprocess and Infoeconomics

The aspect of *infoprocesses* has a complex role in analyzing infoeconomics. Infoprocesses (1) directly impact on infoeconomics, (2) influence organizational economics, and (3) mediate between infoeconomics and other IVO aspects (Figure 1). The first role rests on the fact that infoprocesses—as part of broader organizational processes or being organizational process in their own right—have tangible costs and benefits. Since infoprocesses are directly involved in creation of organizational products, infoprocess performance shows up in organizational performance, thereby fulfilling their second role. The third role draws on the assumption that other IVO aspects influence infoprocesses; therefore, the infoprocess design and performance in part mirrors the other IVO aspects (e.g., hidden costs of infopolitics). It follows from these assumptions that the infoprocess aspect is a prominent mirror of infoeconomics. The infoprocess lens is the researcher's and the manager's superb guide for understanding the infoeconomics of informing agents. Put another way, the infoprocesses stance is the appropriate domain for applying infoeconomic analysis both at the micro- and macro-organizational level.

A well-optimized infoprocess is complete, containing all necessary steps, deploys parallel steps wherever possible, reduces the wait time for resources, exhibits just necessary variation, is simple enough and clean of waste, and effectively deploys IS (refer to Chapter 7). Good design keeps the cycle time and cost on the benchmark and delivers expected customer value (quality, utility/price, delivery time, etc.). Let us re-examine the cases discussed in this book from the perspective of infoprocess and infoeconomics.

The company called Telco (Chapters 7 and 9) experienced problems with its marketing campaign process (actually, an infoprocess). It did not deliver exactly what it was supposed to and it exhibited significant problems in composition, coordination, complexity, and the use of IS (see Table 1 below). This sub-optimal infoprocess had been shaped by the company's infoculture, infopolitics, and management (more on management impacts is in Chapter 9). Infoeconomic consequences were significantly in the red zone. Since the process did not complete a marketing campaign by capturing the market response, its cost showed in a less effective marketing. Infoprocess design ineffectively used CRMS, which fact had the final cost in smaller returns from the system; indeed, a significant part of capital investment was wasted. One of the goals tied to the vision of a holistic picture of customer and to CRMS was to reduce sales personnel; this goal was missed and savings on this basis had never accrued. The customer process problems of wrong addresses and identification across lines of business had a price in delayed payments and losses in customer satisfaction. Reduced employee morale was another cost of the infoprocess problems.

The organization code-named Pavilion (Chapter 6) went through two stages in its development. Mostly inefficient and ineffective infoprocesses characterized the first stage. Knowledge recall from memory of seasoned Pavilion members was slow and prone to errors. This resulted in significant time costs. Knowledge sharing was limited to the circle of insiders and only exceptionally shared outside of it. Low morale and job satisfaction resulted as intangible costs. Management processes were inefficient and ineffective, based on the paper trail (chaotic in itself) and exclusive personal communication. Specifically, decision making was taking a long time and sometimes would never end. In addition, it could not break out of the tradition and move the Pavilion forward. Many processes were poor on coordina-

tion, increasing time and money costs. The accounting process delivered only rough summary figures inappropriate for prudent cost management, which reduced earnings. Marketing was non-existent. The overall infoeconomic effects showed in small revenues and high costs. As much as old infopolitics was responsible for unsatisfactory infoprocesses and infoeconomics in the first stage, infopolitics of a new leadership paved the path to improvements. Design and performance of all infoprocesses were improved. In effect, tangible costs of Pavilion's business were reduced and earnings increased. Intangible benefits of a motivation boost among new recruits were also achieved.

At Utilities (Chapter 5), the infoprocess of self-serve online approvals of time and expenses was not adopted by managers as to-be users. The old infoculture was resilient, and managers pushed the process down to the clerical staff. Managers' dissatisfaction with their new role represented an intangible infocultural cost. This cost did not influence the infoprocess performance but rather showed up at the macro-organizational level: the expenditures for software licenses allocated to managers were wasted. Returns in investment in HRMS became uncertain because clerks reasserted themselves in the HR process. This potentially imperilled the goal of reducing the administrative ratio over time (one of the chief goals behind HRMS and the associated new processes).

The process perspective in general awaits fuller acceptance by researchers and practitioners as a superior gauge of organizational economics. It has certain following and not only among advocates of BPM and BPR. The *balanced scorecard methodology*, which enjoys a broad acceptance among managers, builds in part on the process perspective (Kaplan & Norton, 1992, 1996, 2004; Papalexandris et

Table 1. Infoeconomics and infoprocess antecedents

Case and Informing Agents	IVO Aspect Involved	Infoprocess Design & Performance	Infoeconomics Effects
<i>Telco</i> CRMS	Infopolitics, Infoculture, IS Management	- Marketing campaign process: design mistakes, misses the purpose - Customer service processes: errors, slowness	- Less effective marketing - Diminished returns from CRMS - Cost savings by reducing sales personnel unrealized - Customer satisfaction losses - Low employee morale
<i>Pavilion</i> Knowledge, Email system, office automation	Infopolitics	<i>Phase I:</i> - Knowledge recall: slow, erroneous - Knowledge sharing: very limited - Management processes inefficient <i>Phase II:</i> - Knowledge sharing improved - Processes of governance coordination, accounting & marketing improved	<i>Phase I:</i> - Large intangible costs (low morale and job satisfaction) - Poor decision making, coordination, accounting, marketing - Small revenues, high costs <i>Phase II:</i> - Reduced tangible costs, increased revenues - High member motivation
<i>Utilities Company</i> HRMS	Infoculture	- Online approvals of time and expenses defunct, rejected by managers	- Software licensing costs wasted - Uncertain returns from HRMS - Low managers' morale - Cost savings on clerical work uncertain

al., 2005). Balanced scorecard measures organizational performance in the areas of finance, customer relationships, organizational processes, innovation/learning, and any other an organization deems strategic. The organizational process aspect is apparently one of the assessment bases. As many processes or their segments are actually infoprocesses, the balanced scorecard is applicable to infoprocess and hence infoeconomic analysis. The balanced scorecard is concerned with the performance of those processes that deliver a value proposition for the customer, in terms of both tangible and intangible parameters. The process metrics invites scrutinizing the contribution of informing agents to process performance. The associated costs can be estimated in the ABC manner; for example, what are the costs of data management and IT items that accrue in particular processes?

Another useful property of balanced scorecard is that IS aspects are accounted for as part of business processes. The innovation/learning area of performance directly addresses the IS aspect labelled “information capital” (Kaplan & Norton: 1996) and characterized as a foundational intangible asset. It adds to the other two foundational assets—human and organization capital (organizational climate). These assets determine performance in other areas (process, customers, finances, etc.). Further evolution of the balanced scorecard methodology may benefit from espousing IVO. Specifically, an organization may define an IVO aspect as strategic and then measure progress toward its achievement over time. For instance, a firm intending to turn into a mobile enterprise (ME) discussed in Chapter 3 could establish distributed production infoprocesses and a mobile infoculture as strategic areas. Then, the progress made in these areas can be monitored and regularly assessed.

In summary, formal methodologies for matching costs and benefits of informing agents are lacking. Analysis usually correlates lump costs for some IT/IS with some figures on savings and earnings at the organizational level. From the IVO perspective, costs and benefits of informing agents are mirrored in the relationships between IVO aspects and infoeconomics. The balanced scorecard methodology shares certain ideas with IVO and can benefit from espousing it.

Evolution of Infoeconomics in Cloud Services

Infoeconomics is subject to an evolutionary process. One of the evolutionary forces is a tension between owning and renting IS. Cloud computing is a newer model of renting IS resources and services, which continues on the tradition marked by outsourcing and the model of application service provider. Cloud computing also refreshes the commodification argument discussed above. If complete IS services can be rented rather than owned and internally nurtured in a company, are IS any different from traditional commodities traded in the market? Cloud computing is also interesting for its potential impact on organizational design, as this is discussed in Chapter 7.

In the 2010s, Cloud computing has been spreading in both the private and public sector, and in various industries and geographical regions. From the Cloud client perspective, the motivation to rent Cloud services is in cost reduction. In principle, a company can proportionate the IT portfolio to its real needs, maximize utilization/cost ratios by paying only for the actual use IS services, and avoid the costs of IS development, maintenance and technological progress (while enjoying its benefits). Cloud computing services can be public and private. The public Cloud is offered in the open market to various sorts of customers. Private clouds cater to interest of organizational networks and particular industries. An example is supply chains in the manufacturing sector. A greater transparency in supply chain boosts efficiency in delivery and product return, that in itself is an increasingly important part of supply chain in industries where the pressures to reduce time-to-market result in products that miss a finishing touch.

Another opportunity Cloud computing opens up in the area of mobile systems. Clouds overarch the space in which users of mobile devices operate.

As it is the case with any innovation, however, the cost side of Cloud services is not fully clear and predictable since it is dictated by Cloud vendors. One area of uncertainty refers to the costs of infoprocesses continually running between the Cloud client and Cloud vendor (and potentially creating VOs, as argued in Chapter 7). What are the costs of organizational change, of integrating these infoprocesses in the client organization, and of security? These questions demand that answers are updated as business and technologies evolve. Moreover, as with any model of IS renting, the client organization loses the grip on technology. And the vendor lock-in becomes as a real threat when Cloud supplants organizational IS capabilities.

The crucial issue is how to preserve a blend of technical and professional capabilities that underscore strategy making and execution. The organization member should not be reduced to a passive consumer of the informing services and content—whether these are delivered by the external or internal IS experts. Cognitive sedation is to be avoided by all means. This is true even in the best possible scenario when a Cloud vendor behaves as a true partner in strategizing.

In summary, Cloud computing is a trendy method of renting IS services with a potential of cost savings and avoidance, but also with substantial challenges.

SUMMARY

The term infoeconomics refers to costs and benefits of informing agents and to their contribution to organizational performance. Two contemporary controversies are relevant for exploring infoeconomics—IT productivity paradox and IT commodification. The productivity paradox takes the macroeconomic perspective and challenges the historical premise that IT/IS are the vehicles for working faster or for completing more work with same/less hands. The countering argument focuses attention to the microeconomic level of analysis and establishes productivity gains attributable to IT investment. It is argued that new infoeconomic measurement and better management may assist in leveraging productivity gains from the microeconomic to the macroeconomic level. Several methods of assessing costs and benefits of informing agents are proposed.

The commodification argument posits that IT lost characteristics that make it an asset that brings competitive advantages. While pointing correctly that IT is no longer scarce, the commodification argument fails to account for a management factor and still prohibitive direct costs. It was argued furthermore that assessing benefits of informing agents is quite challenging since these usually have support roles in organizations. Assessing benefits of cognitive informing agents is particularly difficult, as it depends on experience and hindsight. Although initial attempts at valuing knowledge have been made, theory lags behind practical needs that have become more pressing with current trends of data analytics and big data.

The discussion turned to matching of costs and benefits. The matching has usually been applied to a particular IS and calculated in some form of financial returns (cost savings, and cost avoidance, and expected earnings) as compared with lump fixed and variable cost of IT/IS. IVO takes a particular approach to this problem. It is premised on moving away from abstract and proxy measures of technology inputs and of organizational performance. IVO aspects embed impacts of informing agents and each aspect is associated with infoeconomics. Infoprocesses are particularly important, as they are shaped by informing agents and other IVO aspects, and they directly influence infoeconomics. The discussion also

addressed the balanced scorecard methodology, which shares certain ideas with IVO and can be advanced with IVO aspects. Finally, the evolution of infoeconomics was placed in the context of opportunities and threats associated with cost management brought by the newer rental method of Cloud computing.

