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Omid Torabi, Abbas Mirakhor

CROWDFUNDING WITH ENHANCED REPUTATION MONITORING MECHANISM (FAME)

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Omid Torabi, Abbas Mirakhor

Crowdfunding with Enhanced Reputation Monitoring Mechanism (Fame)

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Omid Torabi, Abbas Mirakhor

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1 Introduction

1.1 What is Crowdfunding?

Crowdfunding is a rapidly growing method of mobilizing financing for projects of varying scale. It can be defined as an investment carried out by a group of individuals (“crowd”) rather than financial institutions. Crowdfunding is a result of direct communication between entrepreneurs and investors on an internet platform, without the involvement of any intermediaries such as banks. In other words, entrepreneurs “tap the crowd” by raising funds directly from the crowd (Schwienbacher and Larralde 2010). In crowdfunding, a large number of individuals each provide a small amount of funding, instead of the traditional method of a very small group of experienced investors providing large amounts of funds (Voorbraak 2011). The term could encompass different types of fundraising such as donations or selling shares of a company (Ahlers et al. 2012). Another interesting feature of crowdfunding which is inherited from crowdsourcing is that the individuals involved in crowdfunding gain the *opportunity to play the role of entrepreneur* as well. They are also empowered to be involved in the development of new products and invest in projects of their choice (Ordanini et al. 2011).

There are two types of crowd-based investing according to Schwienbacher and Larralde (2010), namely passive investment and active investment. Passive investment offers only returns to investors – with no possibility of becoming actively involved in the business processes, such as through voting rights, while active investment offers investors the opportunity to become actively involved in the business, which is closer to the concept of crowdsourcing.

Crowdfunding investments can be structured as debt or equity financing (Lehner 2013). In recent times, equity-based crowdfunding – in which crowd members become actual shareholders of a company – has become a prominent financing alternative in the start-up scene. It allows shareholders to be more involved with the growth and direction of the business via the provision of specific rights such as the ability to vote, and a proportionate share of the risk and rewards. Since 2009, the volume of funds raised via equity crowdfunding has doubled every year and is expected to increase sharply in the future (Ahlers et al. 2012). The staggering rise in funds raised via this particular method has prompted more start-ups to consider equity crowdfunding as an alternative option in their fundraising repertoire. As an example, an Australian technology start-up sold approximately 10% of its equity on the Australian Small Scale Offerings Board (ASSOB), one of the world’s most popular equity crowdfunding platforms for AU\$630,000 (approximately US\$645,000) to 23 investors in 2009 (Ahlers et al. 2012). As of 2014, ASSOB has provided more than AU\$150 million in equity investments to small and medium-sized enterprises (SMEs).

Non-risk sharing investments, according to Schwienbacher and Larralde (2010), on the other hand, afford lower levels of risk due to collateral and seniority of their

<https://doi.org/10.1515/9783110582925-001>

claims over equity. This has made some contracts such as *Ijarah* or lease financing, a popular choice in Islamic banking (Osmani and Abdullah 2010), while the risk-sharing model of Musharakah lags behind as the least-utilized contract in the world. Despite its greater potential for profitability, the limited use of Musharakah can be attributed to a perceived problem of information asymmetry between investors and entrepreneurs, since the two parties do not have access to the same level of information (Myers and Majluf 1984). It is assumed that the entrepreneur will have more reliable information on the true quality of the project compared to its potential investors (Ahlers et al. 2012). This problem arises even before the investor decides to embark on a partnership with the entrepreneur and tends to carry on after an agreement is made. As a solution to overcome this problem, investors use signaling and screening methods to assess business performance and draw up contracts to monitor the activities of the firm (Smith and Smith 2004). There are various methods in which businesses can be screened – either via information on their financial statements or the quality of their team. They can also be assessed through their business environment, i.e., the market in which they operate (Berger and Udell 1998). Credit enhancement instruments such as collateral, guarantees and guardians are also commonly used.

Another more innovative technique involves the use of reputation as a mechanism to reduce the problem of asymmetric information. The internet permits this powerful social dynamism to be specifically measured and controlled through proper engineering of the information systems that mediate online communities. Such automated “feedback mediators” specify who can participate, what type of information is solicited from participants, how it is aggregated and what type of information is made available to them about other community members. Through the proper design of these mediators, mechanism designers can exercise precise control over a number of parameters that are either very difficult or impossible to influence in brick-and-mortar settings (Dellarocas 2015).

Equity-based crowdfunding is empowered by social media communication. For example, with user-generated content as a noteworthy guide for investors, Lehner (2013) suggests interesting possibilities to overcome at least part of the information asymmetry problem. Since it is safe to assume that capital is allocated in a democratic way on a social platform, entrepreneurs are more motivated to be transparent about their plans and activities in order to successfully convince investors to participate (Voorbraak 2011). All in all, the networking theory has already proven to be highly accurate in modeling the flow of resources, opportunities and information in various situations (Dobrow et al. 2011).

The main sources of information in a crowdfunding business model are derived from the internet, social media and blogging. The process of an investor choosing a suitable business to invest in is called matchmaking, which is an individual’s decision to participate in an investment, based upon its perceived legitimacy (Lehner 2013). For this to happen, crowdfunding websites provide some metrics such as total pledge amount of the project, funding ratio, number of investors contributing to the project,

and the entrepreneur's number of social media followers. These metrics influence the potential investor's decision about the project's support. For instance, if they observe *significant social support* for the project at an early stage, they will more likely be motivated to invest in the project. In contrast, if the project does not receive active support in its early stages, it is less likely for investors to support it to the end of the fundraising period (Moisseyev 2013). To affirm this claim, data shows that 82% of unsuccessful projects received less than 20% of target funding in the early stages (Kickstarter Stats 2013). Blogs which also fall under the category of social media (Moisseyev 2013) also help to reduce information asymmetry of a crowdfunding project by making information on the project available on a widely accessible network.

However, the availability of such a ubiquitous platform requires investors to analyze and screen the information that is available in a precise manner, especially via signaling indices, in order to effectively reduce information asymmetry. Ahlers et al. (2012) conducted empirical research on start-up signals that are more likely to entice smaller potential investors into taking part in an equity crowdfunding project by introducing and examining various types of signaling. They are comprised of *Basic Information* (such as offering information and a detailed company overview), *Capital Market Roadmap* (financial statements), *External Certification* (third-party endorsements), *Board Experience* (measured by the quantity and quality of entrepreneurial talent, including the management team's education level and qualifications), *Risk Level* (determined by the forecasts of EBITDA, EBIT, and net earnings, the number of intended financing rounds and the ratio of equity offered), and finally information on the *Speed of the Investment*. Their results provided strong evidence of the crucial role of signaling, especially with respect to potential risk factors, share of equity offered, and board size and structure. In addition, they found that start-ups with more board members, higher levels of education, and better networks are more likely to have a higher number of investors (Ahlers et al. 2012).

With regard to observing the psychology and motivations of individual crowdfunding investors, Hardy (2013) designed a model to examine the effect of consumer income and the role of producer strategy defined by a provision of incentives to the crowd. Nevertheless, it seems that the behavior of crowdfunders is not yet well understood in these formulation efforts (see Burtch et al. 2012). Their research considers the information on prior contribution behavior, including the amount and timing of other individuals' contributions as a key factor that can influence the behavior of crowdfunders. In their empirical work, they examine the social influence on a crowdfunding platform for online journalism projects. Lin et al. (2012) have tried to identify the types of information that individuals consider in this marketplace when making decisions about contributing. They found that the likelihood of credit being issued is greater when the borrower represents a larger social network, as lenders take this as a sign of credibility and decide to contribute.

Statement of the problem: Turning to the previous discussion on Musharakah, it seems that the adverse impact of information asymmetry in this Islamic risk-sharing

contract could be reduced considerably using the potential signaling capacity of equity-based crowdfunding. This could also support the idea of forming an Islamic crowdfunding platform within this framework. This setup enables investors to actively participate in financing the project whilst amalgamating information transparency and profitability in a Shariah-compliant manner. This makes it a promising option for Islamic financial investors and entrepreneurs. There is, however, a real problem in the area of financial investment and capital borrowing (Osmani and Abdullah 2010), particularly in Muslim countries. This is due to the inability of small entrepreneurs to raise capital as a result of the following:

- They usually have no collateral.
- Regulations prevent fundraising outside of the traditional financial system.
- The banking system is not inclusive (some entrepreneurs are credit rationed).
- There is a real or perceived problem of information asymmetry.

New IT technology has shown that crowdfunding provides a viable solution to the problem. However, much of this crowdfunding activity is interest-based debt financing. Therefore, an alternative Shariah-compliant IT solution is needed to comprehensively address the problems of potential small entrepreneurs in Muslim countries.

1.2 Motivation for the Research

Designing an IT mechanism to address the needs of SMEs in Muslim countries is the main motivation of this research. We pose the research question: Can crowdfunding be the correct means to address this need?

Why is crowdfunding important?

- It is an effective instrument for risk-sharing in Islamic finance.
- It overcomes information asymmetry.
- It promotes financial inclusion.
- It has the ability to mobilize small funds.
- It provides a new alternative platform that effectively reduces transaction costs in the financial sector of Muslim countries such as:
 - rule of law
 - governance
 - credit rating
 - trust
 - information cost
 - bargaining cost
 - contract negotiation cost
 - contract enforcement cost
- It helps to improve income and wealth distribution by allowing lower-income groups with small savings to become asset holders and wealth builders.

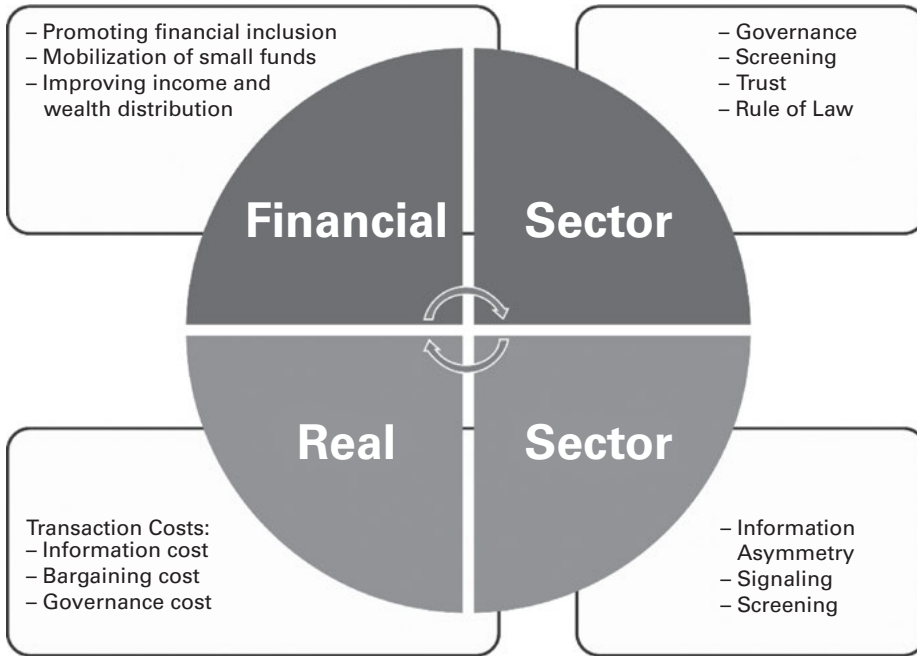


Figure 1: How crowdfunding brings the real sector and financial sector closer.

Source: own illustration.

The Islamic risk-sharing contract, namely *Musharakah*, is well known as one of the most recommended funding tools in Islamic finance from a theoretical standpoint. In practice, however, *Musharakah* is one of the least utilized contracts in Islamic finance. As mentioned earlier, this contradiction arises mostly due to the perceived problem of information asymmetry. Fortunately, the increasing popularity of crowdfunding as a new method of mobilizing project financing, minimizes this asymmetric information distribution. The internet platform is a crucial component in the crowdfunding business model, particularly the concept of Web 2.0 and social networks, which forms information flows and alleviates information asymmetry. Crowdfunding has the potential for adding reputation, history of activities and other vital pieces of information into the decision-making process of the potential funders.

This thesis aims at developing a crowdfunding mechanism in which a new set of systematic parameters are employed to represent the signaling indices of each single individual to all other members of the crowd, thus reducing the adverse impact of asymmetric information. This would effectively boost the use of risk-sharing investment through equity-based crowdfunding and increase the utilization of *Musharakah* investments in finance. The idea of designing a crowdfunding mechanism by which

methodical signaling from crowd to crowd exists could be considered an application of the concept of “the wisdom of crowd”¹ in the area of finance and investment. The crucial notion to be considered here is the systematic implementation of the new parameter of “Fame,” which represents an aggregation of the concepts of reputation, history of transactions, credit of the members (project owners or investors), trustworthiness, and the number of “trustworthy friends” of each member in the system. Figure 2 illustrates the workflow of this idea.

1.2.1 Development of the “Fame” Concept

“Fame” refers to the credit standing of every individual who is a member of the crowdfunding system. This credit will be calculated for all users of the system based on their financial transactions, number of friends and their credit standing, groups in which they are members, amount of deposit, credit history and their activity records in the system. “Fame” has been proposed with the aim of representing the reputation of the users in the social network of the crowdfunding system. “Fame” will be the reference for an individual’s decisions in fields of investment, loan payment, being a guarantor, voting, and other areas. The credit points dedicated to each financial transaction will be determined through the policies and procedures of the crowdfunding system set by the owners and policymakers within the credit-scoring framework. “Fame” is the outcome of this credit-scoring process and is therefore attached to the transaction of every single user.

The parameters which could model “Fame” within the credit-scoring process are listed as follows:

- track record of transactions
- results of previous transactions
- amount of previous transactions
- number of transactions
- nature and economic sector of the previous transactions (project), for example contribution in a charity or green project may positively affect the “Fame” parameter of the member
- number of friends
- fame of friends

¹ *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, published in 2004, is a book written by James Surowiecki about the aggregation of information in groups, resulting in decisions that, he argues, are often better than could have been made by any single member of the group. The book presents numerous case studies and anecdotes to illustrate its argument, and touches on several fields, primarily economics and psychology.

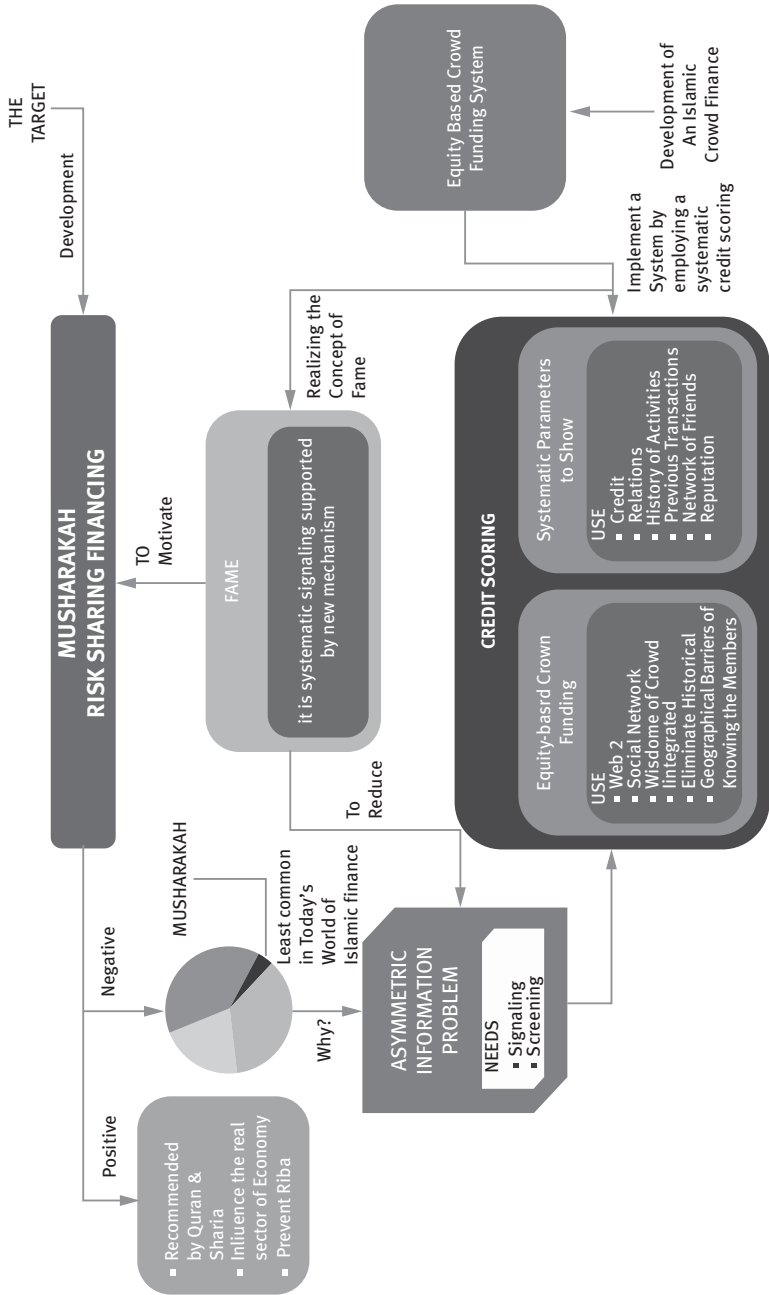


Figure 2: Mechanism of crowdfunding to improve systematic signaling.
Source: own illustration.

- guaranty, voting, guardianship in social network²
- balance of the member’s account in the financial intermediary (if there is (a) bank(s) or financial institute(s) behind the crowdfunding system)
- groups to which the member belongs
- nature of groups to which the member belongs (NGOs, charity groups and so on)

If we compare “Fame” with other legacy credit-scoring systems which are common in financial systems, we can clearly see that “Fame” is more comprehensive. First of all, the number of parameters which are included in the calculation of “Fame” are more various and comprehensive. Moreover, there are some online social parameters that are included in the calculation of “Fame.”

According to our objective of creating a Shariah-compliant crowdfunding platform, this thesis is structured to address the following research questions:

1.2.2 Research Questions

- What should be the key features of an Islamic crowdfunding platform?
- How would a risk-sharing model work in crowdfunding?
- Can crowdfunding be used to enhance capital accumulation by:
 - financial inclusion?
 - mobilizing small/retail deposits?
- How can information asymmetry be minimized in the risk-sharing crowdfunding framework?
- How can crowdfunding be used as a means to circumvent governance issues plaguing the financial sector of less-developed Muslim countries?
- How can crowdfunding technology be used to enhance financial inclusion while minimizing financial transaction costs?

1.3 Research Methodology

In this research, the crowdfunding system is characterized using a *mechanism design*. Mechanism design refers to the design of the business processes through which individuals interact. It takes a systematic look at the structure of the mechanism and how it affects the outcome of various interactions. This method focuses on a design that satisfies certain objectives, assuming that the interacting individuals will behave strategically (Jackson 2003). In the design of the model, a finite group of individuals (crowdfunders) interact within the framework of

² To help an entrepreneur in a crowdfunding system, other members can vote (positively) for his/her project or guarantee his/her project.

crowdfunding. Every individual thinks strategically and makes decisions within a finite set of potential decisions. These processes of decision-making are formed based on the preferences and information which each individual holds. This information consists of all signaling indices available through the broad network of Web 2.0 and blogging (in summary, the value of “Fame” of the other members). Finally, a comparison between the mechanism’s payoffs and other models without access to signaling information is possible when its signaling triggers are active.

Since the aim of this research is to design and develop a new system for applying crowdfunding in Islamic finance, the research will be conducted based on a theoretical model which will look to: (i) design a new risk-sharing crowdfunding structure which is also Shariah-compliant; (ii) form the concept of “Fame” as a systematic signaling index of the reputation and credit standing of the crowd members to reduce information asymmetry and transaction costs; and (iii) design a crowdfunding mechanism and find an efficient and optimal mechanism through graph theory.

1.4 Designing the Mechanism

Two different scenarios of the mechanism, with and without “Fame,” may be compared as below:

Considering Figures 3 and 4, we observed that the second scenario is capable of offering more useful information to the system’s members. In the first scenario, the

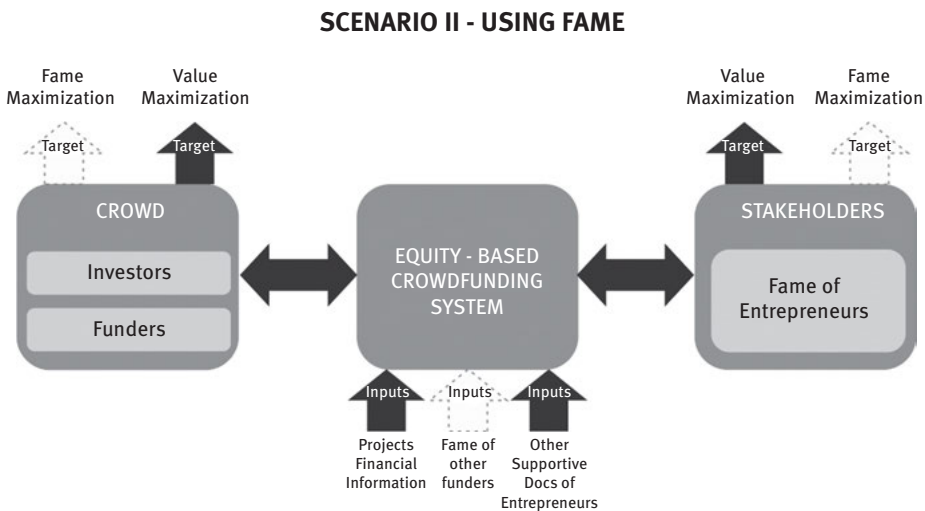


Figure 3: Scenario 1 of a crowdfunding mechanism in absence of “Fame.”
Source: own illustration.

SCENARIO I - WITHOUT USING FAME

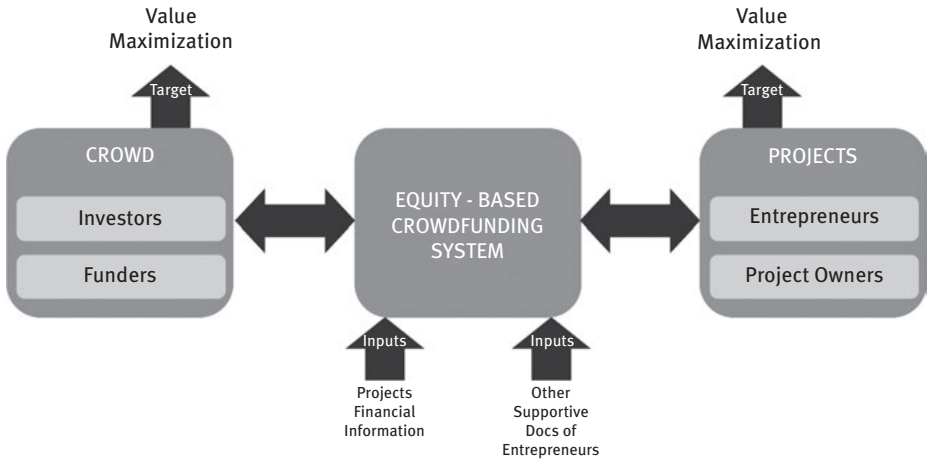


Figure 4: Scenario 2 of a crowdfunding mechanism utilizing the concept of “Fame.”
Source: own illustration.

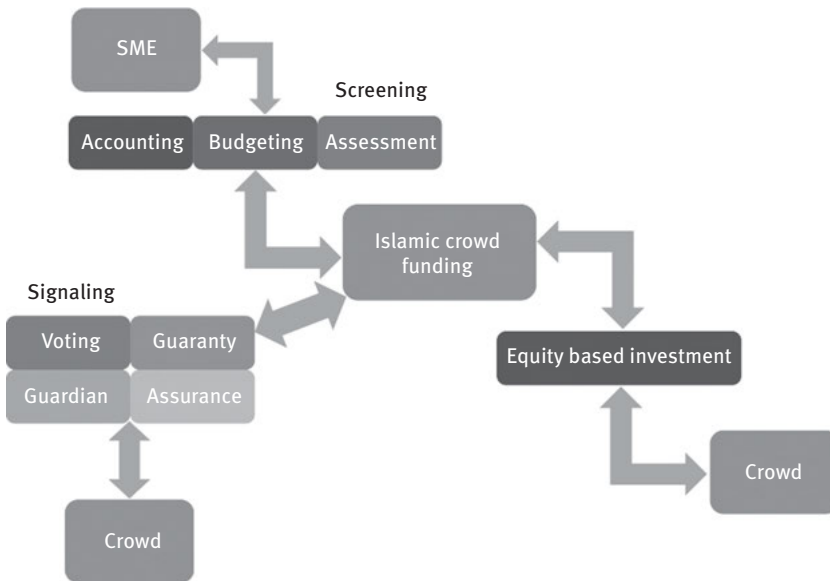


Figure 5: The mechanism of Islamic crowdfunding.
Source: own illustration.

only available information on the project is the value and some other supporting documents which are typically provided by an entrepreneur in any financial project. Therefore, the decision-making process is based solely on present-value calculation methods. Meanwhile, the target of all members, including the investors and project owners, is only value maximization. In scenario 2, other information parameters exist, such as “Fame” of the investors, projects owners as well as the amount of “Fame” that any investor may use (authenticate) for each project. We can create a better setting for decision-making when we know the reputation of the project owner and the reputation of all other customers that invest in the project. This reputation includes various comprehensive parameters to help investors discern the projects better. Adding these parameters to the system’s inputs offers highly valuable information to all decision makers. In addition, the target of the system’s members is not only value inadvertently but also “Fame” maximization. In such a setup, all members are concerned about their reputation and will try to increase their “Fame.” This will inadvertently lead to a design mechanism in which everyone tries for better systematic signaling. The result is a continued improvement in efficiency of the system and a gradual reduction in the problem of asymmetric information. A more effective crowdfunding model which encourages the crowd to actively participate in the project is the expected outcome. Other value-added benefits of signaling in this system are:

- reduces opacity and increases transparency
- “borrower” is held to higher scrutiny
- reduces agency problems (as all members/managers are under screening of the crowd)
- reduces project failures

2 Literature Review

2.1 Introduction

It is widely known that SMEs experience various problems in obtaining financing. Banks are reluctant to provide financing to entrepreneurs due to heightened regulation and the relentless financial crisis, while venture capital (VC) funds typically look to provide larger amounts of capital which exceed the needs of entrepreneurs who require much smaller amounts to start up their business. This leaves entrepreneurs to rely on friends, family or their own savings. They also make extensive use of bootstrapping techniques to mitigate their financial constraints (Bhidé 1992; Winborg and Landstrom 2001; Ebben and Johnson 2006) and boost their short-term profits.

In order to overcome this problem, entrepreneurs are seeking alternative ways of obtaining funding. One of the alternatives is crowdfunding. This method of raising funds is attracting more and more attention and becoming more popular on a mainstream level. In recent times, entrepreneurs have begun to rely on the internet to directly seek financial help from the general public (the “crowd”) instead of approaching financial investors such as business angels, banks or venture capital funds (Kleemann et al. 2008; Lambert and Schwiendbacher 2010). This technique, called “crowdfunding,” has made it possible to seek capital for project-specific investments as well as for starting up new ventures. On the other hand, Islamic finance as a growing sector of the financial market continues to seek new Shariah-compliant financial instruments to serve Islamic communities. Islamic crowdfunding could be one of these new innovative tools to help Muslim people in Muslim communities find an easy Shariah-compliant way of investing. This chapter provides a definition of crowdfunding, the different types of crowdfunding, and a review of the concepts and concerns of applying it to Islamic finance. As information asymmetry is one of the most important problems in risk-sharing investments, it will be reviewed within the context of crowdfunding and specifically in Islamic crowdfunding systems. Finally, this chapter will consider the concept of an optimal Islamic crowdfunding system and the related literature.

2.1.1 Crowdfunding

The concept of crowdfunding involves obtaining funding from a large group of people, where each individual provides a small amount, instead of raising the money from a very small group of experienced investors. Additionally, crowdfunding is also used for acquiring information (Belleflamme et al. 2010). In this context, it is an excellent tool for co-creation, where both a firm and active customers create value through new forms of interaction, service and learning mechanisms (Pralhad and

<https://doi.org/10.1515/9783110582925-002>

Ramaswamy 2004). Rapid developments in global technology have an inextricable influence on our daily lives. The staggering progress of the internet has not only changed the way we communicate, but also the way in which we do business (Howe 2006). The development of Web 2.0 and internet applications that make two-way collaborative communication possible (Kleemann et al. 2008) have enabled people to easily connect with one other around the world. Social media platforms such as Facebook or Twitter serve as a kind of mediator and allow people to form online communities that share similar interests or knowledge (Mislove et al. 2007). This ability for people to interact with each other has been crucial for the recent development of crowdfunding, which is said to have originated from the broader concept of crowdsourcing (Belleflamme et al. 2010). Crowdsourcing enables people and organizations to obtain from a crowd ideas and solutions for private or corporate activities (Belleflamme et al. 2011). In the same fashion, crowdfunding allows people and organizations to raise capital from a crowd.

The concept of pooling money by a large group of people is not something new. However, the fact that such funding happens via the internet places crowdfunding in a new paradigm. The internet enables a global reach for attracting funding. As a result, established intermediaries are often circumvented through use of crowdfunding, which reduces the cost of fund mobilization and increases efficiency (Het Financiële Dagblad 2011). Crowdfunding generally takes place through the means of online platforms. Such platforms have proven to be a successful manner of raising funds for companies as well as projects across different industries. Due to the success of these platforms, crowdfunding is seen as an innovative business model that works. It is also seen as a viable and alternative way to raise funds.