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ENDNOTE

- ¹ In the information-focused research, “information” is usually thought of as undifferentiated data, organized-and-meaningful data, and knowledge, residing outside cognition. Such information is collected, processed, and maintained, in order to be “used,” that is, taken into cognition (e.g., Kettinger & Marchand, 2011). While the use domain is crucial for assessing benefits, it has been traditionally out of research scope. A fixation on collecting, processing, and maintaining informing materials can reveal merely the cost side.

Chapter 9

Information System Life Cycle

ABSTRACT

The chapter discusses the IS life cycle phases of IS design/development, adoption, use, evaluation, and management. These standard topics in the IS field are framed in the IVO perspective. A model of IS life cycle is used for analyzing the case of a system for customer relations management in a telecommunications company. Historical variation and drifts in the IS management leading to the system's marginalization are explored. The chapter also demonstrates how IVO furnishes analytical devices for extending analysis of teaching and research cases on information systems.

INTRODUCTION

The main purpose of the IVO framework refers to study and management of IS. This chapter discusses the IS issues that are standard topics in study of IS (management information systems and similar areas). In the structure of this book, this discussion continues the summarizing started in the previous chapter. The second part of the chapter articulates the main messages of IVO and sketches directions for advancing it.

The concept of IS was introduced earlier. To reiterate two more important points. First, IS is a broader concept than IT, as the former incorporates the latter along with data and procedures. And second, an IS does not “provide information” but rather transformed and organized data that may become information in human cognition. For the following discussion, it is useful to look at IS from a perspective of a cyclical life process. The process starts with the system conception and ends by phasing out the system. The process steps (sub-process in their own right) are IS design/development, adoption, use, evaluation, and management. The IS issues are represented in the inner circle of the IVO framework as depicted in Figure 1 in Chapter 1 and below in Figure 1. Elements in Figure 1 are somewhat rearranged to suit the purpose of this discussion. Some of the IS issues have attracted more attention than others; for example, the issue of system adoption drew in more research than IS design/development, use, or evaluation. It will be argued that more balanced approach is needed, including a concentration on IS use and management.

The topic of issues will be richly demonstrated in a further elaboration of a previously introduced case that after successful initial adoption took on rather a dramatic turn. Next, the contributions of IVO

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will be summarized, guidelines for deploying it specified, limitations stated, and directions for further research outlined.

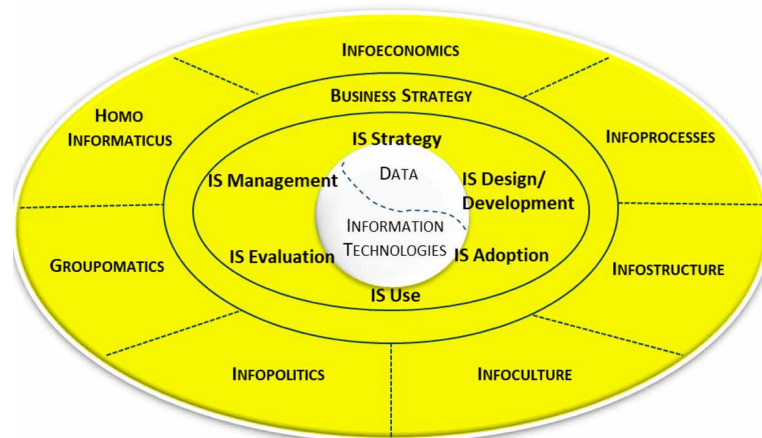
System Life Cycle

The term IS issues captures the main phases or processes that constitute a life cycle of an IS (a large scale process in itself). These are depicted in Figure 2. The cycle starts with the birth of a system, which in this figure is represented in the innermost orbit. A system is first planned in terms of functionality supportive of a particular area of business, funding decisions are made, timing of development and switchover is planned, system requirements are defined, and system design documentation is created. All this is labeled as *IS design*. The design process is coupled with *system development*, which refers to practical work on physically making a system. In comparison to system analysis and design terminology, “design” implies “analysis” (to compress the expression), and “development” is spelled out (to express the differences in management concerns associated with conceiving versus building a system).

A developed system undergoes the process of *adoption* by the users. This phase can also be understood in terms of change management. IVO offers analytical tools for understanding intricacies of system adoption, as it will be discussed in this chapter. System adoption ties into the process of *IS use*. This one normally takes most of the life cycle time, unless a system fails. A system is used for production and other purposes (e.g., organizational maintenance and development), and its effects on the organizational performance materialize.

Throughout the life cycle, the stakeholders *evaluate* the system’s characteristics and data, advantages and disadvantages (ups and downs, pros and cons), or tangible and intangible costs and benefits. Stakeholders are various user groups (differentiated on business area, access privileges, and levels of expertise and use). One group is users that in rapid methodologies can be involved as early as in the development phase (Figure 2). This happens with rapid methodologies system development methodologies, whereas more traditional methodology would engage users once a system is fully developed. In any case, users’ evaluation continues into the adoption phase and later parallels system’s use until the completely routine use sets in. System evaluation by managers is also extensive and parallels other life cycle processes.

Figure 1. Information system life cycle in the IVO perspective



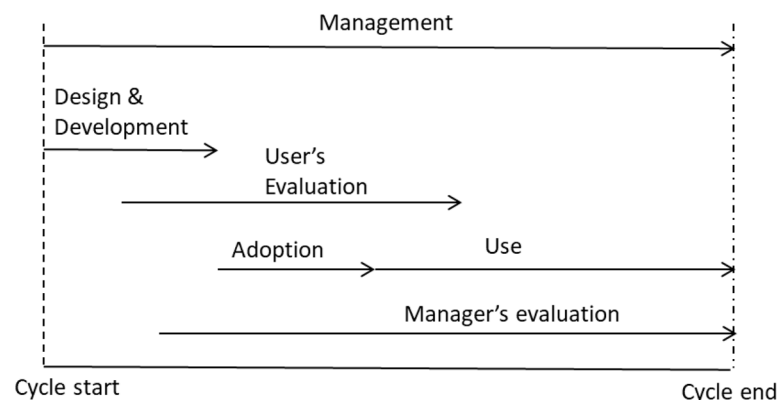
As indicated in Figure 2, IS management is an overarching process starting with system design/development and running until the system is shut down. The chief entities managed are work, people, money, and timing. IS management executes at all levels of management (operational, tactical, and strategic). So for example, at the start of the life cycle, a system that needs to support some strategic goals is identified, and the money, people and timeline are planned. Then, a corresponding development project is defined, budget is allocated, people assigned to project tasks, and a calendar set. In turn, during the execution of the project all these aspects are monitored and controlled.

Similarly, during IS adoption, training tasks are organized, trainers and the trainees assigned, a calendar created, and a budget for training allocated. In addition, change agents are assigned, and activities of selling a system and needed funds and time planned and monitored. In the period of using a system, the user issues, operational costs, and the system's contribution to operational efficiencies are management concerns. Annual reviews are usually performed in order to assess the system's contribution to strategic goals.

The orbit with IVO aspects represented in Figure 1 is re-arranged to insinuate the idea of flow that may emerge when IS issues interact with IVO aspects. The flow may start with infoeconomics, as economic goals normally drive system conception. But there can be exceptions to such a rational approach. Sometimes, the system advent may be primarily motivated by infopolitics. Since a system can affect organizational processes, the infoprocess aspect can be triggered early in the IS life cycle. This depends on whether an organization subscribes to process orientation (e.g., bureaucracy usually does not do so, while project-driven organization may do it) and the IS type (e.g., ERPS does trigger process change, while an IS with a smaller scope may not do so). After addressing infoprocesses, turning to infostructure issues may follow. However, infostructural interventions can be performed independently of infoprocess interventions, and sometimes may not be invoked at all. Furthermore, the infoculture stance can be taken in the adoption phase when resistance of established beliefs and behaviors becomes visible. Optionally, a prudently managed company would deal with a possible infocultural gap earlier in the IS life cycle. The corollary of these propositions is that a sequence of IVO aspects in reality is far from linear and can only be conceived as an emergent process. The same assumption applies to normative modeling: one should sequence IVO aspects and relate them to IS issues in accord with particular organizational conditions.

The discussion in preceding chapters touched on IS issues. In Chapter 2, homoinformaticus was discussed from the perspective of a system evaluation and design capabilities demonstrated during

Figure 2. The IS life process



system adoption. In Chapter 3, issues of system adoption and use had a prominence, being framed in the context of GSS. The message from Chapter 4 is that the processes of system adoption and use are to a significant extent conditioned by aspects of infostructure. The infoculture discussion in Chapter 5 touched on the entire IS life cycle. The same scope was covered in Chapter 6 in relation to infopolitics. The infoprocess perspective (Chapter 7) emphasized IS design, evaluation and management in the context of business process design and performance. Finally, Chapter 8 pointed out to IS evaluation as a key factor in infoeconomics.

In summary, IS issues refer to the life cycle of an IS, which are conditioned and contextualized by other IVO aspects.

Case of Information System Life Cycle

The following analysis will further elaborate on the case company Telco by looking at IS issues and their relation to relevant IVO aspects. The case investigated two departments—Sales and Marketing.

Sales Department

The sales department employed 250 people and it functioned primarily as an inbound call center serving consumers and corporate customers. Responding to customer call on the soft telephone, customer representatives would sell services and respond to billing or servicing inquiries. Line managers oversaw the representatives, and two area managers oversaw line managers and reported to a director of consumer sales. The unit serving the business market had one level of hierarchy less than the consumer market unit. Directors of both markets reported to a vice president.

Depending on experience and training, a representative could operate one or more of Telco's four lines of business (classical phone, cell phone, cable TV, and Internet access). Typically, in each call one had to use multiple IS. A representative would first verify the customer in the CRMS database. A problem could occur right away. As the master customer data was culled from different systems, each using different business rules, the same person could be related to two different customers in the CRMS. This problem persisted despite long-term efforts of a team dedicated to clean the customer data. The "doubled customers" were at loss because they could not use discount pricing for bundled services. Disappointed, they could switch to Telco's competitors, causing a loss for Telco.

After identifying a customer, a representative had to login into another system, depending on the line of business in question. Marketing data were located in electronic bulletins and partly in ordering systems; billing data were stored in five systems; equipment inventory, dispatch, maintenance, and other servicing records were stored at a separate location as well. There was no support to unified access to these different systems developed over three decades. There were some interfaces between the systems, but many updates had to be manually re-entered into different systems.

Experienced representatives commanded avid user skills, and rapidly moved between the systems to fetch the needed pieces of data, while conversing with a customer smoothly and within efficiency standards. For them, CRMS was a mandatory entry point. In addition to customer data, it tracked services per customer, the total annual spend per customer, customers inquiries, and supported some other queries. However, different representatives used the system in different ways. They could choose to run full standard procedures or to leave out some steps. Some noted the calls in CRMS, others did not. The problem was acknowledged, as this comment illustrates:

Information System Life Cycle

Although there was previous communication with a customer, sometimes you're going to see that nobody has indicated that they've spoken to this customer. That is our fault. That's not the fault of the system.

The lack of customer inquiry records was aggravated by the implemented method of coding the content of a call. One manager explained that this was done by selecting predefined labels from a drop-down list. If in rush, a representative could pick random selections without any possibility of follow-up validation. Although the system could have been configured for better call coding, this capability was never used. Sometimes a customer inquiry required additional action and some representatives used a system function for this purpose. But others opted not to use it but were leaving the reminders in handwritten notes or in voice mail. These improvisations weakened the coordination between representatives.