Crowdfunding is a combination of the words “crowd” and “funding.” A crowd is defined by the Oxford English Dictionary as: “A large number of people gathered together in a disorganized or unruly way”, or “The mass or multitude of ordinary people”. In sociology, crowd is “a temporary gathering of people responding to common stimuli and engaged in any of various forms of collective behavior”. There are specific definitions for crowdfunding. Some of them are as follows:

- “Crowdfunding is the use of small amounts of capital from a large number of individuals to finance a new business venture. Crowdfunding makes use of the easy accessibility of vast networks of friends, family and colleagues through social media websites like Facebook, Twitter and LinkedIn to get the word out about a new business and attract investors. Crowdfunding has the potential to increase entrepreneurship by expanding the pool of investors from whom funds can be raised beyond the traditional circle of owners, relatives and venture capitalists.” (Investopedia)³

3 <http://www.investopedia.com/terms/c/crowdfunding.asp>

- “Crowdfunding is the collecting of resources (funds, money, tangible goods, time) from the population at large through an internet platform. In return for their contributions, the crowd can receive a number of tangibles or intangibles, which depend on the type of crowdfunding. Crowdfunding involves three participants: the crowd (or contributors); a crowdfunding platform; and the crowdfunding campaign creator.” (Garry A Gabison 2015)
- “Crowdfunding is the process of raising money to fund a project or business venture through numerous investors and via an internet platform. Online crowdfunding is a relatively new phenomenon that has increased the number of ways in which consumers, entrepreneurs and organizations can access capital.” (Moleskis and Canela 2016)⁴
- “The funding of projects by raising many small amounts of money from a large number of people via the internet through virtual platforms is known as crowdfunding.” (Otero 2015)⁵
- “Crowdsourcing takes place when a profit-oriented firm outsources specific tasks essential for the making or sale of its product to the general public (the crowd) in the form of an open call over the internet, with the intention of animating individuals to make a [voluntary] contribution to the firm’s production process for free or for significantly less than that contribution is worth to the firm.” Or: “Crowdfunding involves an open call, essentially through the internet, for the provision of financial resources either in form of donation or in exchange for some form of reward and/or voting rights.”⁶ (Belleflamme, Lambert and Schvienbacher 2010)

As a summary of literature reviews in order to define crowdfunding, we can say that:

Crowdfunding, as a rapidly growing method of mobilizing finance for projects, is defined as an investment conducted by a group of individuals (crowd) instead of through traditional financial institutions. Crowdfunding takes place as a result of *direct communication between entrepreneurs and investors* on an internet platform, without any intermediaries such as banks. In other words, entrepreneurs “tap the crowd” by raising funds directly from the crowd (Schvienbacher and Larralde 2010). In crowdfunding, every individual provides a small amount each, instead of a very

⁴ Moleskis Melina &Canela Miguel Angel. (2016).“Crowdfunding Success: The Case of Kiva.ORG”. Working paper.IESE Business School-University of Navarra.

⁵ Otero, Paula. (2015). “Crowdfunding.A New option for funding health projects”. Arch Argent Pediatr 2015; 113(2): 154–157 / Special article.

⁶ Belleflamme, Paul; Lambert, Thomas and Schvienbacher Armin (2010). “Crowdfunding: An Industrial Organization Perspective”. Workshop ‘Digital Business Models: Understanding Strategies’, held in Paris on June 25–26, 2010.

small group of experienced investors providing a large amount (Voorbraak 2011). The term could encompass different types of fundraising such as donation collection or selling shares of a company (Ahlers et al. 2012). Another interesting feature which is inherited from crowdsourcing is that crowdfunding gives individuals the *opportunity for an entrepreneurship* role as well. There is also the possibility that they may influence the development of new products and the opportunity to invest in projects of their choice (Ordanini et al. 2011).

2.1.2 The Wisdom of Crowds

Surowiecki (2004) argues in his book, *The Wisdom of Crowds: Why the Many Are Smarter than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, that given the right circumstances, groups are remarkably more intelligent, and often smarter than the smartest person within the same group. According to his theory, in order to let the crowd outperform, it needs to comply with three conditions: the crowd needs to be independent, diverse and it needs to satisfy a “particular kind of decentralization” (Surowiecki 2004). He uses several examples in order to illustrate his theory. One of the examples concerns the television program “Who Wants To Be A Millionaire” where a contestant needs to answer 15 questions correctly in order to win a million dollars. The contestant has two options when he or she is in doubt to produce the right answer. One is the option to ask the audience, and the other to call a trusted person. Research shows that 65% of the trusted persons were able to give the correct answer, while in 91% of the cases the audience was right. Critics, however, argue that the hypothesis formulated by Surowiecki (2004) has not been empirically tested and that only when no specific skill is needed might it work (Silverman 2007).

Nevertheless, especially in the software business, collective development or “open source” models have been growing rapidly (Lerner and Tirole 2000). Howe (2007) argues that communities are better at identifying talent as well as evaluating the outcome. It is probable that online communities comply to a higher degree with the three conditions mentioned earlier by Surowiecki.

Raymond (2001) discusses the “wisdom of crowds” in an open source model that he compares with the metaphor of a cathedral and a bazaar. The cathedral is specifically designed in high detail before being built, while the bazaar is a more chaotic and incrementally-growing phenomenon. The metaphor is used to describe the normal commercial (cathedral) world in comparison to a bazaar world (Raymond 1999). It illustrates that through collaborative and collective teamwork, people from all over the world are able to create something in an often more efficient fashion than normal production.

2.1.3 Crowdsourcing

The term originates from a combination of the words “crowd” and “outsourcing” (Schenk 2009). Howe and Robinson first introduced the term in the June 2006 edition of *WIRED* magazine (Belleflamme et al. 2010). While companies often looked abroad to find cheap labor, the development of Web 2.0 platforms created the potential to reach an unlimited supply of workers (Howe 2006). Crowdsourcing can be used in both commercial and non-commercial environments. It is a form of outsourcing not directed toward companies, but toward the crowd via an open call using the internet (Schenk, 2009). Wikipedia is probably one of the clearest and earliest examples of a non-commercial form of crowdsourcing. Jimmy Wales and Larry Sanger created an online encyclopedia where any entry can be added and modified by its users (O’Reilly 2007). The result is the largest online encyclopedia that exists, comprising 24,083,125 pages made by 14,658,566 users. In Wikipedia itself crowdsourcing is defined as:

“The act of outsourcing tasks, traditionally performed by an employee or contractor, to an undefined, large group of people or community (a crowd), through an open call.”

Crowdsourcing is comparable to the phenomenon of open innovation where the underlying idea is to not solely rely on one’s own knowledge, but to share research and development through intellectual property rights (Schenk 2009). Whilst research and development (R&D) in most companies are strictly done in-house in order to protect potential discoveries, the development of crowdsourcing has made resource sharing possible to the point that it is unrivalled by the business models of even the largest institutions. Companies like P&G, DuPont and Boeing now tap into the global scientific communities in order to find solutions for their most difficult R&D problems (Brabham 2008). Websites like Innocentive.com are an example of platforms where these corporations can post their problems in the hope that someone would be willing to work on a solution for a financial reward. These rewards can vary anywhere from US\$10,000 to US\$100,000. Anybody who is willing can participate in attempts to solve the posted problems (Howe 2009). Due to the commercial use of crowdsourcing, Kleemann et al. (2008) define crowdsourcing more comprehensively as:

“Outsourcing of firm-specific tasks essential for the making or sale of its products to the general public in the form of an open call on the internet, with the intention of animating individuals to make a (voluntary) contribution to the firms production process for free or for significantly less than that the contribution is worth to the firm.”

This definition refers to the creation and sharing of the content of a problem whereby large groups of people give their input. Returning to the wisdom of crowds, given the right set of conditions, the crowd will almost always outperform a set of employees (Howe 2009). Howe (2009) argues, in line with the earlier references on Web 2.0, that there are a number of developments that have made crowdsourcing

possible. For instance, the development of open source software such as Linux has led to a rise of the amateur class (Howe 2009). Furthermore, the advancement of the internet has made it a more widely-used platform available for everybody. Most importantly, the internet has facilitated online communities such as LinkedIn and Facebook.

(Howe 2009) suggests: “Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers.”

Crowdsourcing represents a new way that problem-solving models can be viewed and used across industries in order to solve highly complex tasks (Brabham 2008).

Crowdsourcing is therefore no more just a buzzword on Web 2.0, but can instead lead to renewed strategic models that attract an interested, motivated crowd that is able to come up with problem-solving solutions of superior quality to traditional businesses (Brabham 2008).

Table 1: Types of Crowdsourcing.

Type of Crowdsourcing	Description
1 Participation of consumers in product development and configuration	Companies ask for comments and suggestions on current and future products
2 Product design	Companies ask to develop a whole new product from A to Z
3 Competitive bids on specifically defined tasks or problems	Companies ask to give a solution to unsolved problems
4 Permanent open calls	Companies ask for any new information or documentation
5 Community reporting	Same as before except the work is done by a known community instead
6 Product rating by consumers and consumer profiling	Companies ask for product reviews and opinions for other users to see
7 Customer-to-customer support	Companies ask customers to help other customers and use it for consumer knowledge and product design
8 Participation of consumers in product development and configuration	Companies ask for comments and suggestions on current and future products

Source: Different sources of crowdsourcing, as characterized by Kleemann et al. (2008).

2.1.4 Sharing Economy

The term “sharing economy” is also used in crowdfunding concepts, and it is a term often used by futurists who view crowdfunding as part of a new and more comprehensive paradigm. In his book, *Sharing Economy* (2016), Arun Sundararajan defines it as “crowd-based capitalism” to describe an economic system with the following five characteristics:

- *Largely market-based*: The sharing economy creates markets that enable the exchange of goods and the emergence of new services, resulting in potentially higher levels of economic activity.
- *High-impact capital*: The sharing economy opens up new opportunities for everything, from assets and skills to time and money, to be used at levels closer to their full capacity.
- *Crowd-based “network” rather than centralized institutions or “hierarchies”*: The supply of capital and labor comes from decentralized crowds of individuals rather than corporate or state aggregates; future exchanges may be mediated by distributed crowd-based marketplaces rather than centralized third parties.
- *Blurring lines between the personal and professional*: The supply of labor and services often commercializes and scales peer-to-peer activities like giving someone a ride or lending someone money – activities which used to be considered personal.
- *Blurring the lines between fully employed and casual labor, between independent and dependent employment, between work and leisure*: Many traditional full-time jobs are being supplanted by contract work that features a continuum of levels of time commitment, granularity, economic dependence and entrepreneurship.

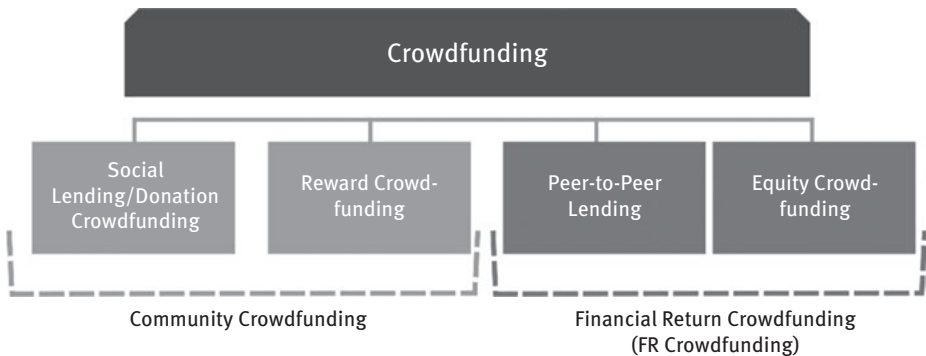
2.1.5 Types of Crowdfunding

Generally, there are two types of crowdfunding – financial crowdfunding and non-financial (or community) crowdfunding. Funders usually look for financial return in financial crowdfunding. The return could be a profit, reward or income from their funding or a share of ownership in the project. Non-financial crowdfunding is mostly for charity aims or art/green non-governmental organizations (NGOs).

Reward-based and donation-based crowdfunding are examples of non-financial crowdfunding, although the crowdfunder’s motivation in each model might differ (Lasse Magnus Klæbo Andersen and Lars Joakim Mauritzen 2015).

Table 2: Types of Crowdfunding.

Types of crowdfunding	Description
Equity-based	The entrepreneur issues shares to obtain funding
Debt-based	The entrepreneur borrows funds from investors and pays them back plus interest after maturity
Shared-profit	The entrepreneur shares profit with investors. This may be maturity-based (until a particular moment in time) or return-based (up to particular amount)
Donation-based	The entrepreneur pays nothing in return

**Figure 6:** Crowdfunding: Four sub-categories.

Source: own Illustration.

2.1.5.1 Donation-Based Crowdfunding

Donation-based crowdfunding is an example of a non-financial model. Crowdfunders typically have an intrinsic motivation to donate, and returns will be intangible benefits from backing the project (Pierrakis and Collins 2013). “Investopedia says that donation-based crowdfunding is a way to source money for a project by asking a large number of contributors to donate a small amount. In return, backers may receive token rewards that increase in prestige as the size of the donation increases, whereas for small sums, the funder may receive nothing at all. Sometimes referred to as rewards crowdfunding, the tokens for donations may include pre-sales of an item to be produced with the funds that are raised. Donation-based crowdfunding can also be used in an effort to raise funds for charitable causes.”⁷

⁷ Investopedia.com - <https://www.investopedia.com/terms/d/donationbased-crowd-funding.asp>

Because this sort of crowdfunding is predicated on donations, funders do not obtain any ownership or rights to the project, nor do they become creditors to the project (Investopedia).

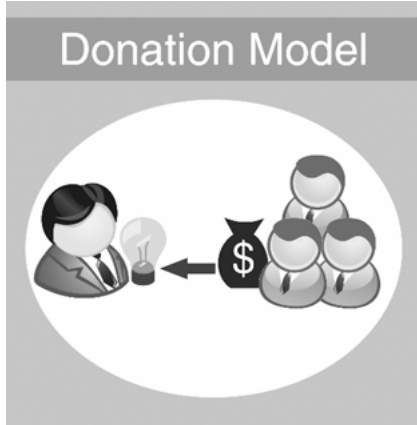


Figure 7: Donation model of crowdfunding.
Source: own illustration.

2.1.5.2 Equity-Based Crowdfunding

This type of crowdfunding involves the issuance of inexpensive shares through the internet, where investors can acquire stock in corporations for a small amount of money, with a claim over the company's future cash flow. It has proved to be a viable form of corporate finance, enabling even companies which may have failed to obtain funds from angel investors, government programmers, friends or family access to funding. Crowd investing deals with the financing of corporate growth and innovation (Bradford 2012a; Klöhn-Hornuf 2012).

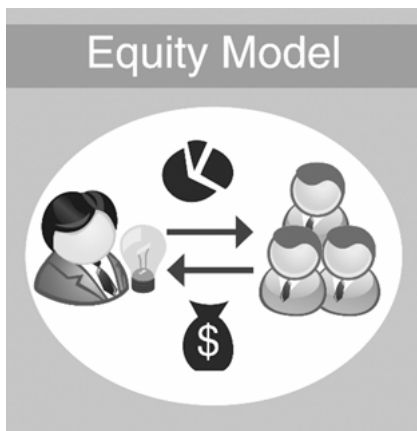


Figure 8: Equity-based model of crowdfunding.
Source: own illustration.

2.1.5.3 Reward-Based Crowdfunding

The reward-based *crowdfunding* model is the largest model of its type, and together with the donation-based model, is more appropriate for campaigns that appeal to funders' personal beliefs and passions (Moutinho and Leite 2013).

Rewards-based crowdfunding is the most common type of crowdfunding option available. This type of crowdfunding involves setting varying levels of rewards that correspond to pledge amounts.

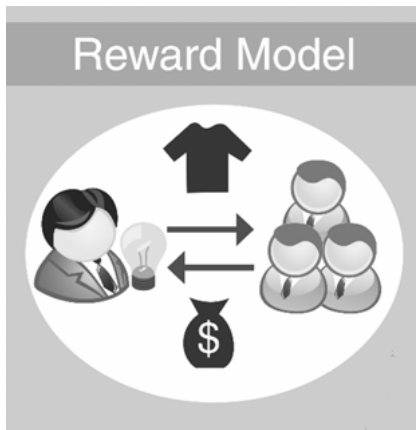


Figure 9: Reward-based model of crowdfunding.
Source: own illustration.

2.1.5.4 Lending-Based Crowdfunding

In this case, the parties agree that funding will be in the form of a loan with a specific interest rate. Donors are considered investors who expect a financial return, so it becomes an attractive alternative to traditional credit. However, its implementation might be difficult in the field of health research (Otero 2015).

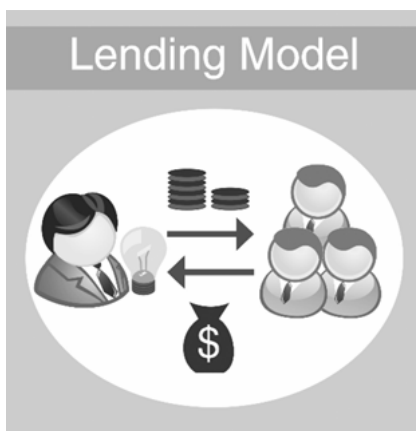


Figure 10: Lending-based model of crowdfunding.
Source: own illustration.

2.1.6 Some Outstanding Examples of Crowdfunding

One of the best examples of crowdfunding systems is the Scottish craft beer brewery BrewDog which has capitalized on the advantages that equity-based crowdfunding presents.⁸ The business has previously initiated three equity-based crowdfunding campaigns, the first one being in 2010, and is currently running a fourth one. Their most recent campaign lasted from April 2015 until April 2016. They call their campaigns “Equity for Punks” and have more than 14,500 shareholders invested in their (private) company (Lasse Magnus Klæbo Andersen and Lars JoakimMauritzen 2015).

Across the Atlantic, the biggest crowdfunding platform in the world is Kickstarter, an American reward-based platform that uses the “all-or-nothing” model. Since it was founded in 2009, it has channeled more than US\$1.8 billion from over 8.9 million investors and more than 88,300 projects. Within the lending-based crowdfunding sphere, LendingClub, founded in 2006 and headquartered in the US, defines itself as the world’s largest online credit marketplace for both personal and business loans, with lower interest rates than traditional credit institutions as a result of its lower operating costs (the company has no physical branches and operates fully online). It was classified as the fifth most promising company in America by *Forbes* in January 2014, with a revenue of US\$98 million (Luís Pedro Cunha de Oliveira 2015).

An Australian high-tech start-up sold approximately 10% of its equity on ASSOBS (one of the most prominent equity crowdfunding platforms) for AU\$630,000 (approximately US\$645,000) to 23 small investors in 2009 (Ahlers et al. 2012). ASSOBS had prepared more than AU\$150 million in equity investments for SME businesses as of 2014. Equity-based investment provides shareholders with some specific rights, such as voting rights, and shares the risks of the project with them.

Indiegogo started its own charity crowdfunding campaign to support the victims of the earthquake in Nepal in the Spring of 2015. As of September 7, 2015, there are 287 ongoing campaigns related to this cause and total funding has amounted to US\$2.62 million (Andersen and Mauritzen 2015).

Figure 11 shows the tremendous growth of crowdfunding in recent years, including the accelerating growth of crowdfunding capital raised with the aim of gaining financial returns.

8 You will find a reference table of some successful crowdfunding projects in Appendix B.

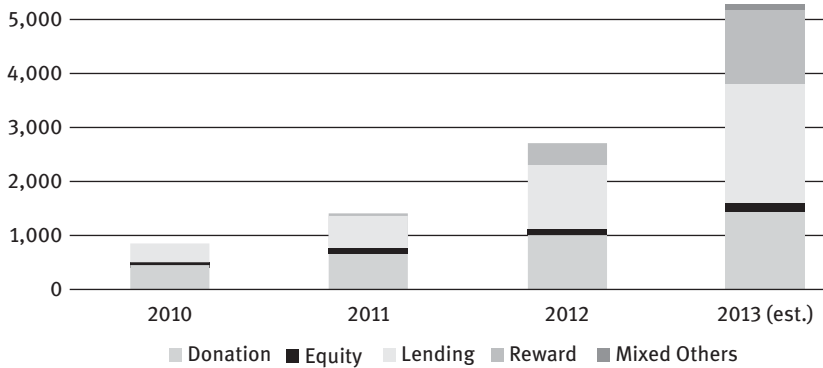


Figure 11: Growth in funding volume by crowdfunding model (US\$ mil).
Source: Massolution 2013 Crowdfunding Report.

2.1.7 Advantages of Crowdfunding

The growth of crowdfunding in recent years points to a new stream in the financial market which can be an alternative for traditional means of financing. Crowdfunding certainly has some outstanding advantages compared to common financing tools as summarized below:

- It can be a quick way to raise financing with no upfront fees, thus reducing transaction costs.
- Pitching a project or business through an online platform can be a valuable form of marketing and attract media attention.
- By sharing the idea, the entrepreneur often can gain feedback and expert guidance on how to improve it.
- It is a good way to test the public's reaction to the product/idea – if people are keen to invest, it is a good sign that the idea could work well in the market.
- Investors can track the progress of the project – this may help the entrepreneur to promote the new brand through their network.
- Ideas that may not appeal to conventional investors have a chance to obtain financing.
- Investors can often become the most loyal customers through the financing process.
- It is an alternative financing option for an entrepreneur who has struggled to get bank loans or traditional funding.
- Geographical barriers are reduced – the entrepreneur can obtain funding from anywhere.
- It can promote financial inclusion.
- Transaction costs are lower compared to traditional ways of financing.

2.1.7.1 Transaction Costs

Transaction costs are costs incurred in making an economic exchange or, in other words, the costs of participating in a market (Dahlman 1979).

Transaction costs can be divided into three broad categories:

- *Search and information costs* are costs such as in determining that the required goods are available on the market at the lowest price.
- *Bargaining costs* are the costs of negotiations required to come to an acceptable agreement with the other party in the transaction and drawing up an appropriate contract.
- *Monitoring and enforcement costs* are the costs of making sure the other party sticks to the terms of the contract, and taking appropriate action (often through the legal system) if this turns out to not be the case.

For example, the buyer of a used car faces a variety of different transaction costs. The *search costs* are the costs of finding a car and determining the car's condition. The *bargaining costs* are the costs of negotiating a price with the seller. The *monitoring and enforcement costs* are the costs of ensuring that the seller delivers the car in the promised condition. As with markets for new retail goods and used items and, more recently, personal services, aggregated platforms reduce search costs and transaction costs, allowing for increased participation in the market.

Transaction costs have a large impact on the selection of fundraising type. Sometimes the cost of funding is the biggest barrier for entrepreneurs starting a project. Transaction costs in crowdfunding are clearly lower, as unlike typical business financing which comes primarily from wealthy individuals and institutional investors, crowdfunding mobilizes financing from the general public. In the past, the transaction costs associated with raising small amounts from a large number of investors would have made crowdfunding unworkable, but the internet has significantly reduced these transaction costs (Bradford 2012). Web-based crowdfunding services such as Kickstarter, Lending Club, Prosper, ProFounder, IndieGoGo, and the paragon of crowdfunding, Kiva, have proliferated. Through these sites, entrepreneurs have access to anyone in the world with a computer, internet access and free cash. Billions of dollars have been raised through internet-based crowdfunding since its inception just a few years ago – possibly marking the beginning of a revolution as to how the general public allocates capital (Bradford 2012). Since transaction costs are lower, the crowd is able to make smaller investments and thus able to spread its capital over a greater number of projects than, say, a traditional friends-and-family seed or angel investment (Agrawal 2014).

2.1.7.2 Financial Inclusion

Financial inclusion, or inclusive financing, is the delivery of financial services at affordable costs to sections of disadvantaged and low-income segments of society;

this is in contrast to financial exclusion where those services are unavailable or unaffordable. Financial inclusion, or access to financial services, varies widely across the globe. Even in some advanced economies, survey data suggests that almost one in five adults have no bank account or other form of access to the formal financial sector (Demirgüç-Kunt and Klapper 2012). In many emerging and developing economies, the share of unbanked adults can be as high as 90%. However, financial inclusion is likely to keep expanding in the coming years, supported by economic development and initiatives by central banks and other policymakers.

Financial inclusion matters for a number of reasons. First, there is the impact of financial inclusion and financial development in a broader sense, on the macroeconomic environment which include long-term economic growth and poverty reduction (e.g., Burgess and Pande 2005; Levine 2005). Access to appropriate financial instruments may allow the poor or otherwise disadvantaged to invest in physical assets and education, reducing income inequality and contributing to economic growth. Financial inclusion also has important implications for monetary and financial stability.

Economic research suggests that financial inclusion can provide economic benefits. For example, setting aside income in the form of savings accounts with safe and affordable financial services providers enables households to cover unexpected or occasional expenses (which is called idiosyncratic risk) when they arise, as well as store income that is in excess of typical consumption levels. Households can thus be said to be “smoothing” their consumption, something that is far more difficult to do in the absence of access to financial services (e.g., Ruiz 2013). This example can easily expand to the use of pocket money in households for crowdfunding projects to help entrepreneurs start a job, earn a return for funders and aid low-income groups to participate in the financial system.

Full financial inclusion will only be possible with collaboration among the private, public and non-profit sectors.

Torkkeli and Mention (2012, p. 11) suggest: “Financial innovation embraces changes in the offerings of banks, insurance companies, investment funds and other financial service firms, as well as modifications to internal structures and processes, managerial practices, new ways of interacting with customers and distribution channels.” Technology has facilitated access to financial and banking instruments in recent years, with the proliferation of automated teller machines (ATM), internet, phone and mobile devices as new channels of accessibility.

However, these are merely mediums or channels for facilitation. The beauty of innovation is to create a new paradigm of business itself and leverage on the interaction of these new technologies. As the literature suggests: “Financial innovation is associated with different development processes in terms of activities, formality and cross-functional involvement as well as performance outcomes.” (Avlonitis et al. 2001, p. 334)

Web 2.0 prepares a framework for these new innovations in technology, social media, social networks and crowdfunding. According to Oliveira and von Hippel (2011, p. 806), “users often develop and self-provide important financial services before banks or other types of financial service producers begin to offer them”.

We can identify crowdfunding as a financial innovation that extends informal financing to the online world, where communities pool monies together to fund members with business ideas. The potential of this new branch of entrepreneurial financing to spur new venture creation and foster financial inclusion has captured the imaginations of many. This way of financing has the potential to become a catalyst for financial inclusion, as it creates risks for both borrowers and lenders which need to be better understood and addressed in a timely manner.

Crowdfunding is evolving and growing at a very fast pace, not just in developed markets but in countries across the income spectrum. The G20 Global Partnership for Financial Inclusion (GPMI) recently published a white paper asserting that crowdfunding can help deepen financial inclusion: “It can be a quick way to raise funds with potentially few regulatory requirements; it can be cost-efficient and can produce a good return for the lender; and its potential market reach is limited only by access barriers to the platform and regulatory restrictions where applicable.”⁹

2.2 Islamic Finance

Islamic finance is governed by principles derived from the Qur’an and Sunnah (teachings of the Prophet Muhammad [PBUH]). Islamic finance refers to the methods for conducting business, banking, and finance transactions in accordance with these principles. If banking or financial institutions are not governed by these principles, they cannot be called Islamic banks and/or Islamic financial institutions. The Islamic way of banking differs from conventional banking on many fronts. It adheres to certain aspects of social, moral, and economic values that are ingrained in Shariah principles and the religion itself (Arsalan T. Buriro 2016).

According to Arsalan T. Buriro (2016), Islamic finance refers to the provision of financial services in accordance with Islamic jurisprudence (Fiqh). Shariah prohibits interest (Riba), products with excessive uncertainty (Gharar), gambling (Maysir), short sales, as well as financing of prohibited activities that it considers harmful to society. The prohibition of interest – or *Riba* in Arabic – is the most significant principle of Islamic finance. Shariah also requires parties to honor principles of fair treatment and the sanctity of contracts. Transactions must be underpinned by real economic activities, and there must also be a sharing of risk in economic transactions. Islamic finance products are contract-based and may be classified into three broad categories:

⁹ see www.cgap.org

- *Debt-like financing* structured as sales, which could be sales with markup and deferred payments (Murabahah) or purchases with deferred delivery of the products (Salam for basic products and Istisna' for manufactured products), and lease (Ijarah) with options to buy. Pure lending is allowed only when benevolent (Qard) or without resort to interest rate. Qard is often used in current deposits.
- *Services, such as safe-keeping contracts (Wadi'ah)* as for current deposits, or agency contracts (Wakalah), which are also increasingly used for money market transactions.
- *Two financing modalities similar to profit-and-loss sharing (PLS):* (i) profit-sharing and loss-bearing (Mudarahah) whereby the financier (investor or bank) provides capital and the beneficiary provides labor and skills (profits are shared, but losses would be borne by the financier who does not have the right to interfere in the management of the financed operation – unless negligence, misconduct, or breach of contract can be proven); and (ii) pure profit-and-loss-sharing or risk-sharing (Musharakah) where the two parties have equity-like financing of the project and would share profits and losses.

Musharakah refers to the act or contract of a partnership between two or more parties. It is a participatory mode of finance which basically involves direct participation of the parties in profits as well as losses. The term “Musharakah” can be defined as a joint enterprise formed for conducting some business in which all partners (two or more) share the profit according to a specific agreed ratio, while loss is shared according to the ratio of their contributions (Farooq and Mushtaq Ahmed 2013).

This is often perceived to be the preferred Islamic mode of financing because it adheres most closely to the principle of risk-sharing. Partners contribute capital to a project and share its risks and rewards. Profits are shared between partners on a pre-agreed ratio, but losses are shared in exact proportion to the capital invested by each party. Thus, a financial institution provides a percentage of the capital needed by its customer with the understanding that the financial institution and customer will proportionately share in profits and losses in accordance with a formula agreed upon before the transaction is formalized. This incentivizes the partners to invest wisely and take an active interest in the investment. In Musharakah, all partners have the right, but not the obligation, to participate in the management of the project, which explains why the profit-sharing ratio is mutually agreed upon and may be different from the investment in the total capital. (Mirakhor and Zaidi 2007)

For distribution of profit in Musharakah, the proportion of profit to be distributed between the partners must be agreed upon at the time of affecting the contract. It is not allowed for any one of the partners to fix a lump sum amount, or any rate of profit tied up with his investment. However, in the case of loss, all Muslim jurists are unanimous on the point that each partner shall suffer the loss exactly according to the ratio of his investment.

Islamic financial contracting laws deal with a risk-return relationship in a broader sense, and risk-return parity is not required. One implication of this requirement is that the investor is not permitted to require collateral from the borrower (Samadzadeh 2012).

Some risks in a Musharakah contract are: credit risk, market risk, liquidity risk, operational risk and legal risk. For example, in the case of risk-sharing modes of financing, the credit risk will be non-payment to the bank by the entrepreneur when it is upon the due date. This problem may arise due to asymmetric information gathered on the part of the bank where they do not have sufficient information on the actual profit of the firm (Khan, Tariqullah and Habib Ahmed 2001). Also, according to Mirakhor and Zaidi (2007), this kind of contract would introduce a higher degree of discipline into the financial system because it would motivate financial institutions to gauge the risks more carefully and effectively monitor the use of funds by the entrepreneur. This is why risk in a Musharakah contract is so important – as it is directly related to information asymmetry. We review these details further in the following section.