The most paramount deviation from the initial vision of CRMS was the coordination between sales and marketing. Here is how the sales managers and line managers pointed to the problem:

I know that there's some functionality in the system that would let you track if you were a 'yes' or a 'no' on a sales attempt, but we don't do any of that. So I think there's a wealth of information that we're not doing.

The actual marketing information is stored all over the place and it's not linked to a specific customer... It's not granular and specific of the customer as to what you should be trying to sell to this particular customer.

If I have to have interaction with the marketing department, there's nothing that drives me to use this system [CRMS] to communicate or give them. There's not a process that's put in place to say that this is going to be the way we communicate. We basically pick up the phone and call or send an email.

The consequences of these broken interdepartmental processes were that the sales representatives neither looked for marketing data in CRMS nor they recorded results of marketing campaigns in it. In fact, they did not collect these results. One line manager explained:

We do a lot of targeted marketing, direct mail... but then we don't take advantage of that when a customer calls. And when they call in they're just like everybody else. They might say: 'We got this advertisement last night.' And we'll say: 'Wow, what does it look like?'"

The enforcement of standard use procedures by line managers was imperfect. Higher level managers bear their part of responsibility since they did not supervise line managers in the direction of consistent use of the system. However, managers had technological means of control at their disposal. Indeed, there was a "Big Brother" capability embedded in electronic surveillance. Instead of enforcing standard use procedures, line managers used the surveillance for tracking significant drops in the representatives' efficiency. The representatives were aware of the loose enforcement of the CRMS use procedures.

Line managers had very limited exposure to CRMS. They did not even think of it as a part of the customer support process. Although many line managers descended from the representatives' level, over time they lost touch with CRMS and system skills. Their first priority was to achieve efficiency quotas. That meant keeping pressure on the representatives. The electronic surveillance was a public secret. It

would surface when an under-performing representative would get a warning of a line manager over the soft phone. Time pressure was indeed a part of the sales department's culture.

In spite of the obsessive preoccupation with efficiency, managers typically failed to realize that time indicators of performance depended on systems' support. Even management consultants, who regularly investigated efficiency in the call center, did not include technology aspects in their econometric analysis. Thus, the management philosophy separated the business process from the system. The official reasoning was that technology was the domain of technology experts.

In summary, after four years in the CRMS production stage the sales department used it in a limited way, systems' design did not progress through planned stages, system evaluations were unfavorable, management was lax in enforcing standard system-based procedures, and CRMS did not feature in efficiency equations.

Marketing Department

The marketing department at Telco numbered about 170 employees. The management hierarchy included eight directors and managers of product or channel units. In the mobile phone business, marketing relied on external telemarketing vendors. In contrast to the sales department, marketing people worked in quiet cubicles with no direct pressure of performance norms. The value adding contribution of marketing had been measured by the increase in sales, although a direct causal relationship between sales and marketing campaigns could not be established because marketing campaign responses were not collected at the point of sale.

In contrast to the sales department, CRMS had just about two dozens of licensed marketing users. In reality, a half of these used it weekly or sporadically for the purpose of storing marketing campaigns or for running simple customer inquiries. Marketers were convinced that CRMS did *not* deliver on the initial promises. One of them commented:

You enter your campaign, you get a database person to attach a list of customers, and then you close the system and forget about it because nobody ever enters campaign results into it.

Another agreed: "The system is largely not used, and it's often the last thing that people remember to do because you don't get any information from the system." Apparently, intrinsic motivation was missing. Management did not request that reporting on transpired marketing campaigns be informed by the system. Therefore, extrinsic motivation to use CRMS was missing as well. Laissez faire management culminated when the entire advertising unit had rejected to use the system as the source of customer lists.

The use of CRMS was not any better outside marketing campaigns. One disgruntled user abandoned the system after identifying inaccurate customer data in several occasions. Another former CRMS user verbalized what lied in mind of many:

I stopped using it just because there is no point; it's a waste of time. But I was using it for the first year that I was in my function, and I was like John the Baptist in the wilderness by myself. You feel a little silly after awhile.

Halted in development and ignored by marketing managers, CRMS could not inform customer profiling and market segmentation, critical marketing processes. Instead, the relevant data were sourced

from billing systems and processed by a data warehouse and data mining software. The missing sales data influenced the campaign process (as previously discussed). Another example was the coverage of unsatisfied customers. Generated in the sales department, the reports on these customers did not flow to marketers via CRMS but rather via improvised channels.

Marketing managers were responsible for the euthanasia of CRMS taking place in their department. According to employee's perception, managers exercised little control over the system use. Also, management enforcement of the standard procedures involving CRMS was perceived as weak. Marketers cited many examples of using alternative systems when CRMS could actually do the job. Their choices were dictated by their technical knowledge (e.g., a user knew how to use Excel), habit (e.g., a familiar system was "stretched" to fit a task), chance (e.g., having access to person technically competent and willing to help with a work problem), and other arbitrary choices devoid of prudent management. In any case of opting for alternatives to CRMS, the supervisors would turn blind eye, and professionals would not be reprimanded for abandoning CRMS.

Marketing management received lower grades in other areas related to IS management as well. The professionals pointed that they were "hung up in the air" with respect to the future of the system. In addition, help was missing in critical situations. For example, one marketer detected errors in customer data and asked his manager to investigate this with the sales department and their end of CRMS. But the manager never delivered help.

In summary, marketing professionals unfavorably evaluated CRMS, many abandoned it and moved to alternative systems, while managers followed a *laissez faire* approach, taking little care of the system and its existing users, and letting professionals to choose between CRMS and alternatives.

Withering Strategic Management

Telco's CRMS was initiated in the early 2000s, with a vision of creating an integrated picture of Telco's corporate customer. This vision was translated into a planned multi-stage system design called "roadmap." It included several system modules, such as, a product catalogue, order entry, order management, and Web-based front-end for accessing both the catalogue and ordering system. An idea was also to include the home customer in the vision of integrated picture.

Although several revisions of the roadmap were produced, each of them preserved a broad functionality that was supposed to be added in the development process. In addition to the integrated picture of customers, CRMS was supposed to improve support to and management of the sales force, increase cross-sell and up-sell, and enable cost savings (one roadmap cited savings of about 150 full time employee equivalents). On the technical side, CRMS was supposed to integrate data from legacy systems for managing customer orders and billing. CRMS was intended to be the technological solution for a new, deregulated, privatized and increasingly competitive telecommunications industry.

Corporate management shouldered CRMS roadmaps. The first achievement was in the area of integrating business customer records in order to identify services per customer and the total annual spend. These advances in infrastructure suited a new market segmentation module. In addition, a module for conducting marketing campaigns in the business market was introduced and it provided some initial results in capturing the market response.

While the planning of upcoming modules continued, IS management focused on system adoption. An executive team led by the President and the CEO was actively involved, and change agents were set in motion. Results of system adoption were continuously and closely monitored. Early adopters of the

system enjoyed rewards. The future of CRMS and associated business processes looked bright. Then, some unexpected events happened. During the first phase of system implementation, Telco acquired a telecommunications company that enjoyed a strong position in a particular nation-wide market. This company had its own CRM system. Heralding a dramatic turn of events, the new comer signaled that it did not buy into the CRMS roadmap.

The next critical event was a strategic shift to the local home (consumer) markets of mobile telephony and Internet services. While this opened up opportunities for profiting from the network resources and cross-selling, the new markets were contested by other telecommunications companies. In order to capitalize on its historical advantages, Telco had to find a way of drawing business opportunities from its extensive pool of customer data. This meant implementing the common customer identification, as previously was done for the business market. Another direction was a push toward realizing the initially planned customer self-serve functionality. This led to considering product catalogue and the entire consumer order management subsystem. However, cost estimates of such a sub-system sent a shockwave through management echelons, as the price was unexpectedly high. The new system modules did not receive sufficient support. The *coup de grâce* to the CRMS roadmap followed a year and half from the cited acquisition: two top executives, the champions of CRMS and the roadmap, left the company.

These events reflected on the development of CRMS. The roadmap was put on hold. The common customer identification and a module for marketing campaigns in the consumer market were implemented, but other development was frozen. Operations in the corporate market continued to be supported by a different CRM system. Possibilities of integrating it with CRMS were examined. A revision of the roadmap in that direction was circulated for a while, and then abandoned. As for integration of consumer data stored in the legacy systems for order and bill management, the plan on building an enterprise-wide system solution was sidelined. Instead, IT budget allocations were going to be funneled to maintaining complex interfaces between the legacy systems and CRMS. Announced as merely temporary, this solution indeed became permanent. As one technical expert put it graphically, the hope that old “spaghetti solutions” would eventually be retired were buried for the sake of growing “tentacles and band aids” between the nine customer support systems. Retirement dates of legacy systems vanished from the management vocabulary. The term “roadmap” survived but turned to symbolize a dream.

Strategic management was most responsible for the fall of CRMS. Former system champions were clear about it. One of them commented on “a loss of courage and the sense of direction:”

When we put the system in, we did a lot of the things, and we used it to the extent that we could. And then we were done, and we never went on to additional phases. So we never saw and maximized possible benefits.

Another former system champion walked a full cycle to end up by denying any value to CRMS from the marketing perspective:

There needs to be leadership and vision that is supporting it and there needs to be an emphasis on having a dashboard which measures key indicators. The CRMS should be the tool that is used, if you're investing the kind of money that you're putting into it. The next piece of adoption is that you reward and you compensate people on the use of the tool. We did these only in the first year.

Information System Life Cycle

Another executive admitted in retrospect that there never was “a clout to radically switch” to CRMS system. Moreover, an IS executive agreed and characterized the system’s management as “the win of tactics over strategy:”

We tend to simply layer problems on top of other problems. You’re fixing the in-year problem but you’re creating a bigger longer-term problem. Tactical decisions are made with no strategic value.

Lower echelon managers and employees in both departments detected the withering strategic management of CRMS. In the sales department, line managers with a longer tenure looked at the system with resignation. One of them said: “The system does what it does and we’ve never taken it a step forward.” Some of younger managers voiced dissent. One questioned the reasons for freezing development funds and wisdom behind it:

Who has the vision? Why would you stop funding the system? Why would you make funds not available to continue on? Is the price so prohibitive? Is it cheaper to do things manually versus automatically? And it just might be. And if that’s what’s driving it, I don’t know!

A seasoned line manager seconded the critique and stressed that the first level of management has been left out of relevant decision processes:

When the system rolled out, it was supposed to be a five year-plan and we were supposed to be from point A to point B. And there were a lot of points in between. But the system seems to be at a stalemate now. So we’re not sure where it’s going. Like it’s almost dead in the water. This is what you’ve got and there will be a little minor tweaking. We’re just not sure what has happened.

The survey administered as part of the investigation in the sales department suggested that corporate management got an average grade (a mid-point on a grading scale) for managing CRMS. Marketing professionals were even more critical as they gave a failing grade to the corporate management for managing the system. Interviewing yielded more details. Many felt that executives “dropped the ball” by choosing or rather not choosing to implement certain system functionality. In result, the system ended up with not much to offer to a marketer. It was useless for understanding customers and markets. Unresolved issues of the customer data governance were also debited to the top management account. Even a harsher critique was addressed to the executives for failing to turn the vision of integrated customer into reality. In words of a marketing professionals: “There is a huge gap between the vision and reality. The system was sold on the basis that there would be one customer. But this didn’t happen.”

As the executives’ commitment to the system collapsed, lower management ranks followed the suit. Within two years, the previous achievements were reversed. CRMS-supported processes suffered. For example, market segmentation and campaigning in the local corporate market could not be performed with CRMS. The mobile phone business rejected the system. The decline in system support and use led to severe limitations in the data. In turn, data draught amplified the positive feedback to the deteriorating system use.