2.3 Musharakah: Risk-Sharing Financing

Abbas Mirakhor (2010, p. 23) defined risk as “A consequence of choice under uncertainty,” adding: “The fact of human existence is uncertainty. Humans act on the edge of an uncertain future. The future is unknown, and therefore unpredictable. Uncertainty if severe enough can direct to anxiety, indecision and inaction. One of the most fundamental capabilities of humans is making decisions. To make a decision, the person can use known probability techniques to make an expectation of returns to an action. Either way, the predictable results will make an expression in terms of chance of occurrence of consequences to an action. In other words, uncertainty is converted into risk. Risk, therefore, is a consequence of choice under uncertainty.”

“Risk exists when more than one outcome is possible. It is uncertainty about the future that makes human lives full of risks. Risk can arise because the decision-maker has little or no information regarding which state of affairs will prevail in the future, but nevertheless makes a decision and takes action based on expectations. Risk can also arise because the decision-maker does not or cannot consider all possible states that can prevail in the future. In this case, even if the decision-maker wants to consider all possible states of the future, there is so much missing information that it is impossible to form expectations about payoffs to various courses of action. This situation is referred to as ‘ambiguity’. If severe enough, this type of uncertainty leads to reluctance or even paralysis in making decisions. People adopt various strategies of ‘ambiguity aversion’. One strategy is to exercise patience and

postpone making decisions until the passage of time makes additional ‘missing’ information available.” Abbas Mirakhor (2010)

According to Fischer Greg (2008) individuals are risk averse, but they cannot save and lack access to formal insurance. Habib Ahmad (2011) argues that the nature of risks faced by Islamic banks are complex and difficult to mitigate for different reasons:

- Unlike conventional banks, given the trading-based instruments and equity financing, there are significant market risks and credit risks in the banking book of Islamic banks.
- Risks intermingle and change from one type to another at different stages of a transaction. For example, trade-based contracts (Murabahah, Salam and Istisna) and Ijarah (leasing) are exposed to both credit and market risks. For example, during the transaction period of a Salam contract, the bank is exposed to credit risk, and at the conclusion of the contract it is exposed to commodity price risk.
- Because of rigidities and deficiencies in the infrastructure, institutions and instruments, the risks faced are magnified and/or difficult to mitigate. For example, there are objections to the use of foreign exchange futures to hedge against foreign exchange risk and there are no Shariah-compatible short-term securities for liquidity risk management in most jurisdictions.

The core difference between conventional and Islamic finance lie exactly at the point of risk-sharing. Profit and loss are the consequences of participation risk in any financial transaction.

Moreover, Ei Massah, Suzanna and Al-sayed, Ola (2013), in their paper, argue that Islamic finance is fundamentally different from the conventional finance model as it is based on a profit-and-loss structure, which requires that a financial institution invest with a client in order to finance their needs, rather than merely lending money to the client. Because of the inherent risk involved in an investment, the financial institution is entitled to profit from the financial transaction.

In order to maximize utility, parties may enter into an informal risk-sharing arrangement and in this system, if one of them earns more than the other, he or she may give something to his or her less fortunate partner. Sharing risk is the spirit of Islamic finance (Kuala Lumpur Declaration 2012). Therefore, earning will be shared between the partners based exactly on their percentage of sharing in the risk, and depending on the type of contract which is agreed upon among partners. As an example, Schwienbacher and Larralde (2010) mention that non-risk-sharing investments include lower levels of risk due to collateral and seniority of their claims over equity. This has made some contracts such as Ijarah, or lease, a popular mode of financing in Islamic banking (Osmani and Abdullah 2010), while Musharakah remains one of the *least utilized contracts* in the world of Islamic finance.

Generally, despite greater potential profitability of a risk-sharing contract such as Musharakah, its limited use has been attributed to a *perceived problem of information asymmetry* between investors and entrepreneurs such that the two parties do not have access to the same level of information (Myers and Majluf 1984). Normally, it is assumed that the entrepreneur has more reliable information on the true quality of the project compared to its potential investors (Ahlers et al. 2012). This problem arises before the investors' decision on partnership is made and continues even after launching the partnership. As one solution to overcome this problem, investors use signaling and screening methods to assess business performance. They make contracts and monitor the activities of the firms (Smith and Smith 2004). Businesses can be screened by the information on their financial statements and quality of their entrepreneurial team. They can also be assessed according to their business environment, i.e., the market in which they operate (Berger and Udell 1998).

2.3.1 Crowdfunding: An Alternative to Traditional Finance

Crowdfunding can solve some of the problems that is faced in the Islamic finance landscape today. Some outstanding advantages of crowdfunding in Islamic finance are:

- *Financial inclusion*: Islamic banks have come under growing criticism for not offering their services to poorer social groups. Such criticism has gained traction due to the fact that more than 60 percent of Muslims live in relatively impoverished countries in Asia, with the vast majority deprived of banking services. Ironically, it is these economically-deprived Muslims who are most in need of financial assistance to help raise their standard of living. Given the growing wave of social unrest across the Middle East and North Africa, and the heavy toll it has already taken on some of the region's financial sectors, Islamic banks would be well advised to start addressing the financial needs of this demographic. What's more, it could even work to their benefit. After all, this largely neglected segment of Muslim society represents a potentially enormous new market for Islamic banks – a market that institutions in some less-developed Muslim countries have already begun to tap into, by providing microfinance to a growing rank of micro-entrepreneurs. Alberto Ribera and Wackerbeck (2011) stated: “Perhaps what is needed is to devise a microfinance model based on profit and loss sharing rather than the payment of interest. One potential avenue for achieving this would be to offer microcredits via Internet crowdfunding, which would help to minimize the bank's administration costs. For such a micro-funding model to work, however, it must be highly standardized and scalable – no easy feat given the divergent nature of most national banking regulations.”

- *Minimizing information asymmetry*: Turning to the previous discussion about Musharakah, it seems that information asymmetry is a deterring factor in the use of this Islamic risk-sharing contract. This can be lessened considerably by using the potential signaling capacity of equity-based crowdfunding. It could also support the idea of forming an Islamic crowdfunding tool within this framework. Since, in this setup, investors can actively participate in financing the project, this structure will combine both information transparency and Islamic profitability, making it a promising option for Islamic financial investors and entrepreneurs.

2.3.2 Islamic Crowdfunding

SMEs in Muslim countries are capital constrained. The reasons are:

- They have no collateral.
- Regulations prevent direct fundraising.
- The banking system is not inclusive.
- There is a real problem of information asymmetry.

(Osmani and Abdullah, 2010)

New IT technology has shown that crowdfunding is a viable method of fundraising. However, much of it is interest-based in orientation. We therefore need a Shariah-compliant alternative that addresses the problems of potential small entrepreneurs in Muslim countries. Addressing and fulfilling this need is the main motivation of this research.

There exists mutual harmony between the spirit of Islamic finance and the idea behind crowdfunding. There are some nascent examples of Islamic crowdfunding systems in Muslim countries, with some being successful and popular in these communities.

Shekra and Yomken are examples that provide the possibility of a fruitful collaboration between the industries of Islamic finance and crowdfunding. In these two examples, a Musharakah platform is developed for crowdfunding projects.

Ideally, Islamic finance would be an alternative way of financing based on ethical and socially responsible standards which ensure the fair distribution of benefits and obligations between all parties in any financial transaction. Crowdfunding possesses these characteristics and provides grounds for new developments in the field, as it can utilize Islamic finance as an ethical and socially responsible tool to promote financing and development. This would represent “an exciting opportunity to promote innovation across various sectors of the MENA (Middle East and North Africa) economies, especially in the areas of technology, agriculture, health services, and education.” Islamic finance and crowdfunding both conceptualize customers as investors and can potentially provide investment opportunities with higher returns.

Interestingly, as most crowdfunding platforms charge a percentage commission on funds paid out to fundraisers, they are already applying a PLS formula. In addition, they both place a strong emphasis on transparency, mutual involvement and trust.

The project and products being offered on this platform must in essence be halal and permitted by the religion of Islam. Likewise, the source of funding that will be used to finance a project must be halal. To determine whether a project or product is halal, it is necessary to establish a Shariah Supervisory Board to ensure that the funding that will be offered to finance a project or product is lawful. Following that, the owner of the funds (potential funders) will be required to fill out a form declaring that the source is halal.

Generally, Hibah and Qard al Hassan contracts can be appropriate contracts for non-financial crowdfunding. Islamic donation-based crowdfunding can be operating by using the concept of Hibah. In the case of benevolent or social lending, a Qard al Hassan contract can be used. For example, some reward-based forms of crowdfunding are applicable by Qard al Hassan contracts (if the reward is not monetary and it is not fixed in the time of contract, it can be a Hibah of the entrepreneur to funder). Other reward-based crowdfunding forms are also operable by using a Joalah contract (if the reward is a type of fee or Ujra).

Our main focus in this research, however, is on financial crowdfunding. For the main categories of financial crowdfunding, such as equity-based crowdfunding, shared-profit crowdfunding and shared-revenue crowdfunding, the best applicable contract is Musharakah. The concept of Musharakah and equity-based crowdfunding are very similar to one another. Most Islamic crowdfunding systems that have been deployed are based on Musharakah. In this research, we also target the Musharakah contract for our risk-sharing crowdfunding system. Hence, all concepts, regulations and limitations of a Musharakah contract will be considered in the system. The mechanism which will be designed in Chapter 4 is also based on a Musharakah contract.

Table 3: Types of Crowdfunding and Their Islamic Contract Equivalents.

Type of crowdfunding	Islamic contract	Description
Equity-based crowdfunding	Musharakah	By issuing shares
Shared-profit crowdfunding	Musharakah	Profit-sharing
Shared-revenue crowdfunding	Musharakah	Musharakah, Sukuk or Musharakah
Donation-based crowdfunding	Hibah, Qardal Hassan	Ujra
Social lending	Qard al Hassan	
Debt-based crowdfunding	Qard al Hassan	If it is a zero-interest loan
Peer-to-peer lending	Qard al Hassan	If it is a zero-interest loan. Generally this is the hardest category of crowdfunding to make Shariah-compliant

Islamic crowdfunding could be a new and innovative financial tool in the world of Islamic finance to attract more Muslims to Shariah-compliant financial transactions through a risk-sharing platform. However, there still exists the problem of information asymmetry in crowdfunding systems. There are also some important risks which will be discussed in the following section.

2.3.3 Crowdfunding Risks

There are, however, some specific risks which are more sensitive in a crowdfunding paradigm. The main risks associated with crowdfunding are *fraud* (the money is not used for the declared aim), *loss due to project failure*, *lack of liquidity*, *exchange rate fluctuations* and *operational risk*. For the crowdfunding process to be completed successfully, the project needs to be attractive enough to gather the required funding prior to the expiration date, entrepreneurs need to abide by all of the platform's regulations to avoid being expelled, and they must repay their loans in accordance with the agreement made with lenders – on time and in full (Melina Moeskis 2016).

Crowdfunding comes with drawbacks as well. Crowdfunding may not be a valid complement to traditional financing options because crowdfunding suffers from some of the same issues as these traditional sources of funds. First, equity campaigners may face the same information asymmetry issues with potential investors that they face with banks because they inherently understand the value of their project better than outsiders.

To overcome these issues, entrepreneurs must disclose enough information to obtain funds from the crowd, but not so much that it detrimentally impacts the value of their project. A public forum like a crowdfunding website may deter fund-seekers because these forums do not lend themselves to non-disclosure agreements (while these agreements may be easier to enforce with banks), as the main reason for most of these risks is asymmetry of information. We study the problem of information asymmetry in the following part.

2.4 Asymmetric Information

Information asymmetry is a situation in which one party in a transaction has more or superior information compared to another. This often happens in transactions where the *seller* knows more than the buyer, although the reverse can happen as well. Potentially, this could be a harmful situation because one party can take advantage of the other party's lack of knowledge.¹⁰ The term “asymmetric information” describes

¹⁰ See Investopedia.

three information problems which are based on certain coordination and motivation problems: adverse selection, moral hazard, and hold-up (Martin Schiege 2008). This is also affirmed by Ricardo N. Bebczuk (2003), Praveen R. Nayyar (1990) and Holmstrom (1984) in which they state: Asymmetric information in financial markets can adopt any of the following types: *adverse selection, moral hazard, or monitoring costs*.

A lender suffers adverse selection when he is not capable of distinguishing between projects with different credit risks when allocating credit. Given two projects with equal expected value, the lender prefers the safest one while the borrower the riskiest. In this context, those undertaking risky activities find it convenient to hide the true nature of a project, thereby exploiting the lender's lack of information (Bebczuk 2003). Or, put more simply: *When two (or more) individuals are about to agree on a trade, and one of them happens to have some information that the other(s) do not have, this situation is referred to as adverse selection*. Seminal contributions include Akerlof (1970), Spence (1973), and Rothschild and Stiglitz (1976).

By *moral hazard* we mean the borrower's ability to apply the funds to different uses than those agreed upon with the lender who is hindered by his lack of information and control over the borrower. As in the case of moral hazard, *monitoring costs* are tied to a hidden action by the borrower who takes advantage of having better information to declare lower-than-actual earnings.

Adverse selection appears before the lender disburses the loan, in contrast to moral hazard and monitoring costs. In this case, the problem occurs after having conceded the capital. In adverse selection and monitoring costs, the borrowers are assumed to have previously chosen the project, while in moral hazard they can opt for a different project once in possession of the funds.

2.4.1 Solving the Information Asymmetry Problem

There are a number of articles searching for solutions to the problem of asymmetric information. Some solutions which are applicable in a crowdfunding system are as follows:

Ajay et al. (2013), argue that four broad categories of market design mechanisms exist that have been deployed in crowdfunding or other online market settings that may be effective in reducing information-related market failures in equity crowdfunding: 1) reputation signaling, 2) rules and regulations, 3) crowd due diligence, and 4) provision point mechanisms. The first three potentially reduce the information asymmetry between creators and funders (helping overcome both adverse selection and moral hazard), and the fourth may diminish the collective action problem.

Furthermore, Huixiang et al. (2015) found that asymmetric information is the main reason for problems such as moral hazard and market failure, thus introducing *government interventions, reputation system, warranties and guarantees* as useful ways to solve this problem.