The termination of system development impacted on the sales department as well. Although the system survived in its mandatory albeit limited role, the customer representatives were left stranded. Instead of

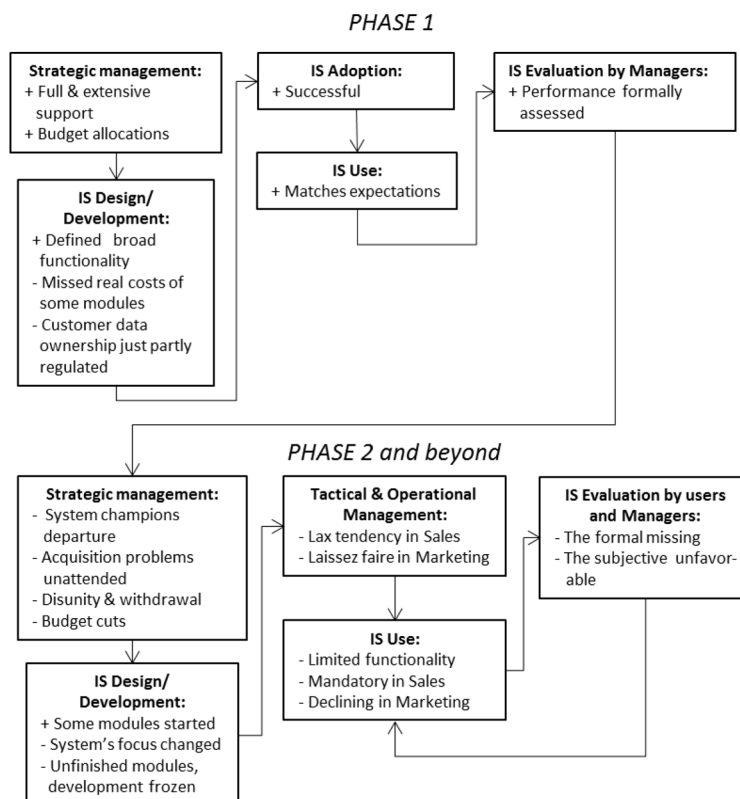
simplifying their work, CRMS actually extended the list of legacy systems pushed on the representatives. In effect, the complexity of the customer process increased. A former system champion explained:

The representatives in the consumer area don't like it... One of the problems in the call centre was that we never did anything to make the representatives' lives easier. We just added a layer of complexity. There was nothing in the new CRM applications for them.

The discussion so far illuminated a larger part of the CRMS life cycle. Although the investigation at Telco was conducted during the use stage, reflections of the actors shed the light on system management, evaluation, adoption, and design/development as well. Figure 3 summarizes the discussion.

Note that in Figure 3 the outcomes favoring CRMS are marked with a plus sign, and those unfavorable are preceded by a minus. It is immediately visible that after a successful start in Phase 1 CRMS experienced turbulence in Phase 2, and then went into a free fall. The processes it was supposed to support were not optimized but rather left in a previous state, resting on legacy systems (in Sales) or moved to new systems (in Marketing). Strategic (corporate) management bears chief responsibility for the demise of CRMS and the contemplated process organization that was supposed to create an integrated picture of customers in both the home (consumer) and corporate market.

Figure 3. The CRMS management in different phases



Even in the first phase, corporate management made two significant mistakes when it planned costs and decided on governance of customer data. Phase 2 was plagued with problems in strategic management. The departure of CRMS champions along with the acquisition of a company with its own customer support system were probably the turning points for CRMS. As strategic management withdrew support to further CRMS development, tactical and operational management followed the suit, particularly in the Marketing department. The lack of care reflected on the system use and evaluation. Phase 2 had never ended and the system kept surviving within an infinite loop of limited/declining use and the meagrely satisfied users.

In summary, after a successful start and executives' decisive support to CRMS in all stages of its life process, a series of unexpected events froze further development and the system was marginalized. Further analysis will illuminate relevant IVO aspects that contextualized and conditioned the life trajectory of CRMS.

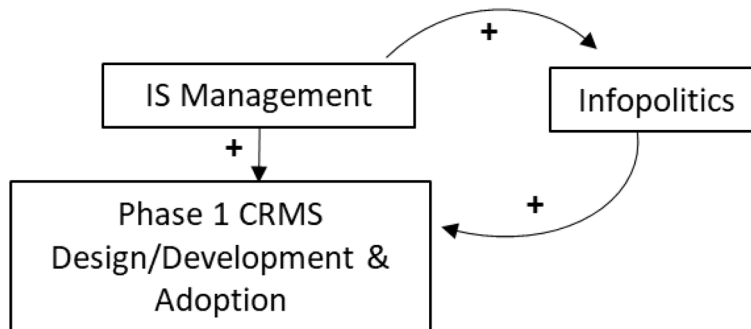
Constructive and Destructive Workings of Infopolitics

The perspective of infopolitics can contribute to understanding the context in which the life process of CRMS was unfolding. One contextual factor is infopolitics. Infopower as the key segment of infopolitics (Chapter 7) stems from controlling data and IT, managing meaning, or possessing expert knowledge. Infopower is facilitated by infopolitical agenda, and it is accumulated by and played out in infopolitical flights and fights.

The vision of integrated picture of customer underscored the infopolitical agenda of Telco's executives in Phase 1. The goal was to get well informed in order to better run the company in the era of increasingly volatile telecommunications markets. From the power perspective, executives expected to increase their infopower based on controlling aggregated customer data. Other stakeholders expected certain gains as well. Department management had a share in this agenda. Since CRMS did not promote rigid data centralization, infopower dynamics at the strategic vs. tactical level of management did not have to be a zero-sum game. Marketing management expected more expert power based on better understanding of customers and markets. Similarly, sales management expected power gains resulting from controlling more complete customer data. Therefore, for strategic and tactical management, CRMS was a political currency and the system roadmap was the common denominator of congruent infoagendas. The actors expected different gains that did not necessarily collide with each other. Slicing wisely power domains and selling the system on that ground appeared a realistic winning combination. Managers joined in a flight around CRMS. This supportive infopolitics facilitated IS design and development (Figure 4). This constellation characterized the adoption of CRMS Phase 1 as well. Managers at all levels monitored adoption of the system, measured its performance, and rewarded early adopters.

With the acquisition of a new company, a new player entered the political arena. The acquired company, now Telco's unit, resisted the system in favor of its own CRM system. Giving up the system and losing control over its data would amount to an immediate loss of infopower for managers of Telco's new unit. In contrast, controlling its own CRM system, while operating in a separate (corporate) market, was instrumental in upholding infopower in the unit. Telco's top management could have opposed this outcome. The fight would include cost of replacing the system, change management, and opportunity costs of slowing down business in a new lucrative market. Telco's top management avoided the fight. But this also had a price in—undermining of CRMS.

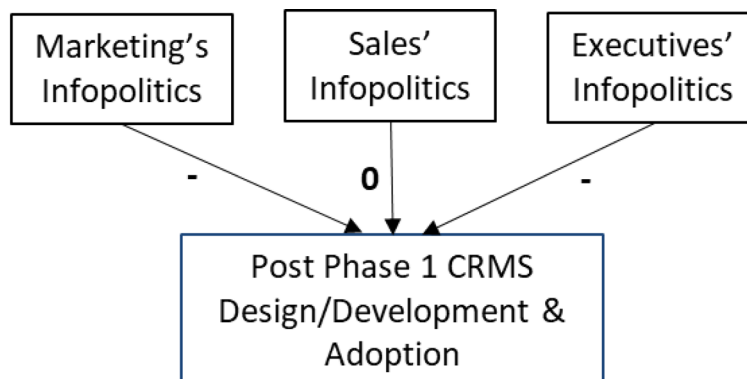
Figure 4. IS Issues and infopolitics in Phase 1



As the flow of other threats hit Telco's CRMS, management began wondering if the planned additions to the system would deliver sufficient infopolitical gains at acceptable cost. Substitutes were available—the system of the acquired company and legacy systems in combination with data warehousing and mining. Why investing dearly in the planned CRMS development if the alternatives could do the job? This question startled marketing management. As the effects of freezing CRMS development surfaced, CRMS was quickly losing attractiveness in comparison with alternatives. Its capability to generate infopower was vanishing. When a majority of the executives abandoned CMRS, this released the pressure off lower management. Marketing managers began opposing the system, while sales managers were neutral at best. Therefore, infopolitics ceased fueling support for CRMS and even turned into a destructive force. This turn is depicted in Figure 5.

While the system was marginalized in the executives' true infopolitical agenda, the roadmap language survived in the language of corporate management. The term "roadmap" was still in public discourse and had allegiance. However, the term came to signify different notions for different actors, while fueling an illusion of agreement. The "roadmap" became the means of executives' management of meaning, a form of infopower. Subordinates were kept in the dark and could only guess the leaders' mind. In Deetz (1992) terminology, subordinates were "disqualified" from partaking in the system's evolution. Executives traded meaning management for unrealized power based on controlling integrated customer data.

Figure 5. Relationships between infopolitics and IS issues after Phase 1



Either way, the fogging “roadmap” language kept the stakeholders in a stand-by mode. The end-effect was a negative relationship between executives’ infopolitics and CRMS (Figure 5).

In summary, the unrealized expectations in the domain of infopower explain in part why the IS management declined from prudence to mismanagement along the life cycle of the system. Infopolitics turned from a constructive to a destructive force. Regarding the IVO framework, the discussion demonstrates relationships between IS management and other IS issues (Figure 2), as well as the impact of infopolitics on IS issues.

Resurgence of Adversarial Infocultures

When the upper rank management stood behind CRMS, the fragmentation rifts in Telco’s infoculture were suppressed. Chapter 5 discussed in detail differences between the sales and marketing department with regard to cultural practices and beliefs related to informing agents. But when the top management withdrew support for the system, infocultural differences emerged. The sales department, which maintained a bureaucratic infoculture, which framed the sales representative as a bolt in a daily grind, still had to abide by the mandatory use of the system. However, an entirely different constellation dawned in Marketing, precipitated by resurgence of its person culture in which professionals acted as critical readers in a book club (see Chapter 5).

At detriment of CRMS, long-lived traditions in the company as the whole surfaced as well. One was a tendency toward *liaises faire* IS management, already discussed in regard to tolerating the truncated and modified procedures of using the system. The tradition was *resistance toward change*. One sales manager illustrated it by commenting how a hefty number of employees would not accept the new, modern office space. Instead, employees dogmatically claimed that working in older buildings felt better, although these were aged, of varying quality, and scattered throughout the city. Another sales manager described in detail processes in which paper trail, a relict of the past, intervened into electronic processes. These interventions were driven by individual habits that, in effect, succeeded in rescuing paper trail even when it was absolutely unnecessary. The cohabitation of the resilient paper trail and electronic data management was the company’s living infoculture. A line manager in the sales department attributed *resistance toward change* to IS and to pragmatic reasons:

Habits, well... If I’m a service representative, then I’ve been trained thoroughly in a particular legacy system. Well, so I’m going to revert to doing a lot of my work in that system because it works. Even though I could do this function or part of it in another system, I go with what I can do the quickest.

Despite the clear diagnosis of such clerical practices, this manager was unable to identify any remedy. The old habits reflected on CRMS. Commenting on why their representatives did not record details of customer calls in the system, a line manager ascertained: “I think that’s just habitual. I think they’re just used to doing it on paper, and it’s very hard to change that.” Still another member of the management hierarchy calmly noted: “Some people are using the system as they should, some aren’t using it at all, and others are using it very little and are not updating it.”

Management in the marketing department was even more vested in the corporate culture of *laissez faire* management. Since this department’s infoculture rested on personal preferences and fiefdoms, managers had to make an additional effort in order to promote novelties in work processes. Managers exerted pressure on employees while CRMS was under adoption and actively driven by executive management. As

the top management lost the direction and lifted the pressure before the organizational change stabilized, marketing managers resorted back to *laissez faire* practices, and the department's person infoculture re-emerged. As CRMS was halted in development, this infoculture became adversarial toward the system, thereby adding to negative effects of corporate culture and infoculture (see Figure 6).

In summary, during the first phase of CRMS, the corporate executives actively managed organizational change. Lower management was engaged, and all this earnest effort resulted in suppressing this adverse part of the infoculture. The start of the newborn systems was promising and the future looked bright. But when the executives lost direction and released pressure, tactical and supervisory management followed the suit and a reversal to adversarial traditions took hold. The IVO insight reveals critical relationships between IS management and other IS issues (Figure 2), as well as the impacts of infoculture on the life cycle of CRMS. These effects added to the impacts of infopolitics to prevent CRMS from maturing. Surviving in a severely limited role in the sales department and mostly abandoned in the marketing department, the system resembled a paraplegic patient.

Quantitative assessments of IVO dimensions can be combined in a spider diagram depicted in Figure 7. Each dimension discussed is represented on a scale, and its values for Phase 1 and Phase 2 are approximated. Note that the infoprocess dimension was discussed in Chapter 7, and it refers to marketing campaigns. Uncovered dimensions are those that the case study did not address (infostructure, etc.). It is immediately visible that the larger web in Phase 1 has contracted in Phase 2. Spider web diagramming is a diagnostic method that can be particularly useful for managers.

Figure 6. Impact of infoculture on evolution of CRMS

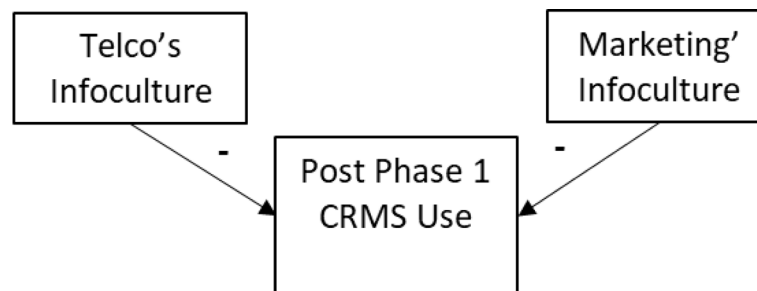
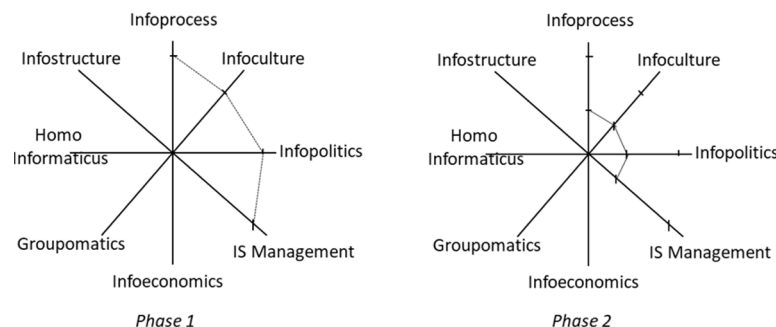


Figure 7. Representing IVO dimensions with a spider web diagram



Deepening Case Studies with IVO

This section discusses how the IVO optics can contribute to studying the IS issues that are discussed in several published cases written for teaching or research purposes. Recommendations for IVO-based analysis apply to case analysis today, rather than to case writing when it was performed. The selection of cases and main points is displayed in Table 1. The selection of cases is supposed to demonstrate variety on system types and life cycle issues.

Adoption of a GDSS by Canadian Clear Water Foods features in the cases by Parent and colleagues (1997). The adopter was a finance unit, which tested on a rental basis a GDSS in strategic planning. Although the unit had a good experience with the system, the finally purchased system was not accepted much beyond the unit's boundaries.

Expanding the analysis with the perspective of infoprocess could assist in identifying causes. A process diagram would immediately show that visibility of GDSS was severely limited, exclusive to the adopting group. Another helpful aspect is groupomatics. It could illuminate elements of group cognition,

Table 1. Cases on IS issues and possible IVO contribution

System or Management Methods and Organization	Case Problem	IS Issue	Possible IVO Contribution
GDSS in a sea food firm (Parent, 1997)	Limited system adoption	IS adoption	Infoprocess, groupomatics
An e-exchange and supply chain systems in hospital industry (Gruber & Deutscher, 2001)	Marketing and sales of e-exchange	IS adoption and evaluation	Infoculture, infoprocess, infoeconomics
KWS change in a global consulting firm (Meister & Davenport, 2005)	Knowledge management and economics of old system	IS design, use and evaluation, new IS design	Infoprocess, Infoeconomics, infoculture
MIS in an accounting firm (Kelley & Compeau 2002)	Hardware upgrade Forced system change	Old IS design and use	Infoprocess, infoeconomics
E-commerce IS vs. classical sales channel at two PC vendors (Ryans & Wandenbosch, 2000)	Selling PCs in the Internet age	IS design use and evaluation	Infoculture, infoeconomics
CRMS at a copier vendor (Zhao & Newson, 1997, 1999)	Limited use of CRMS	IS use and evaluation	Infoculture, infopolitics
Various systems in a small consulting firm (Travica, 2010)	Readiness for distributed project work	IS design and use	Infoculture, groupomatics, infoprocess
Supply chain methods at electronics company; no IS specified (Anupindi, 2013)	Recovery of supply chain with incomplete supplier records	Implied, data coverage (implied)	Infoprocess and its IS
Financial management and scandal at energy company; no IS specified (Moore, 2010)	Inappropriate accounting leading to bankruptcy	Implied accounting IS, cost & income accounts	Infoprocess and its IS, infoculture, infopolitics
Trip evaluation system at TripAdvisor (Orlikowski and Scott, 2015)	Opaque system practices	System design & output	Infopolitics
Wikipedia (Ling, 2011)	Creation of new value propositions for Blue Ocean strategy	System use	Infoculture

which helped the adopting group learn how to use the system beneficially for their professional needs. Such insight could have helped to expand adoption of the GDSS.

IS adoption features also in the case of Health Care Exchange in Canada's hospital industry (Gruber & Deutscher, 2001). The case revealed several challenges in promoting and selling the e-exchange services to hospitals. These can be read as infocultural obstacles to adopting new infoprocesses of planning and executing purchasing on the buyer side. An infoculture approach could differentiate between infocultures types that buyer firms belong to. This would help to understand better the obstacles. Also, the infoprocess stance could focus management attention onto the most sensitive points in to-be processes, which demand infocultural indoctrination. In addition, this case translates directly into the perspective of infoeconomics. Identifying savings from optimized purchasing processes, or improvements in process performance could strengthen the sales proposition for this e-exchange.

The issues of IS design, use and evaluation were addressed in the case on a KWS system at Accenture, a global consulting firm (Meister & Davenport, 2005). The existing KWS' functionality for knowledge codification and sharing was critically examined and found to sub-optimally contribute to the firm's profit objectives. Requirements for a new system were sketched. By focusing on cost/benefit of the processes of knowledge codification and sharing via old and new KWS, case analysis could deliver a compelling economic argument for system change. In addition, invoking the concept of knowledge infoculture would paint a more analytical picture of knowledge management, in which different organizing principles co-exist (e.g., bureaucracy in knowledge coding and market in knowledge sharing).

Issues of IS design and use in Canadian accounting firm MNP were addressed in the case by Kelley and Compeau (2002). The firm owned a mainframe-based MIS that successfully tracked most of daily operations and provided management reports. In spite of user satisfaction with the system, the mainframe brand was discontinued and IS management contemplated about a PC-based solution. To better inform management about optional solutions and reach beyond hardware doom, one may combine perspectives of infoprocess and infoeconomics to arrive at costs of key processes with mainframe vs. PC support. Optional system/process designs may be expanded by other alternatives, such as deploying different Cloud services.

A comparison of sales channels used by Compaq and Dell Computer is the topic of the case written by Ryans and Wandenbosch (2000). Compaq persisted in using a traditional multi-layer channels based on personal contact between the PC merchant and customer. Contrary, Dell spear-headed e-commerce channels in both the consumer and corporate market. The comparison was in favor of Dell. Selling PCs in the age of Internet turned out to be a big problem for Compaq. The infoculture stance, if taken, may help to identify a winning set of beliefs and behaviors associated with e-commerce systems for sales management. The quantitative evidence in the case can be read as an infoeconomics complement to the winning infoculture.

Zhao and Newson's case (1997, 1999) focused on the use of a CRMS at Xerox-Hong Kong. The system was underused due to several factors that were cultural and technological in character. For example, managers preferred face-to-face reporting over electronic, which allowed them to read subtle body language of their mobile staff. On their part, the staff was not used to recording work in the system. The cultural stance of the case could be expanded by asking questions that probe into infoculture (Who are we in relation to the system? What is the system's role? When should systems change? How should a system be used?). Revelations of an infoculture would enriches stereotypical analysis and ground it in systems-specific realm. This shift increases the value of case messages for comparable systems and organizations. Moreover, the stance of infopolitics could illuminate relative positions of management

and customer support staff with regard to the sources of infopower with regard to the manual and system-based data management and reporting. For example, for a body language of a subordinate acting purposively, when expressed in face-to-face communication with a superior, can be a source of impression management infopower for the subordinate. Or, a loss in informing the manager may experience due to switching from the personal to system-based reporting may be balanced by a gain in infopower based on controlling data.

Various home-grown systems at Protegra, a small consultant in the areas of IS and management, are described in terms of their design and use in the case by Travica (2010). Several systems supported the basic production process typically executed via projects delivering custom solutions. Although the systems met requirements and the firm exhibited a good performance, the case determined challenges of adjusting the company to spatially dispersed teamwork. By combining ideas of groupomatics and infoprocess one could identify precisely the bottlenecks in the distributed project work. Then, new IS and process solutions could be sought for removing the bottlenecks. This finding can be used to determine necessary changes in the existing infoculture that suits collocated teamwork.

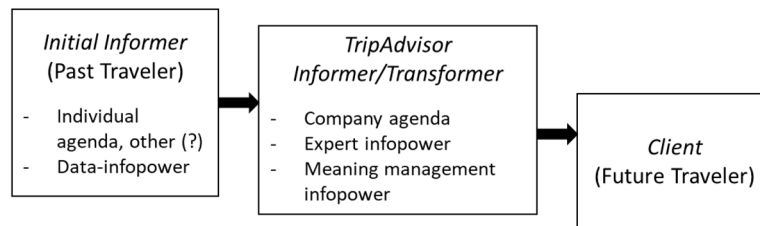
Supply chain management in emergency conditions, which Cisco Systems faced after the 2011 catastrophic earthquake and tsunami in Japan, are analyzed in Anupindi's (2013) case. Many of Cisco's Japanese partners were affected, which jeopardized products under development and regular deliveries. Without own manufacturing function, Cisco has paid keen attention to managing its global and changing supply chain, and developed relevant methodologies and techniques. However, the Japan accident revealed that tracking of suppliers beyond the first tier was incomplete. Analysis of this case would benefit from the infoprocess approach. It could inquire if Cisco's supply chain management had mapped out complete supply processes for critical products. Auditing the company's IS for supply chain management and operations would be an essential part of the inquiry.