Using the principal-agent theory, Ceric Anita (2012) suggests that information asymmetry causes three problems – *adverse selection*, *moral hazard* and *hold up* – and introduces *bureaucratic control (contracts)*, *information systems*, *incentives (bonuses)*, *corporate culture*, *reputation and trust* as main strategies for minimizing information asymmetry. Additionally, Katherine Ralston and Frederic S. Mishkin (1996), Bert Scholtens and Dick van Wensveen (2003), Buckle, M. and J. L. Thompson, (1998), suggest the following solutions to asymmetric information:

- *Rules and regulations*: Information regulations aim to correct the market failure associated with information asymmetry (when sellers have more information about product characteristics than buyers, or vice versa) (Katherine Ralston). Regulations like the Jumpstart Our Business Start-Ups (JOBS) rules in the US can help both sides of the market (investors and entrepreneurs) to trust more. Governments can put in place regulations to compel entrepreneurs and companies to disclose more information about their companies and projects as well as commitment to the disclosed information and plans.
- *Collateral or guarantee*: An effective way for financial markets to solve asymmetric information problems is through the use of collateral. Collateral reduces the consequences of adverse selection or moral hazard because it reduces the lender's losses in the case of a default. If a borrower defaults on a loan, the lender can take title to the collateral and sell it to make up for the losses on the loan. Thus, if the collateral is of good enough quality, the fact that there is asymmetric information between the borrower and lender is no longer as important, since the loss incurred by the lender if the loan defaults is substantially reduced (Mishkin 1996).
- *Financial intermediaries*: According to Bert Scholtens and Dick van Wensveen (2003), asymmetry can be of an *ex ante* nature, generating adverse selection, or it can be *interim*, generating moral hazard. It can also be of an *ex post* nature, resulting in auditing or costly state verification and enforcement. These information asymmetries generate market imperfections, with many of these imperfections leading to specific forms of transaction costs. Financial intermediaries appear to overcome these costs, at least partially.
- *Monitoring and enforcement*: Monitoring and enforcement of restrictive covenants (provisions in debt contracts that restrict and specify certain activities of the borrower) are necessary to reduce asymmetric information and moral hazard. By monitoring a borrower's activities to see whether he is complying with the restrictive covenants, and enforcing the covenants if he is not, lenders can prevent borrowers from taking on risk at their expense (Mishkin 1996).
- *Restrictive Covenants*: The problem of asymmetric information and moral hazard can be reduced by banks through the introduction of restrictive covenants into loan contracts. A restrictive covenant is a provision that restricts the borrower's activity. One example is a mortgage loan that contains a provision that

requires a borrower to purchase life insurance which pays off the loan in the event of the borrower dying. Restrictive covenant encourages the borrower to undertake desirable behavior – from the lender’s point of view, making it more likely for the loan to be repaid. Restrictive covenants can be (and are) written into bond contracts. Therefore the answer to the question: “Why is an intermediary better at reducing moral hazard compared to traded bonds containing restrictive covenants?” is that restrictive covenants have to be monitored and enforced if they are to do the job of reducing information asymmetry and thus moral hazard (Buckle and Thompson 1998).

2.4.2 Signaling

Signaling is the idea that one party (termed the agent) credibly conveys some information about itself to another party (the principal). In signaling models, agents can take actions to distinguish themselves from their lower-ability counterparts. The precondition for this action to be useful as a signaling device is that its marginal cost must depend on the agents’ type. (Alex Gershkov 2007)

For closing the contract *ex ante*, the project manager, as a representative of the principal, is confronted with the problem of adverse selection. He cannot be sure whether the chosen planner meets the qualities stated above to a sufficient degree. An approach to solving this problem is to overcome information asymmetry by signaling. The market party which is better informed, e.g., the contractor, signals its type to the client who is the less-informed party by means of certain signals. In the case of signaling, the initiative lies with the better-informed market participants who sends out their signals first, and is offered a contract by the less-informed party. The planner can therefore present his qualities and prove them by means of certificates or references. The advantages of signaling must be higher for desired agents than its costs. At the same time, the advantages of signaling must be lower for undesired agents compared to the cost (Schieg 2008).

2.4.3 Screening

Another way to reduce information asymmetry while allowing the client access to information is through screening. Screening is the term used for all activities whereby the principal tries to gain more accurate information on the quality attributes of the agent that are relevant to him (Schieg 2008). Screening is an uninformed party’s effort to glean information from the more informed party. One of the main characteristics of a successful screening is that it is essentially unprofitable for bad “types” to mimic the behavior of good types.

2.4.4 Reputation

Reputation networks constitute an ancient solution to trust building. The historical appeal of these networks is their power to induce cooperation without the need for costly enforcement institutions. Before the establishment of formal law and centralized systems of contract enforcement backed by the sovereign power of a state, most ancient and medieval communities relied on reputation as the primary enabler of economic and social activity (Benson 1989; Greif 1993; Milgrom, North and Weingast 1990). Many aspects of social and economic life still do so today (Klein 1997).

These mechanisms are emerging as one of the most promising solutions to the problem of building trust on the internet. *Online reputation mechanisms*, also known as *reputation systems* (Resnick et al. 2000; Dellarocas 2003a), utilize the internet's bi-directional communication capabilities in order to artificially engineer large-scale word-of-mouth networks where individuals share opinions and experiences on a wide range of topics; including companies, products, services and even world events.

For example, eBay's feedback mechanism is the primary means through which the ecommerce platform elicits honest behavior and facilitates transactions among strangers on the internet (Resnick and Zeckhauser 2002). Several other communities also rely on reputation mechanisms to promote trust and cooperation. Examples include booking.com (online hotel booking), agoda.com (online hotel booking) and tripadvisor.com (travel reviews).

Table 4: Noteworthy examples of reputation mechanisms the current context.

Website	Business category	Feedback mechanism	Format of solicited feedback	Format of published feedback
eBay	Online shop	Buyers and sellers rate one another following transactions (Dellarocas 2015)	Positive, negative or neutral rating plus a short comment; service provider may post a response	Sums of positive, negative and neutral ratings received during past 6 months
Booking.com	Online hotel booking	Guests rate hotels	A review score between 0–10 in 7 categories: Cleanliness, comfort, location, facilities, staff, value of money and Wi-Fi, including comments	An average of review scores are calculated
Agoda.com	Online hotel booking	Guests rate hotels	A review score between 0–10 in 7 categories plus comments of guests	

Table 4 (continued)

Website	Business category	Feedback mechanism	Format of solicited feedback	Format of published feedback
Google.com	Search engine	Search results are ordered based on how many sites contain links that point to them (Brin and Page 1998)	A web page is rated based on how many links point to it, how many links point to the pointing page, etc.	No explicit feedback scores are published; ordering acts as an implicit indicator of reputation
Slashdot	Online discussion board	Postings are prioritized or filtered according to the ratings they receive from readers (Dellarocas 2015)	Readers rate ad post comments	
TripAdvisor	Travel reviews	Tourists post reviews on hotels, flights, restaurants, etc. They also recommend “things to do”	Tourists comment on all locations of a city and also rate it between 0–100	All comments and a rating average is available to users

A minimum degree of participation in reputation communities is required before reputation effects can induce any cooperation. Once this threshold is reached, however, the power of reputation immediately springs to life and high levels of cooperation emerge in a discontinuous fashion (Bakos and Dellarocas 2002). Therefore, the vastly increased scale of internet-based reputation mechanisms is likely to render them powerful institutions in environments where traditional word-of-mouth networks were hitherto considered ineffective devices.

According to Dellarocas (2015), information technology enables systematic design. In offline settings, word-of-mouth emerges naturally and evolves in ways that are difficult to control or model. The internet allows this powerful social force to be precisely measured and controlled through proper engineering of the information systems that mediate online reputation communities. Such automated *feedback mediators* specify who can participate, what type of information is solicited from participants, how it is aggregated and what type of information is made available to them about other community members. Through the proper design of these mediators, mechanism designers can exercise precise control over a number of parameters that are very difficult or impossible to influence in brick-and-mortar settings.

The primary objective of reputation mechanisms is to enable efficient transactions in communities where cooperation is compromised by post-contractual opportunism (moral hazard) or information asymmetry (adverse selection).

Reputation mechanisms can deter moral hazard by acting as *sanctioning devices*. If the community follows a norm that punishes traders with histories of bad behavior (by refusing to buy from them, or by reducing the price they are willing to pay for their products), and if the present value of punishment exceeds the gains from cheating, then the threat of public revelation of a trader's cheating behavior in the current round provides rational traders with sufficient incentives to cooperate.

Moreover, reputation mechanisms alleviate adverse selection issues by acting as *signaling devices*. For example, by soliciting and publishing experiences of consumers who have stayed in advertised hotels, they help the community learn the true quality of each hotel. This, in turn, allows a better matching of buyers and sellers and a more efficient market.

In addition to signaling quality, firms may attempt to provide potential buyers with greater information in order to reduce the information asymmetry between buyers and sellers. Recall that buyers attempt to ascertain various attributes of goods and services prior to making their purchase decisions. Services and goods may be described by a mix of three qualities that consumers use to evaluate them: *search qualities*, which are attributes that a consumer can determine prior to purchase; *experience qualities*, which are attributes determined only after purchase or during consumption; and *credence qualities*, which are intangible qualities that a consumer may be unable to evaluate even after purchase and consumption (Darby and Kami 1973). The mix of search, experience, and credence qualities of goods and services in question moderates the lack of information in buyer behavior. The availability of information before purchase is considerably more important in the case of services which are high on experience qualities, such as medical services and consulting services, since they are more difficult for potential buyers to evaluate. Note that the value of prior information to buyers in assessing the quality of services is directly proportionate to the severity of the consequences suffered by consuming services of less-than-anticipated quality. Buyers seek information about quality and other characteristics of goods and services either by searching prior to purchasing them or from experience by their purchase, whereby the user's search is limited by the cost incurred in obtaining information by experience. Experience is used to judge quality when the search becomes too expensive. Prior to sampling different brands of a product, consumers may obtain information about various brands from several sources, such as advertisements and word-of-mouth. Advertisements provide direct information about the search qualities of a brand. However, in the case of experience qualities, the most important information conveyed by advertising is simply that the brand advertises (Nelson 1974). For experience qualities, word-of-mouth information may reasonably be considered as constituting better information than advertising, since in a sense, it provides an avenue for evaluation of the

goods or service through a vicarious experience. As buyers rely more on word-of-mouth, they will respond less to advertising (Nelson 1974). Each sampling, by search or experience, contributes to the information bank which buyers maintain on the various brands sampled (Dellarocas 2015).

The growing importance of peer-to-peer (P2P) networks (Oram 2001) introduces new challenges for reputation mechanism design. In P2P networks, every entity can act both as provider and consumer of resources. Entities are assumed to be self-interested and thus cannot be trusted to engage in cooperative behavior unless concrete incentives are in place. For example, in hotel booking websites, self-interested entities have short-term incentives to free-ride (consume as much as they can without contributing any content themselves) or to contribute low-quality content. Furthermore, there is usually no central, universally trusted entity that can act as a repository of reputational information.

To cope with these challenges, several researchers have proposed decentralized reputation mechanisms. Two lines of investigation stand out as particularly promising, the first being: *reputation formation based on an analysis of “implicit feedback.”* Traditional reputation mechanisms rely on explicit solicitation of feedback from transaction participants. If reliable explicit feedback is not available, information about an agent’s type can often be inferred by analyzing publicly available attributes of the network in which the agent is embedded. Perhaps the most successful application of this approach to date is exemplified by the Google search engine. Google’s PageRank algorithm assigns a measure of reputation to each web page that matches the keywords of a search request. It then uses that measure to order the search hits. Google’s page reputation measure is based on the number of links that point to a page, the number of links that point to the pointing page, and so on (Brin and Page 1998). The underlying assumption is that if enough people consider a page to be important enough in order to place links to that page from their pages, and if the pointing pages are “reputable” themselves, then the information contained on the target page is likely to be valuable. Google’s success in returning relevant results is testimony to the promise of that approach. Pujol, Sangüesa and Delgado (2002) apply network flow techniques in order to propose a generalization of the above algorithm that “extracts” the reputation of nodes in a general class of social networks. Sabater and Sierra (2002) describe how direct experience, and explicit and implicit feedback can be combined into a single reputation mechanism.

2.5 The Role of Reputation in Crowdfunding

In traditional trading atmospheres, such as bazaars, we can clearly see the function of reputation between people. Borrowing and lending, paying a loan or financing a new project is intrinsic to the trust and reputation of the project owners. This still

stands in the modern-day context, where reputation is one of the most important elements in decision-making between businessmen.

In a crowdfunding system, this age-old tradition is adapted to a new technological social network. Most participants in a social media platform are unlikely to meet offline. They most likely do not know each other – which raises the issue of *how trust is managed between the users of this system*. How can users of crowdfunding systems know the reputation of other users? How can reputation be simulated in this new paradigm of business interaction?

It seems that we need a mechanism to reinvent the concepts of reputation and “Fame” in this new system of funding. The history of people, the history of their business transactions and their interactions in previous deals all affect the reputation of people in a real bazaar situation. Therefore we should also try to simulate these factors with regards to social network reputation and design a reputation mechanism specifically for crowdfunding.

In the literature review, there is substantial research about the importance of reputation to eliminate moral hazard and reduce asymmetric information. Agrawal Ajay and others (2013), in this context, emphasize the important role of reputation as a mechanism for establishing trust to address the risk of fraud in online transactions, stating: “While there are various mechanisms to deal with fraud, reputation is one of the best candidates – and arguably one of the more effective ones.” Generally they argue that reputation can be a powerful antidote to information asymmetry and moral hazard problems. Users on both sides of the market can take multiple approaches to develop their reputation, such as quality signals, feedback systems, and trustworthy intermediaries. However, although these mechanisms have been quite effective in other online markets, they may need to be adapted to the particular characteristics of equity crowdfunding.

An important question arises here: Can a crowdfunding system which is equipped with a structure of reputation work better for its users? How can this reputation help to increase inclusion? This question is one of the most important questions which this research will try to address by using game theory and mechanism design in Chapters 3 and 4.

2.6 Quranic Guidance on Developing a Community

Verse 96 of Chapter 7 in the Qur’an explains what amounts to necessary and sufficient conditions for the actualization of development in a community. To do so, it explains how each messenger called upon their people to comply with the creator’s prescribed rules and desist from economic, social, and political exploitation, oppression and transgression. The rules included treating other humans with fairness, justice, and dignity commensurate with their human state; not oppressing the weak; being faithful to their promises and contracts; avoiding opulence and other

behavior contrary to human dignity and purpose and not discriminating against other humans for whatever reason.

If the people of these communities had (dynamically and actively) believed and had taqwa (were fully conscious and aware of Allāh) We would have opened for them barakah (blessings) from the heavens and the earth. (96:7)

This verse contains the essence of the Qur'an's concept of development and growth as well as the necessary and sufficient conditions for achievement of all dimensions of development in communities. The Qur'an asserts that provided that society is believing (Iman) and fully conscious (Taqwa) of the Creator, the process of development will take place through the mechanism of blessings (Barakah) (Mirakhor and Idris, 2009).

The words "Iman", "Taqwa" and "Barakah" can be explained as:

- *Īmān*, translated as "belief" in its natural linguistic-cultural setting conveys notions that do not accurately reflect the meaning of Iman in the Quranic sense. For one, the word "belief" conveys a sense of being static, rigid, passive, dogmatic, self-righteous and unapproachable. In its Quranic setting, Iman is a dynamic process – a process of leapfrogging from one level of belief to another. Each plateau represents an experiential inner set of expectations, intending, and feedback loops in response to external stimuli generated from the processes of submersion into the crucible of testing, trials and tribulations. Each plateau signals higher consciousness and awareness of the *self* and her Creator. Upward movement from one plateau to the next is facilitated by the correct response to external stimuli through compliance with the rules – which gradually strengthens the Iman through the qualitative evolution of expectations and intending. This last term, "intending" – the verbal noun of intention – is selected to represent the concept of *niyyah*, which is a dynamic concept representing the directed will of the self. It expresses the changing quality of Iman, its strength and the lessons the self has learned from her experience in the crucible of testing. Every "intending" of the will has consequences. In a famous saying, the Prophet Muhammad (PBUH) asserts that: "Actions (and their consequences) depend on the intention (that generates them)."¹¹ Intention expresses the degree of the development of the self, an experiential and existential manifestation of her progress toward full realization of her Creator. (Mirakhor and Idris 2009)
- The word *Taqwa* has been translated as consciousness of Allah and explained as an intense awareness of the presence of the creator with the help of the metaphor of an inner torch. The word consciousness signifies a subjective degree of cognizance by the self of herself and of her dependence on the Lord Creator.