The next teaching case explores American natural gas producer and trader Enron (Moore, 2010). The case analyzes dubious partnerships, methods of falsely inflating revenues, manipulation of cost figures, undetected conflicts of interest, inadequate auditing, massive off-balance sheet transactions, and other methods that led the company toward eventual bankruptcy. As in the Cisco case above, analysis does not involve IS. However, it would be very interesting and educational to examine accounting IS at Enron and partner companies from the perspectives of design and use. The false financial figures resulting from such systems must have had inputs and propagation paths that could be process-diagrammed. Was there a particular infoculture fitting the deviant accounting? How was infopolitics involved in Enron's accounting? This IVO-driven analysis would be instrumental to teaching the prevention of similar frauds.

The infopolitics approach may also be a useful theoretical background for extending the study of TripAdvisor cited in Chapter 4 (Orlikowski and Scott, 2015). As discussed there, this social medium mediates between past travellers as the content providers and future travellers as content consumers. The social medium is a business with a website-based front-end, which collects the input and transforms it into formatted statements, visuals and starred rankings of the travel destinations. The authors of the case wrapped into a philosophical argument slanted toward sociomateriality. However, as argued in Chapter 4, TripAdvisor can be viewed as an embodiment of the designer's and the owner's goals and agenda, thus establishing a power relationship between them and the content consumers. The scenario can be even more elaborate, and the infopolitics approach can help to illuminate it. Deploying the generic model of informing science, it is possible to detect infopolitical relationships as depicted in Figure 8.

The content provider/past traveller is the informer in the informing science terms. But this is the initial informer coming before the TripAdvisor company being the second level informer which trans-

Figure 8. Infopolitics around TripAdvisor



forms the initial input (so it is here called “Transformer” as shown in Figure 8). The initial informer has a personal agenda (to share, inform, show off), and possibly some other agenda (e.g., concealed motives of business competition via a negative appeal). On its side, TripAdvisor carries out a company agenda related to generating revenues and competing within its own market. Infopower flows along the informing process from left to right. The initial performer possesses infopower over TripAdvisor, which is based on controlling the input data. TripAdvisor’s systems professionals wield expert power, while their company’s management controls the presentation formats and rankings, which paves the way to meaning management. At the receiving end of the informing process and infopowers of these two actors, sits the client/future traveller.

The final case by Ling (2011) uses the Blue Ocean strategy approach to explain the success of Wikipedia. This Internet-based encyclopedia can be likened to the first revolutionary jump in the history of this sort of compendium publication since its launch in the 18th century France. Although electronic encyclopedias have emerged by the end of the 20th century, the advent of Wikipedia in 2001 was a game changer on several front lines. A non-profit enterprise centered around a wiki system for distributed and group authoring, Wikipedia took advantage of crowdsourcing. In the process, it created innovative value propositions for the volunteering content providers, readers and charitable investors. The Wikipedia case teaches how to conduct analysis for Blue Ocean strategy that is cited in Chapter 1. From the IVO perspective, it would be interesting to learn how an infoculture (or infocultures) jells up through interaction of the writers, readers and editors; what type of infoculture(s) has developed; what historical trajectory of infoculture values and behaviors has Wikipedia procreated as its writers have been maturing, professional editorial staff increasing, and the readership growing.

To summarize, IVO furnishes analytical devices for extending case analysis and deepening understanding of IS issues. Of course, IVO can also guide case investigation. Salient aspects of a case organization may help in selecting IVO aspects to be used as a guide. An IVO-driven case investigation should deliver rich details for subsequent IVO-driven case analysis. This is particularly critical in the realms of infoprocess and infoeconomics.

Summary

The case of Telco’s CRM system demonstrates the importance of IS management throughout the life cycle of an IS. Designing the system to support a business strategy, allocating budget, changing the organization of work, managing employee expectations, motivating them to embrace change, and managing the macro time line of system development and adoption are inescapable tasks before executive management. Reinforcing change on a minute basis, allocating time for learning, motivating employees,

managing the system's micro timeline in the production stage, and monitoring the system's performance are the key tasks before lower rank managers. Put another way, making a system part of the management and employees' agenda and managing organizational infoculture in a way favourable to a system are the obligations before managers. The Telco case shows how these can be both successfully and unsuccessfully responded to. With regard to the IVO framework, the discussion above demonstrates relationships between IS management and other IS issues as well as the impact of infopolitics and infoculture on IS issues in different historical phases of an IS.

SUMMARY

This chapter discussed the IS issues of IS design/development, adoption, use, evaluation, and IS management. The first phase refers to planning, conceiving and developing a system. In the second phase, the system and organization change is adopted by the users. In the production stage, the system is used and its contribution to organizational performance is tracked. The evaluation of system extends through the adoptions and use stages. IS management refers to managing work, people, budgets, and timing aspects throughout the system life cycle, at both operational and strategic levels.

Based on the concept of system life cycle, a model is represented in which IS management is juxtaposed to other life cycle aspects. The model served for analyzing the case of Telco. It was demonstrated that IS management varied through the life cycle of Telco's CRM system and was responsible for both the early successes and eventual demise of the system. As opposed to the initial strategic goal of using the system to arrive to a unified picture of a customer, the system ended up with a severely limited functionality and data. In the sales department, the system was used mostly for verifying customers and compiling the figure of the total annual spend per customer. Managers did not enforce consistently the system procedures, did not consider the system a productivity tool, and had no clear understanding of the system's future. In the marketing department, the system ended up as storage of marketing campaigns. As the in development of CRMS' data, functionality and process coverage was gradually frozen, the users were degrading it accordingly. Management at different levels did little to stop the system from tumbling into free fall. Infoculture and infopolitics reversed their impacts from supportive in Phase I to adversarial in Phase II and beyond. Old traditions of the corporate culture contributed to charting the trajectory of CRMS from a healthy newborn to a paraplegic adult.

IVO also furnishes analytical devices for extending analysis of teaching cases that deal with IS issues. This was demonstrated on examples of several cases. IVO can also guide investigations resulting in teaching cases, which can deliver rich details for IVO-driven case analysis.

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Chapter 10

Conclusion

ABSTRACT

The chapter reviews the book and reiterates some of the key ideas. It also discusses methodological limitations and the directions for future research. Furthermore, the informing view of organization is described by using everyday language as a guide for managers and professionals.

INTRODUCTION

The preceding chapters discussed the conceptual framework of IVO. Seven aspects of the framework were presented—homo informaticus, group informatics, infostructure, infoprocess, infoculture, infopolitics, and infoeconomics. A sizeable literature that helps establish a bridge between theory in the areas of IS, organization, and cognition was explored. Some literature was also deconstructed in order to provoke an IVO-inspired reading of it. Furthermore, particular IVO aspects were demonstrated in case studies. This chapter will formulate main messages of IVO for studying and managing organizations.

IVO brings more than a terminological change. Coupling of IS theory with organization and cognitive theory extends beyond simple correlating of organizational and system aspects. Specifically, in the context of groupomatics, concentrating on the cognitive characteristics of individuals and work groups clarifies the focus of IS-relevant research. IS interact directly with human mind at the individual and group level, while meaning, knowledge and wisdom are intrinsic to cognition. The cognitive focus of IVO complements behavioral dimensions of individuals and groups, which usually capture researchers' attention (sometimes without clearly defined IS-relevant reasons).

The infoculture approach, which IVO advocates, advances understanding of the cultural binding of IS beyond correlational studies based on extending theorizing on national culture to organizations. Grounding cultural beliefs and behaviors in the domain of informing agents maps a part of organizational culture that is certainly relevant from the IS perspective. IVO also establishes the relationship between infoculture and organizational culture, introduces a categorization of infocultures, and supplies a methodology for conducting study of infoculture. These contributions scrutinize the infoculture approach over the similarly labelled inquest (e.g., information culture).

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The infostructure aspect of IVO illuminates the relationship between social structure and IT/IS. Analysis is deepened comparative to the inquiry focused merely on the relationship between dimensions of organizational structure and constructs of IT operationalized in proxy measures. Dimensions of infostructure (infohierarchy, infocentralization, infoformalization, infodispersion, and infofragmentation) additionally explain social structure with regard to its foundations and stability. As a new IS implies infostructural changes, these indicate a magnitude of the needed structural change.

The infopolitical inquiry is intended to sharpen the critical edge of political analysis of IS. Infopower concepts and their nascent measures are particularly useful since they slant general concepts of power to the power emanating from specific power resources—data and IT, meaning, and knowledge. This gives rise to three categories of infopower—data/IT control, meaning management, and expert power. IVO also moves political analysis to a broader ontological horizon charted by the paradigms of institution, symbol, and object. This creates room for advancing study of IS and organization from the always sensitive political perspective.

The infoprocess aspect of IVO drives the process view of organization to data aspects that mark the IS domain. In this way, one can better understand where an IS can fit in organization design, and how it can or does IS contribute to organizational performance. At the level of cognitive processes, the infoprocess approach explains relationships between data, knowledge and information, as well as how these fit into particular business infoprocesses, such as problem solving.

Finally, the stance of infoeconomics inspires measurement that is closer to effects of IS than sheer correlations between IS investment and financial indicators can reveal. Ontology of informing, which is part of IVO, brings potentially interesting turns in microeconomics analysis. Understanding organizational performance as a result of influences that infoprocess and other IVO aspects exert opens up a new perspective on economics of IS. The following section details contributions of IVO to certain disciplines.

Contributions of Informing View of Organization

The IVO framework is inter-disciplinary. It brings together IS theory, organization theory, and select parts from cognitive theory, theory of human communication, and semiotics. The emphasis has been on the first two academic fields. That is where intended contributions are to be salient. In particular, IS theory should benefit from:

- Broadening the research focus by balancing the “hard” and “soft” aspects, i.e., technological and cognitive aspects;
- Enhancing the research focus by deepening ontology of the fundamental concepts in the field—data, information, and knowledge;
- Sharpening the research focus by introducing concepts that capture those facets of organizational dimensions that pertain to IS (IVO aspects). This amounts to effective grounding of IS in the organizational context.

Organization theory should benefit from:

- Differentiating between IT and other technologies;
- Differentiating between material technology and social and cognitive aspects that have traditionally been bundled into it;

Conclusion

- A new slant of classical organizational views (structure, culture, politics, etc.), which places informing agents at the nexus.

The discussion in this book can also be characterized in terms of several highlights as follows:

- An approach embracing a critical synthesis of various literatures, inter-disciplinary orientation, and ontological and epistemological openness;
- A different way of looking at information and knowledge as cognitive artifacts rather than reified phenomena;

An expansion of theorizing agency by modeling individuals and groups from a cognitive perspective;

- An emphasis on the process approach, as in the concepts of informing and infoprocess, and in modeling organizational performance;
- New grounding of organizational structure, politics, culture, process, and economics;

A coherent taxonomy of social power based on informing agents;

- An encompassing platform for looking at IS in their entire life cycle;
- A new angle at economic evaluation of IT, IS, knowledge, data, and information;
- New concepts and models, such as Spiral of Uncertainty, Three of Virtual Life, and models for research;

Ontological openings in theorizing technology, organization, and power.

Using IVO in Research

How can IVO be used in research? Case studies discussed in this book, in which IVO featured as an interpretive framework, demonstrate selective use of IVO aspects. The hints on expanding teaching cases in Chapter 9 add to the guide. Apparently, IVO represents a broad-based framework that consists of seven aspects. Each aspect is a rich topic unto itself, and there can be various relationships between the aspects.

IVO can be deployed in full, by using its topics as rubrics for research questions. But such a complete coverage is not necessary. The framework can be used selectively, according to the purposes of research, character of the research problem, preferences of a researcher, resources available, and so on. A metaphor of Chinese buffet pictures well this idea.

A researcher with cultural preferences may wish to ground the investigation in the infocultural perspective. Combining infoculture with infopolitics is another option, which has been demonstrated in several cases discussed. Such a combination is parsimonious and resonates with the interest of current social research. Sometimes, the organizational issue or problem studied suits certain IVO aspects more than others. For example, infopolitics jumped out as the compelling lens in the investigation of festival pavilion because power play and public displays of fight between competing groups filled the sight. Difficulties in the management of IS and organizational performance call for investigating business processes that rest on particular IS. And so on. The selection of IVO aspects is essentially liberal, while the topic at hand may encourage the inclusion of particular aspects.

The IVO framework is intended to be used for theory building, both in interpretive fashion and in the manner of formal (provided that IVO dimensions get backed by scales). Researchers can create various research models to address important research problems. Here are examples capturing several important problems.

Infopower types could be modeled as the antecedents to aspects of IS design/development (e.g., technical decisions) that, in turn, could be related to infoprocess design and performance. The model is shown in Figure 1. This theorizing could reveal opaque impacts of organizational politics on organizational performance.

In the realm of groupomatics, dimensions of group cognition could be related to infoprocesses bound to the group's task, which further relate to infoeconomic aspects (the group's efficiency and effectiveness). Figure 2 depicts these relationships. Such theorizing could contribute to understanding and managing of collocated and distributed teams.

In the context of knowledge management, knowledge codification and diffusion, and IT level can be related to knowledge use in order to determine where the given organization is in relation to practices of knowledge infoculture. Possible hypotheses behind the model in Figure 3 is that positive relationships exist between IT and the two knowledge dimensions, and between the three dimensions on the left and knowledge use. This study could expand the practitioner's guide for knowledge management.

For advancing study of social media, it may be interesting to study relationships between the infostructure imposed by owner (built into design of IS making a particular social media), informal social structure (network aspects), infoprocesses, and infoculture of a particular social media (Figure 4). All these are interesting characteristics of communities that develop upon using social.

VO and other new organizational forms can be better understood if VO models are supplemented by infoprocess and infoeconomics aspects at the minimum, as discussed in Chapter 7; of course, modeling can expand to other IVO aspects.

Big Data has a potential of expanding understanding of a particular entity (customer, citizen, energy consumer, competitor, traffic congestion, environmental pollution, etc.). Figure 5 suggests that the generic

Figure 1. Antecedents of performance

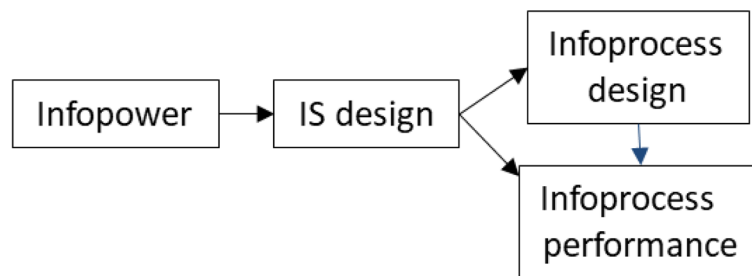
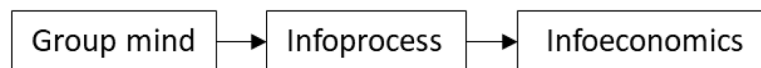
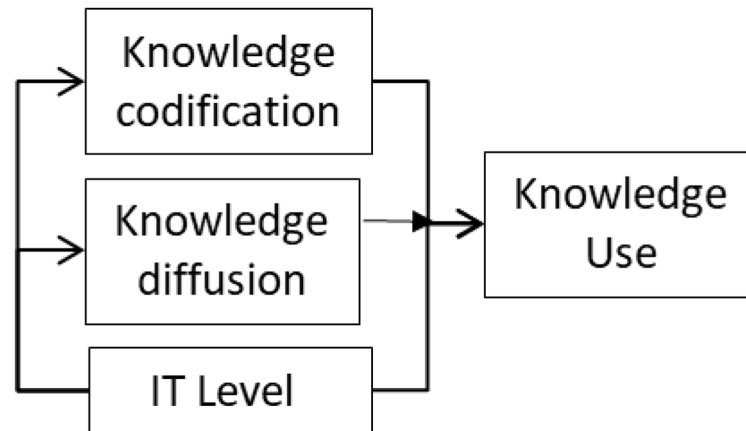


Figure 2. Infoeconomics of group work



Conclusion

Figure 3. Detecting knowledge culture



process of Big Data deployment can be explored by applying the model of fundamental informing process model as shown in Figure 5. The negative feedback from the evaluation step demands adjustments in the Big Data input and deployment of different knowledge and wisdom. The model can be useful for practitioners' learning about requirements at each step, which may grow the Big Data expertise over time. More on applying IVO to Big Data topics is in the next section.

In short, IVO is a framework one can liberally choose from as the guide for research in both qualitative and quantitative domains. In the former, it can be used for guiding data collection and/or interpretation. In the quantitative domain, IVO can be used for building measurement instruments and hypothesis testing.

IVO-Big Data Alignment

IVO provides a holistic research framework for aligning organization with Big Data technologies and data. Elements of an alignment model were presented in previous chapters. The model appears in Figure 6. The bullet points summarize key ideas discussed in chapters corresponding to the IVO aspects.

Figure 4. Understanding social media-based communities

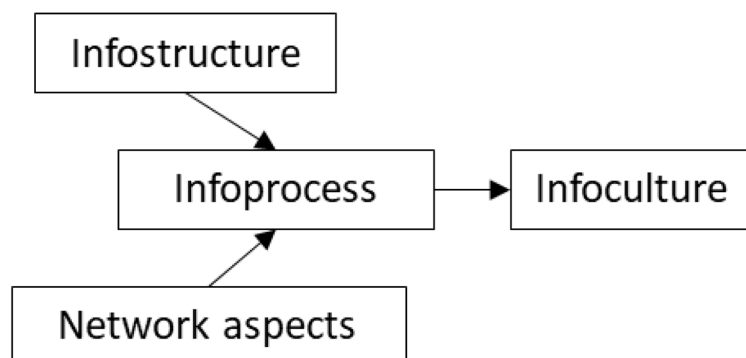
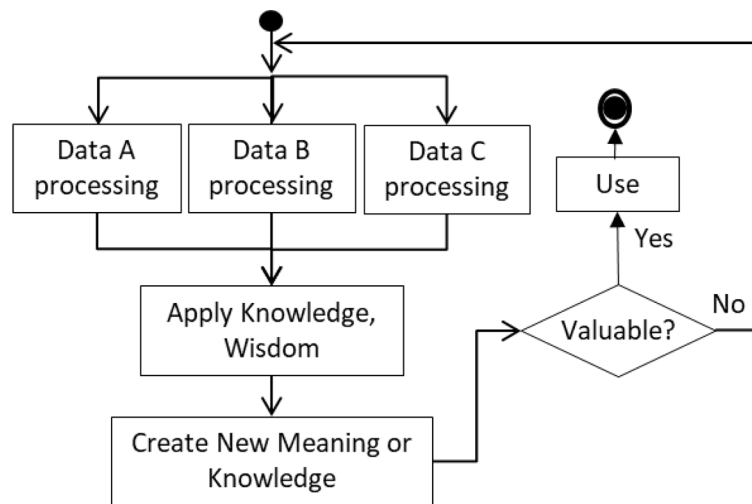


Figure 5. Big data deployment

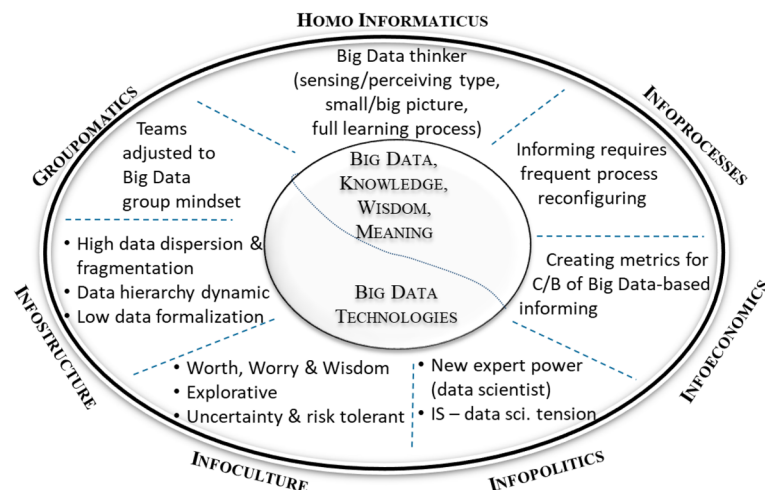


Note that this model is not an IS strategy on its own. It should better be understood in terms of digital transformation. Therefore, it lays foundations for strategizing, and particularly so when business and IS strategy are in sync. For example, this can be a digital business strategy that takes advantage from Big Data. The propositions following from this model are testable theoretically and practically.

Practical Use of IVO

Managers and professionals may find it handy to approach IVO from a more popular perspective free from the academic vocabulary. Figure 7 shows the IVO model with everyday language labels in capitals; their parallel labels rooted in organization theory appear in the normal font, and IVO labels are in *italic*.

Figure 6. Big Data-IVO alignment model



Conclusion

For each of IVO topics, it may be a good idea to focus on (1) a popular cue, (2) key questions, and (3) links to other IVO aspects. Here you go.

I, individual organization member:

- (1) Tell me what you see and we can work it out!

Some people believe what they see, while others see what they believe. Acknowledging the other's perspective may help in bridging cognitive and technological gaps between system users. For managers, this may be hard to do, as power may prefer taking shortcuts rather than pondering. IS professionals may also struggle with acknowledging unfamiliar technology likings.

- (2) The key questions are: What cognitive and learning types are in the company? What are individual preferences regarding essential electronic technologies used at work? Do end-users have sufficient opportunities to influence the making and use of IS? Are there true opportunities for expressing relevant professional ideas? How do different groups of IS users usually make decisions, and are they technologically well-supported? What technical skills need an improvement given a promoted business strategy?
- (3) Watch for links between individuals and the team composition, system adoption, and system use. Play with the idea that what you take as information may be opaque to others. Also, think of individual turfs and the fit between the official beliefs and practices and the individual ones that show up.

My Team:

- (1) With a little help from my friends, we can work it out!

Two brains may know more than one but this is not guaranteed to happen. What can be done that it does?

- (2) The key questions to ask: How to avoid running on the automatic pilot of agreeing without thinking? How to ensure everyone puts in their fair share of work? How to use technology against these pitfalls? How to sync workflows when teammates work in different time zones? Is group technology doing the job expected? Are there any unexpected surprises when the people and technology are put together; if so, are those for the better? Can a promoted business strategy benefit from a yet untried teaming up?
- (3) Watch for links between teamwork and key business processes.

What work we do:

- (1) Down in the trenches, it's been a hard days and night!

Jobs and tasks, grouped and done as part of the daily grind – that's the space of operations that provide for the bread and butter and also drain lots of money. In modern companies, much of these run on IS so that system users' tasks are actually work tasks.

- (2) Think of this: Is the fit between business needs and software support optimal? Where are the business documents located and is something missing out there? Are these accessible as they should be when you are thinking out of the box? What is happening on the grapevine and small talk? Could it pay off to strengthen electronic channels for this purpose to let creative, grassroots ideas grow, especially so in connection with an intended business strategy?
- (3) Keep in mind that operational matter links up to business processes and the company's bottom line, even though it is just business as usual.