It is a stock of accumulated cognizance resulting from the feedback sourced in the response of the self to external stimuli (tests) and her interaction with other humans and with her Creator. The more the self processes experientially that her being is contingent and dependent on her Creator, the more consciously aware her intending becomes. Although consciousness is a stock concept, awareness is a flow concept in the sense that consciousness directs the will to become *aware* of the consequences of a particular action-decision. The stronger the consciousness (the larger its accumulated stock) of Allah, the more focused the directed will and awareness of the intending behind an action targeted to drawing near to Allah (Mirakhor and Idris 2009).

- The concept of *Barakah* refers to a mechanism instituted by Allah to provide multiple payoffs to any act of righteousness, i.e., those that are fully compliant with the prescribed rules. A reading of the Quranic verses related to this concept suggests that this is an automatic process. For example, the Qur’an says: “Whosoever comes with a beautiful deed, for him there is ten like it.” (6:160) This is an unconditional assertion that seems to suggest that the manifold return will accrue automatically. (Mirakhor and Idris 2009)

It is then not surprising that, as the verse suggests, if the members of society act out of *belief* and are *fully conscious* that their actions are to please their Creator and do so to draw near to Him, all their actions will be “beautiful” because they are undertaking these actions fully aware of His ever-presence. Therefore, all their actions, in production, exchange, distribution and redistribution, will have manifold return. The verse seems to suggest an accelerated rate of progress and economic growth for such societies. Resources are made available by the Supreme Creator for the use and benefit of all of mankind regardless of whether they are Muslim or not or whether they follow the rules prescribed by the Creator. The verse, however, seems to imply that the returns from actions involved in the use of these resources will have an increasing rate if these actions are in full compliance with the prescribed rules.

Since the availability and the efficiency in the use of these resources will determine the level of economic development and the rate of economic growth, the verse can be understood to say that the closer one complies with the rules in their actions – in production, exchange, distribution and redistribution – the higher will be the total factor productivity (TFP), therefore, the higher the rate of growth and the level of economic development. The development of the self and her material development are also included in the verse through the dynamics of belief and conscious awareness. An implication of *Taqwa* in this verse is that of the awareness of people to care about their reputation and “Fame” in community. In other words, *Taqwa* will create a credible reputation (“Fame”) for those who comply with the behavioral rules prescribed by the Qur’an.

2.7 Literature Review of Similar Research

Moeskis et al. (2016), in their research “Crowdfunding Success: The Case of Kiva.com” focus on the Kiva platform as one of the most successful crowdfunding platforms in the world. Their objective is to examine more closely the new and important phenomenon of crowdfunding as an alternative method for raising finance and the factors responsible for its success. They describe the participants (borrower, lender and partner) and the processes of loan statutes and funding and repayment. Their data includes approximately 850,000 loans and 1.6 million lenders. They use descriptive statistics to understand the Kiva world in its entirety and use univariate analysis to examine across main variables, looking at the distribution, the central tendency (e.g., the mean), and the dispersion (e.g., the standard deviation and range). Moreover, they use cross tabulation to capture the likelihood of interaction between two events – for example, the professional occupation of lenders and how active they are on the Kiva platform. The results show that the attractiveness of a project is a topic of interest to entrepreneurs, marketers, crowdfunding platforms and their partners, while the successful repayment of the loan is of greater interest to the lenders, crowdfunding platforms and their partners.

From the authors’ point of view there are multiple reasons for funding in crowdfunding projects in addition to the speed of funding. However, the results have been mixed and sometimes contradictory, which should encourage more researchers to tackle the topic of crowdfunding and further explore these issues.

Otero Paula (2015), in his research “Crowdfunding. A new option for funding health projects”, studies the mechanism of crowdfunding in the health sector. The author concludes that crowdfunding is becoming a new source of micro-funding for personal and institutional ventures that have previously lacked access to traditional financing. One of the main characteristics of crowdfunding is that it uses collective funding to help any person or institution carry out their project – whether related to business, culture, society or health, when it is not possible to secure tendency it through traditional means. An additional value of crowdfunding is that it promotes collaboration among people who have common interests and allows them to broadly disseminate a project that would otherwise go unnoticed.

Devashis Mitra (2012), in her research, examines crowdfunding and its role in funding start-ups and new enterprises as a new trend in alternative financing. In her paper, the market for crowdfunding is examined in the context of different crowdfunding models. The study also includes illustrations of enterprises that have adopted specific models based on their strategic objectives. In her findings, she concludes that crowdfunding as a means of alternative financing is growing globally, and that donation-based and reward-based entities still remain the largest group. However, equity-based platforms have also proved to be successful models in fundraising in some European countries as well as Australia. Presently, equity crowdfunding is not legal in Canada, while in the US legalization is being sought under the JOBS Act.

Kalashnikova Viktoriia (2016) introduces crowdfunding as a new type of social interaction used by individuals to solicit funds from other individuals to realize projects. In her research, Viktoriia analyzes companies such as Kickstarter, biggggi-dea and FundedByMe. She begins with an analysis of crowdfunding as an element of information, and subsequently investigates the content and techniques of crowdfunding platforms. Next she studies its socio-symbolic interaction in order to find similarities with the crowdfunding process. Finally, the paper discusses social exchange theory and its connection with rewards in crowdfunding platforms.

The research found that while both theories of social interactionism and exchange are relatively well established, crowdfunding contains some patterns from these theories. This is due to the fact that any platform has its own *theatre*, created by entrepreneurs, makers, artists and fans; every individual act has a *social context* and the network is based on social *exchange*, where the entrepreneur receives funds and the donator receives a reward. The three platforms analyzed are based on peer-to-peer lending, where the units of social act can communicate without face-to-face contact. This concurs with the findings of information society theorists who argue that the driving force for the development of society should be the production of information, rather than material production. Consequently, it is fair to assume that crowdfunding is a new type of social exchange.

Wahjonosentot, Marianaanna and Widayathn (2015) investigate how far Islamic crowdfunding can be used as a medium to fund Islamic projects and products for the purpose of an Islamic community. They introduce the notion of an Islamic crowdfunding platform after investigating other crowdfunding platforms in Asian countries such as China, Japan, Singapore, Philippines, Thailand, Malaysia and Indonesia. They arrived at the conclusion that the role of Shariah boards is very important and necessary to filter projects and products, while the recommended forms of Islamic crowdfunding include Musharakah and Qard. Under Musharakah, the purpose of crowdfunding is for investments, donations and equity, while Qard is used to support the financing of projects. These include a provision for the refund of the loan at an agreed time with a number of benefits that can be enjoyed by the potential funders who provide the lending.

Ajay, Christian and Avi (2013), in their research entitled “Some Simple Economics of Crowdfunding,” highlight the extent to which economic theory, in particular transaction costs, reputation, and market design, can explain the rise of non-equity crowdfunding and offer a framework for speculating about how equity-based crowdfunding may unfold. They describe three primary actors (creators, funder and platforms) incentives and disincentives in crowdfunding and then investigate market failure factors and market design factors. “Reputation signaling”, “rule and regulations”, “crowd due diligence” and “provision point mechanism”, are all considered market design factors in their paper.

Chung and Lee (2015), in their research, “A Long-Term Study of a Crowdfunding Platform: Predicting Project Success and Fundraising Amount,” analyze the projects

and users on crowdfunding platforms to understand whether incorporating social media information would improve project success prediction and pledged money prediction rates. They undertook this research in four phases:

1. collect the largest datasets from Kickstarter, consisting of all project profiles, corresponding user profiles, projects' temporal data and users' social media information
2. analyze characteristics of successful projects, behaviors of users and understand dynamics of the crowdfunding platform
3. propose novel statistical approaches to predict whether a project will be successful and a range of expected pledged money for the project
4. develop predictive models and evaluate performance of the models

Their experimental results showed that the predictive models can effectively predict project success and a range of expected pledged money.

Mónika and Madarász (2014), in their research entitled "Crowdfunding," focus on the principles of crowdfunding such as equity-, credit-, reward- and donation-based models. They concluded that, besides the benefits of crowdfunding, better performance in the implementation of crowdfunding requires an investigation of the risks involved.

Surunceanu Gabriela (2015), in her master's thesis, "The Effect of Social Capital on the Success of Crowdfunding Projects," used data gathered from the crowdfunding platform kickstarter.com and focused on a reward-based crowdfunding model. In her research, the author evaluates models using specific variables such as reputation, external and internal capital, and social media intensity.

To determine the importance of social capital in a reward-based crowdfunding environment, she posed the question: "To what extent does social capital impact the success of a crowdfunding project?" The conceptual model was tested with the statistical software SPSS. The empirical results suggest that external social capital does not influence the success of a project – a finding which contradicts published works.

In addition, the findings highlight that the role of internal social capital ends once the project reaches its goal. However, the entrepreneur's reputation continues to exert its power even after the funding goal has been successfully achieved or oversubscribed.

The research also found that although the role of social media intensity is significant in fundraising, and the role of social capital is significant in non-US crowdfunding initiatives, there are other factors such as the entrepreneur's reputation that are perhaps more crucial to achieving the desired goal.

Mollick Ethan (2014), in an empirical study, argues that the success or failure of projects in a crowdfunding system are affected by various factors such as project goal, funding level, pledge/backer, backers, category, updates, comments and duration. The goal of the paper was to develop initial evidence about the nature of crowdfunding and its role in entrepreneurship research. He suggests that personal

networks and underlying project quality are associated with the success of crowd-funding efforts, and that geography is related to both the type of projects proposed and successful fundraising. The author finds that the vast majority of founders seem to fulfill their obligations to funders, but that over 75% deliver products later than expected, and that the length of the delay can be predicted by the level and amount of funding a project receives. These results offer insight into the emerging phenomenon of crowdfunding, and also shed light more generally on the ways that the actions of founders may affect their ability to receive entrepreneurial financing.

Kuppuswamy and Bayus (2013) examine how backer support on Kickstarter varies depending on project success and timing. Agrawal et al. (2010) used a market of musicians seeking crowdfunding to understand whether crowdfunding relaxes geographic constraints on fundraising that are typical of venture capital firms.

Finally, Burtch et al. (2011) examined how timing and exposure affected 100 pitches for new journalism stories. All these working papers offer valuable contributions, but no work to date has provided a large-scale understanding of the empirical dynamics of crowdfunding across a wide variety of projects, and most have mainly focused on backers and not the project founders themselves.

Specifically, since crowdfunding is a novel and potentially disruptive concept to traditional approaches to funding, it is a research area that should be of interest to entrepreneurship scholars. First, it is important to understand whether crowdfunding successes and failures are driven by the same underlying dynamic as other forms of entrepreneurial investment – i.e., are crowds more likely to fund projects that signal potential quality, or is some less rational selection system at work? Second, since a salient feature of crowdfunding compared to other funding methods is the removal of geographic limitations (Agrawal et al. 2010; Stuart and Sorenson 2003), it is important to understand what role, if any, geography continues to play in new ventures in a crowdfunding regime.

As a brief study, the different aspects of crowdfunding are reviewed in the following.

Being a relatively new phenomenon, the written works on crowdfunding are still limited and mainly of an empirical and case-based nature. Agrawal et al. (2014) talks about crowdfunding's economic foundations and prepares a broad presentation that shows the main issues by emphasizing entrepreneurial moral hazard with clear, explicit quotes from the popular press and clearly states that crowdfunding can decrease demand uncertainty. However, they do not discuss the features of crowdfunding schemes that are particularly useful in this regard. Theoretical studies by Belleflamme et al. (2014) are some of the few that deal precisely with crowdfunding. They address the question of whether a crowdfunding entrepreneur should prefer to raise funds via reward-based crowdfunding or equity-based crowdfunding.

Instead, the profit accrued through crowdfunding depends on their assumption that consumers will acquire an additional utility from participating in the crowdfunding plan. The economic literature on demand indefiniteness has mostly focused on

its result on equilibrium prices rather than on its effect on investment intentions (e.g., Klemperer and Meyer 1989; Deneckere and Peck 1995; Dana 1999).

In a study of the dynamics of innovation, an exception is Jovanovic and Rob (1987), who state that firms can obtain data about the consumers' evolving taste and introduce innovative products to them. Even though these randomly evolving changes express request indefiniteness, the paper is only tentatively related to the present study, as it does not consider direct inspiration mechanisms that act on consumers' preferences.

In contrast, the marketing literature clearly addresses a firm's ability to reduce demand uncertainty through market research tools like consumer surveys (e.g., Lauga and Ofek 2009). Meanwhile, Ding (2007) points out that marketing research relies on voluntary, non-incentivized consumer surveys. He emphasizes that consumers need to be given a clear motivation for revealing information truthfully.

Current crowdfunding schemes process such motivation naturally. In Ordanini et al.'s marketing-based qualitative case study on crowdfunding, they argue that crowdfunding obscures the boundaries between marketing and finance and view the consumers' investment support as a fundamental distinguishing characteristic of crowdfunding that sets it apart from other marketing theories. They do not focus on reward-based crowdfunding and instead study two equity-based crowdfunding schemes and a pure donation-based one.

Experimental studies of crowdfunding try to identify the "deceit" features of crowdfunding projects by focusing on the geographic origin of consumers relative to the entrepreneur in studies such as Agrawal et al. (2011) and Mollick (2014). Kuppuswamy and Bayus (2013) also show that social information plays a main role in the success of a project (i.e., other crowdfunders' funding decisions). Hildebrand et al. (2013), whose research focuses on equity-based crowdfunding, identify an increased problem of moral hazard.

- Moreover, one of the best evaluations of the concept of mechanism design for crowdfunding that is similar to our research was done by Roland Strausz (2015), and is titled "A Theory of Crowdfunding – a mechanism design approach with demand uncertainty and moral hazard." The research studies the moral hazard impacts on crowdfunding by using mechanism design, with the findings as per below: Efficiency is sustainable only if expected returns exceed investment costs by a margin reflecting the degree of moral hazard.
- A constraint in efficient mechanisms exhibit underinvestment
- Crowdfunding destroys the classical separation between finance and marketing, but complements traditional entrepreneurial financing.

Therefore, we could clearly see the impact of the crowd in a crowdfunding system not only in terms of fundraising, but also in an increase of sales through effective marketing and branding and a decrease in the risk of moral hazard.

2.8 Conclusion

In this chapter, the research literature was thoroughly reviewed and crowdfunding in its various forms were studied and elaborated on as a novel financing framework. Islamic crowdfunding and the risk-sharing equity model of crowdfunding, which can be completely Shariah-compliant, were also studied. The current situation of crowdfunding in different countries and its growth in popularity across the world were also explained. Finally, some related articles that have used mechanism design theory for structuring crowdfunding were reviewed.

3 Methodology

3.1 Abstract

In this chapter, the research methodology is explained in detail. First, we introduce game theory and mechanism design as the main areas of research. Then the methodology of mechanism design, specification of the mechanism and the model of this research are discussed. Finally, we report some relevant examples of social issues which can be solved by mechanism design.