How we think and act:

- (1) This is a magical mystery tour zone, where the flying carpet makes a difference.

The company people may share a dream and behave in the same way as they face technology. This binding may be more powerful than that by company rules and regulations.

- (2) Cut to the chase by answering these: What do we believe without questioning, when it comes to digital tools for work? What technologies do we like using for number crunching, communicating, making decisions, and why so? Are we anyhow different from others in our beliefs and work with technology, and if so, what sort of pack do we make? How do we feel about changing digital tools and the way we do work? Can inventive and beneficial new practices be shared across the board? How does your business strategy square with the core culture? Is any modification needed on either side?
- (3) Do not miss the many links the culture shares with politics, IS issues, and eventually the company's bottom line.

Turfs & Battles:

- (1) You can't always get what you want!

Your interests may strike the turfs of others. People differ in technology expertise and privileges, access to documentation, and opportunities to influence others. Managers and experts are privileged but groups may jell up around shared interests to battle the establishment (or each other).

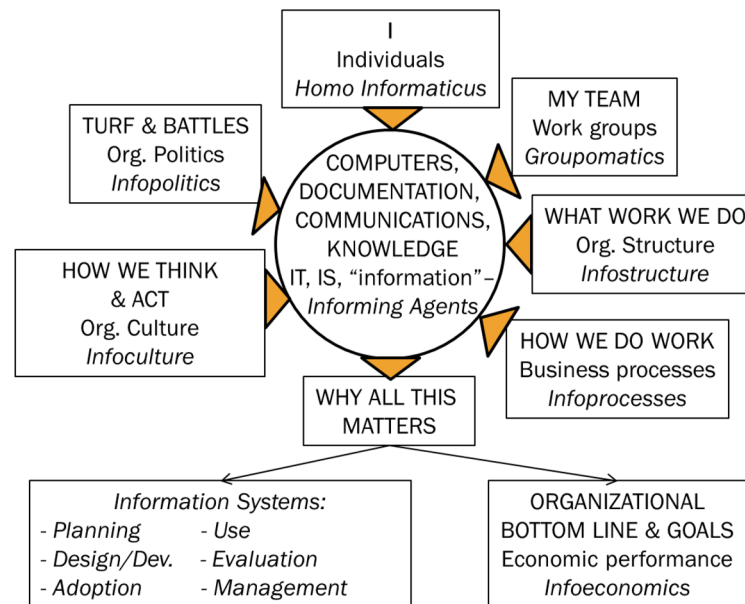
- (2) Ask: Who are the thought leaders when it comes to technology issues? Are there any camps based on technology preferences? Any camps rooted in different ways of handling documents and communications? Are there any battles in this arena or perhaps tensions that can explode into battles, particularly with regard to a promoted business strategy?
- (3) Politics paint management and the entire life of IS. Keep in mind that a no brainer-mindset does not work in managing politics as this a world of smoke and mirrors.

How we do work:

- (1) Time, time (and cost) is on my side!

Conclusion

Figure 7. IVO practitioner's lookout



Business processes are about linking tasks so that a process customer – inside or outside the company – is happier. The trick is to separate processing of materials and data from grinding process workers, that is, to shrink a toll of efficiency.

- (2) Get to answering this: Is what we do in the company put together the best we can? Is technology doing enough? How do our workers feel? How about the customers we want to have for a long ride? Can we hook up the customers online, so we get to know more about them and take some advantage of picking up their brains? Do we connect to our business partners in the best way we could? Can we think out of the box of our own organization and try out new ways to get organized through partnering?
- (3) Business processes are linked to almost anything else in the company, including everyone's pay-check. A radical intervention into processes is a strategic move. Apparently, there is a lot of space for action in this area.

Organizational bottom line:

- (1) Economy of IS is a long and winding road!

Costs pile up, while benefits challenge straightforward assessments. There is no much space for neat books with debit and credit rubrics. Yet, this where the ultimate test of IS rests.

- (2) Think through these questions: Is cost accounting clearly defined? Is there an acceptable agreement of stakeholders on the benefits' nature (not only monetary) and assessment? Would a process ap-

- proach help your company to square costs and benefits from IS? What about a scorecard approach, involving a process aspect? Keep the swing of owning/renting (Cloud) always on your radar screen.
- (3) Economy of IS is linked to everything in your company, including strategizing.

Information Systems Life Cycle:

- (1) This is where you have to face a *twist and shout* and sometimes *helter-skelter* happenings.

Most people involved in making a new system want order. But things get complicated already at the planning step by colliding interests of stakeholders. In the development stage, technical challenges may pile up in a helter-skelter way. Then, a new system creates a big shout among users as it twists old routines and habits.

- (2) Questions to ask: Is there a clear IS strategy in your company and how does it fit with the business strategy? How will new structures and processes square with beliefs about technology's role in business? Who are the winners and losers when it comes to accessing and controlling a new system? Are there any pockets of tough resistance developing? How to motivate a better acceptance and use of the system? When, why and how to replace it?
- (3) Systems' life, like their economic side, is linked to all other things in your company.

Besides using IVO for understanding the IS-organization present state of alignment, the framework can help in forecasting business well. The spider web appearing in Figure 8 is a visual tool for tracking the progress in these diagnostic and forecasting activities; look at the dashed lines. All IVO dimensions are included in the graphic along the radial axes that represent the extent of covering IVO aspects. Optionally, some may be suppressed if they are not relevant for a particular instance of decision making. The graphic also shows the established relationships (e.g., in the diagnosing stage) between IVO aspects; look at the bolder axes of infostructure, infoprocess, IS management and infoeconomics.

IVO can apparently be used at every stage of a system life cycle. Based on understanding the state of organization based on IVO, a manager can make decisions and plans on mobilizing people and resources in order to achieve a desired shape of the spider web.

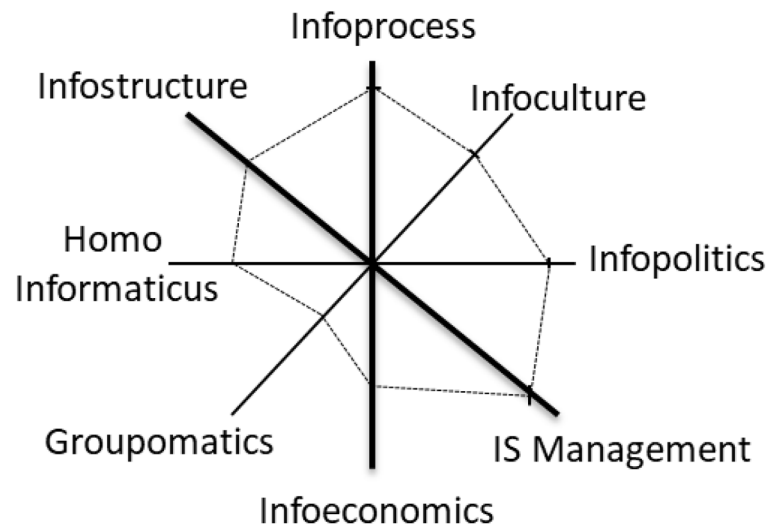
Limitations and the Road Ahead

In spite of the efforts to deploy the literature that is as inclusive as possible, the literature featuring in the discussion is limited. This characteristic is partly determined by the breadth of the topic. Another literature limitation is in its apparent North-American bias. The international dimension is also missing in the geographical coverage of research phenomena. These limitations were in part caused by the characteristics of the literature that has been accessible through standard channels. Nevertheless, the limitation of geographical coverage is the fact. An expansion of IVO toward international/global horizons is certainly a goal to be pursued in the evolution of this framework.

Another aspect that may have not been fully realized concerns communicability of the book to the intended audience. At some places in the book, logic of argument called for such technical terms that a practitioner reader may be less familiar with. Thus, additional study may be needed. In connection with

Conclusion

Figure 8. Spider web diagram for diagnostics and planning



the reader profile, most of the discussion caters to the readers interested in the business company rather than other forms of social organizing (e.g., community, social network, and territorial forms).

The cases presented in order to demonstrate IVO concepts have been investigated via grounded theory and other interpretive methods. On the one hand, this was strength because no pre-conceptions were imposed on research design, which could—on a conscious or sub-conscious level—influence research results. To facilitate self-informing as naturally as possible, the primary coding of the interview, observation and other data collected was devoid of any theoretical vocabulary. In the coding process, categories gradually emerged and evolved toward different conceptual frameworks; IVO was one of them.

On the other hand, this open research design imposed a limitation to IVO coverage. No study produced a complete demonstration of the IVO framework. Most of them demonstrated well infoculture and/or infopolitics without touching on other IVO aspects. Although it is true that an IVO inquiry should have a natural fit with a context studied, and so, say, the infoprocess perspective should not be forced upon on a saliently groupomatics phenomenon, it remains a goal to deploy more comprehensive IVO inquiries.

Since the first edition of this book, the topic of infoculture has aroused much of attention. The infoculture view certainly is an interesting and useful way of understanding how both material and immaterial aspects of informing work in the organizational context. The message for future research again is to try addressing a broader organizational context.

The theme of IVO-driven research design points to another limitation of the current state of IVO research: So far, it has been qualitative only. However, the IVO framework lends itself to quantification, which can be one venue of advancing the framework. Some parts of IVO can be turned into scales, for example the concepts of infopower, infostructure, infoeconomics, and infoprocess (design, performance). Others may be more challenging, such as measurement of infoculture categories and facets of homo informaticus. Of course, one may involve the already developed scales, such as those pertaining to groupomatics, whenever these suit research design. As discussed above, the scale development could lead to the development of formal theory. Theory development along the qualitative path can, of course, continue. The two may be combined in the same study. Comparing research results from quantitative

and qualitative inquiry would advance triangulation techniques. Another venue of triangulating methods is by comparing IVO-based findings with those resulting from alternative frameworks and theories. In any case, the scope of theorizing is certainly wide open.

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The discussion in this book began by characterizing the last four decades as an epoch of significant changes in organizations and macro-society. The discussion focused on the latter domain viewed from the IS perspective. It showed that changes in organization are associated with IS, where unexpected fluctuations are a source of uncertainty. Uncertainty pertains to different kinds of IS. Among the remarkable examples discussed are the systems for communication, work groups, human resource management, customer relations, production, enterprise-wide operations, decision making, and social media. The IVO framework elaborated in the book is a response to the challenges of change and uncertainty. IVO supplies intellectual tools for predicting, explaining, and managing changes.

Electronic devices and machines we call “information technology” (information and communication technology, digital business technology, and the like) have become indispensable in the contemporary enterprise. This claim can be stated with great certainty. The same may not apply to the academic fields focused on the management of these devices and machines. There is a gap between the boldness with which these fields have been addressing technological developments and the visibility of their results. To the extent that these fields belong to the domain of social science, their *raison d’être* is assessed by their recognized contributions to responding to pressing theoretical and practical challenges in the social context of interest. The IVO framework represents an attempt at such a response. It is based on synthesizing the contributions, while expanding theoretical horizons through a different framing of some fundamental concepts and by embracing inspiring results from various disciplines.

There are signals in the IS literature that the organizational context of a firm has become too tight for the study of IS; the discussion on technology philosophy in Chapter 4 is indicative in this respect. Broadening the scope of research is not either good or bad by itself. All depends on a contributing capacity of the IS field that, in jumping to a broader context, must be capable of matching up with older, well-established social sciences. However, the context shift is undoubtedly undesirable if its motive is in escaping the responsibility for supplying relevant research for business and other organizations.

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