3.2 Model of Research

The main purpose of the present study is to examine a crowdfunding system in a web infrastructure in order to find an arrangement closest to Pareto-optimal for the players in this system. Crowdfunding systems provide an opportunity for project owners and entrepreneurs to present their projects and ideas to funders to find the funds necessary to execute those projects. Funders are also individuals with various preferences searching for projects to fund (typically with a small amount of investment). The theory of mechanism design pertains to situations where a policymaker or social planner attempts to aggregate various preferences of players to reach a sound collective decision, especially when the real preferences of players are not readily clear and well-known. Considering this, one of the most effective ways to design an optimal system for a crowdfunding system is mechanism design.

The theory of mechanism design applies the structure of *non-cooperative games with incomplete information*. It is concerned with finding information from private sources. In fact, mechanism design can be considered as reverse engineering of games or “the art to design the rules of a game in order to reach to a specific result.” In the present study, mechanism design is employed in order to specify a Pareto-optimal state in a crowdfunding system. The system is designed within two different scenarios, the first being a common situation (“without Fame”) and the second being within a “with Fame” crowdfunding system. What follows will provide further detail on the methodology of Chapter 4, which includes mechanism design and game theory.

3.3 Game Theory

Game theory is defined as “the study of mathematical models of conflict and cooperation between intelligent rational decision-makers” (Myerson 2002). The term is usually employed in economic and political sciences, psychology, logic and biology. In the beginning of its development, it addressed zero-sum games, in which one person’s

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gains result in other participants' losses. Today, however, game theory is used in a wide range of behavioral relations, and is now an inclusive term for the science of logical decision-making in humans, animals and computers.

Modern game theory was first developed based on the idea of the existence of mixed-strategy equilibria in two-person zero-sum games and its validation by Von Neumann, who employed Brouwer's fixed-point theorem on continuous mappings to compact convex sets which formed a standard method in game theory and mathematical economics. His study was followed by the 1944 book, co-authored by Oskar Morgenstern, which discussed cooperative games of several players. The second edition of this book provided an axiomatic theory of expected utility, which allowed mathematical statisticians and economists to examine decision-making under uncertainty.

This theory was extensively developed by many scholars in the 1950's. Game theory has been widely recognized as an effective instrument in a great number of fields of study, beginning with the Nobel Memorial Prize in Economic Sciences given to game theorist Jean Tirole in 2014. Eleven game theorists have so far won the Nobel Prize in economics.

3.3.1 Main Structure of a Game

A game encompasses the following components:

- a collection of decision-makers, called players
- the possible information states of each player each time a decision is made
- the collection of possible moves (decisions, actions, plays,...) that each player can choose in each of his possible information states
- a procedure to determine how the move choices of all the players collectively determine the possible results of the game
- preferences of individual players over these possible outcomes, typically measured by a utility or payoff function (Leigh Tesfatsion 2012)

3.3.2 Key Assumptions of a Game

Perfect rationality: It can be assumed that the people who take part in the system will behave with perfect rationality, which means they try to act in a way that enhances their ability, and are able to have complicated deductions in the game. They behave in ways that serve their best self-interest. They will be able to think clearly about all the outcomes thereby choosing the action which will lead to the best outcome. Economic rationality is different from super-rationality. It tends to predict that rational players will normally choose a dominant strategy.

Intelligence: This concept means that all players in the game are imagined to be intelligent and know all the details related to the game known by the designer. The

players can do calculations that the designer can use. All players are able to review the actions of other players to choose the most effective strategy to win that game. It is also believed that all the information required to choose a strategy is available to all players.

Common knowledge: Common knowledge is a kind of knowledge for agents. There is common knowledge of p in a group of agents G when all the agents in G know p , they all know that they know p , they all know that they all know that they know p , and so on ad infinitum.

Utility: In all types of games, utility refers to the players' motivations. A utility function assigns a number for every outcome with the property that a higher number indicates that the outcome is preferred more. Utility functions may be either ordinal in which the relative rankings are important, but not the quantity, or cardinal, in which quality is the basis of valuation and which are important for games in which mixed strategies are involved.

3.3.3 Game Types

Cooperative/Non-Cooperative

A game can be considered cooperative if the players can form binding commitments. For example, the legal system enforces commitments and requires the players to stick to their promises. In a non-cooperative game, however, this is not the case. Typically, it is believed that communication among players is possible in cooperative games, but not in non-cooperative games. Still, this classification has been criticized, and in some cases rejected.

In addition, non-cooperative games are more comprehensive and model situations to the smallest details, thus producing better results. Cooperative games, on the other hand, focus on the game as a whole. Much effort has been given to connecting these two approaches. The Nash program (a research program for investigating effective bargaining solutions as well as the equilibrium outcomes of strategic bargaining procedures) has proposed many of the cooperative solutions as non-cooperative equilibria. In addition, hybrid games include both cooperative and non-cooperative elements. For example, coalitions of players are created in a cooperative game, but they play in a non-cooperative method.

3.3.4 Normal Game

The normal (also known as strategic) game is typically represented by a network which illustrates the players, payoffs and strategies. More broadly, it can be represented by any function associating a payoff for each player with every combination of possible actions.

In the following example, there are two players: one selects the row and the other selects the column. Each player has two strategies, which are specified by the number of rows and columns. The payoffs are given in the interior. The first number is the payoff received by the row player (Player 1 in the example); the second is the payoff for the column player (Player 2 in the example). Imagine that Player 1 plays *Up* and that Player 2 plays *Left*. Then Player 1 gets a payoff of 4, and Player 2 gets 3.

When a game is made in normal form, it is assumed that each player acts at the same time or without knowing the actions of the other player. If the players have information regarding other players' choices, the game is often presented in extensive form. Games in extensive form have an equivalent normal-form game, but the transformation to normal form can sometimes result in an exponential increase in the size of the representation, which can cause it to become computationally impractical.

	Player 2 chooses <i>Left</i>	Player 2 chooses <i>Right</i>
Player 1 chooses <i>Up</i>	4, 3	-1, -1
Player 1 chooses <i>Down</i>	0, 0	3, 4

Figure 12: Payoff Matrix.

Note: Normal form or payoff matrix of a 2-player, 2-strategy game.

Source: own illustration.

Symmetric/Asymmetric Game

A symmetric game can be defined as a game in which the payoffs for playing a certain strategy depend solely on the other strategies used, not on the person playing them. Indeed, if the identities of the players change without changing the payoff to the strategies, then a game can be considered as symmetric. Many of the typically investigated 2x2 games can be classified as symmetric. Some researchers classify particular asymmetric games as cases of such games as well. However, the most widely known payoffs for such games are symmetric.

The most widely investigated asymmetric games are games in which there are not similar strategy sets for both players. For example, the ultimatum game and, similarly, the dictator game have different strategies for each player. However, it is possible for a game to have identical strategies for both players but be asymmetric. For instance, the game pictured as below is asymmetric in spite of having identical strategy sets for both players.

	E	F
E	1, 2	0, 0
F	0, 0	1, 2

Figure 13: Asymmetric Game.
Source: own illustration.

Zero-Sum/Non-Zero-Sum Games

Zero-sum games can be considered a particular case of constant-sum games where choices by players can neither increase nor decrease the resources available. In zero-sum games, the total benefit to all players in the game invariably adds up to zero, i.e., a player benefits only at the expense of others. However, in non-zero-sum games, a gain by one player may not mean a loss by another.

Constant-sum games include such activities as gambling and theft, but not the basic economic situation in which there are gains from trade. It is possible to transform any game into a zero-sum game by adding a dummy player (which is commonly called “the board”) whose losses can compensate the players’ net winnings. The game which will be designed in Chapter 4 of this research is a “symmetric non-zero-sum” game.

Simultaneous/Sequential

Simultaneous games can be defined as games in which both players move at the same time, or if they do not move together, the later players are unaware of the earlier players’ actions. Sequential games (called also dynamic games) can be considered as games in which later players have some information about earlier actions. Yet, this is not always perfect information about all the actions of earlier players and it might be very limited knowledge.

For example, a player might know that an earlier player did not perform a specific action, while he does not know which of the other actions that were available to the first player have been performed. Typically, normal form is applied to represent simultaneous games, while extensive form is applied to represent sequential games. The transformation of extensive to normal form transforms extensive form games so that they correspond to the same normal form. As a result, concepts of equilibrium¹² for simultaneous games are inadequate for discussing sequential games.

¹² *Equilibrium* is a solution concept for a non-cooperative *game* involving two or more players in which it is assumed that each player knows the *equilibrium* strategies of the other players, and no player has anything to gain by changing only his or her own strategy.

Perfect Information and Imperfect Information

A notable subset of sequential games includes games of perfect information. A game has perfect information if, in its extensive form, all players know the actions previously taken by the other players. Simultaneous games cannot be classified as games with perfect information, as the conversion to extensive form converts simultaneous actions into a sequence of moves with earlier moves being unknown. Most games investigated in game theory can be classified as imperfect-information games.

Perfect information is sometimes confused with complete information. Complete information requires that every player knows the strategies and payoffs which are available to the other players but not necessarily the actions taken. However, games of incomplete information can be reduced to games of imperfect information by introducing “moves by nature.”¹³

3.4 Mechanism Design

Mechanism design can be seen as a field in economics and game theory which assumes an engineering approach to designing economic mechanisms or incentives, toward desired objectives in strategic settings in which players act rationally. Since mechanism design starts at the end of the game, then goes backwards, it is sometimes known as *reverse game theory*. It has a wide range of applications, from economics and politics (voting procedures, markets, auctions) to networked systems (sponsored search auctions internet, inter-domain routing).

Mechanism design studies solution concepts for a class of private-information games. Leonid Hurwicz (2007) states that in a design problem, the goal function is the main “given”, while the mechanism is the unknown. Hence, the design problem is the “inverse” of traditional economic theory, which is normally dedicated to analyzing the performance of a given mechanism. Therefore, two differing attributes of these games include:

- that a game “designer” selects the game structure,
- that the designer is interested in the game’s outcome.

In a class of Bayesian games, one player, who is called the “principal,” is interested in orient his behavior around on the information known to the other players privately. For instance, the principal would like to understand the real quality of a used car which a salesman is offering. He cannot understand anything by simply asking the salesman, since it is in the salesman’s interest to distort the true quality of the car. Fortunately, in mechanism design the principal does have one

¹³ In game theory a *move by nature* is a *decision* or *move* in an extensive form game made by a player who has no strategic interests in the outcome.

advantage: he may design a game in which the rules can influence others to behave in his interest.

If there were no mechanism design theory, the principal's problem would be hard to solve. He would need to consider all the possible games and choose the one that optimally influences other players' strategies. Furthermore, the principal would need to make decisions based on the information provided by agents who can potentially lie to him. In light of mechanism design, and specifically the revelation principle, the principal needs to only consider games where agents truthfully report the private information they have.

3.5 Mechanism Design History

Leonid Hurwicz (Economics Nobel laureate in 2007) first devised the concept of mechanisms in 1960. He proposed a definition for a mechanism as a communication system wherein participants send messages to each other and possibly to a message center, and a pre-determined rule assigns an outcome (such as allocation of goods and payments) for every collection of the messages received. William Vickrey (Economics Nobel laureate in 1996) conducted research in 1961 in which he introduced the famous Vickrey auction (second price auction is an auction in which bidders submit written bids without knowing the bid of the other people in the *auction*. The highest bidder wins, but the *price* paid is the *second*-highest bid).

To date, the Vickrey auction has occupied a significant position in the annals of mechanism design. John Harsanyi (Economics Nobel winner in 1994 with John Nash and Richard Selten) developed the theory of games with incomplete information for certain Bayesian games. Harsanyi's study later proved critical to mechanism design. Hurwicz introduced the significant concept of incentive compatibility in 1972. This concept allowed the application of incentives of rational players in the development of mechanism design. Clarke and Groves subsequently generalized the Vickrey mechanisms, contributing to the definition of a broad class of dominant strategy incentive-compatible mechanisms in the quasi-linear setting.

There were two remarkable advances in mechanism design in the 1970s. The first was the revelation principle, which basically explained that direct mechanisms are the same as indirect mechanisms. This indicated that mechanism scholars had to worry only about direct mechanisms, leaving the development of real-world mechanisms to mechanism practitioners and designers.

Gibbard (1973) developed the revelation principle for dominant strategy incentive-compatible mechanisms. This was later improved to the Bayesian incentive-compatible mechanisms through many independent efforts – Maskin and Myerson (both Nobel winners in Economic Sciences in 2007) had a primary role in this where Myerson developed the revelation principle in its widest generality. The second remarkable advance in mechanism design in the 1970s was on implementation theory, which dealt with the

following problem: Can a mechanism be designed in a way that all its equilibria are optimal? Maskin gave the first general solution to this problem.

There were outstanding advances in mechanism design all throughout the 1980s and 1990s, as well as in the last few years. It has enjoyed much applicability across a wide range of disciplines, including computer science regulation and auditing, design of markets and trading institutions, and social choice theory. The above list is by no means exhaustive. In this research, our focus is on applying mechanism design in the area of social networking and network economics.

3.5.1 General Mechanism Design Setting

Mechanism design can be envisaged as a game between players in which a decision function exists. In this game, players are either agents or principals. In all types of games, players show specific preferences which normally originate from their private information and are named as “type.” Players’ preferences are described based on their utility function, which is a function of types. Types are nominations of preferences and decision functions. The structure of a mechanism is as follows:

3.5.2 Individuals

A finite group of individuals who interact. This set is denoted as $N = \{1, 2, \dots, N\}$ and generic individuals are represented as i, j and k .

3.5.3 Decisions

The set of potential social decisions is denoted as D , and generic components are represented as d and \hat{d} . This set of decisions may be finite or infinite which largely depends on the kind of application.

3.5.4 Mechanism

A game of mechanism design is considered as a game of private information wherein one of the agents, who is commonly called the principal, selects the payoff structure. As Harsanyi (1967) has argued that the agents receive secret “messages” from the state of nature with information regarding the payoffs. For example, a message may include information about their preferences or the quality of a good intended for sale. This type of information is called the agent’s “type” (usually noted θ and thus the space of types Θ). Agents then report a type to the principal (commonly noted with a hat $\hat{\theta}$) that can be imagined to be a strategic lie. After the

report, the principal and the agents are paid according to the payoff structure the principal chose.

The timing of the game is:

1. The principal commits to a mechanism $y(x)$ that grants an outcome y as a function of reported type
2. The agents report, most possibly dishonestly, a type profile $\hat{\theta}$
3. The mechanism is executed (agents receive outcome $y(\hat{\theta})$)

To understand who gains what, it is typical to divide the outcome y into a goods allocation and a money transfer,

$y(\theta) = \{x(\theta) \cdot t(\theta)\} \cdot x \in X \cdot t \in T$ where x stands for an allocation of goods rendered or received as a function of type, and t stands for a monetary transfer as a function of type.

The designer often defines what would happen with all the available information.

Define a *social choice function* $f(\theta)$ mapping the (true) type profile directly to the allocation of goods rendered or received,

$$f(\theta) : \Theta \rightarrow X$$

In contrast, a mechanism maps the reported type profile to an outcome (again, both a goods allocation x and a money transfer t)

$$y(\hat{\theta}) : \Theta \rightarrow Y$$

3.5.5 Preferences and Information

Individuals have private information. Individual i 's information is represented by a type θ_i lying in a set Θ_i . Let $\theta = (\theta_1, \dots, \theta_n)$ and $\Theta = X_i \Theta_i$

Individuals have preferences over decisions represented by a utility function $v_i : D \times \Theta_i \rightarrow \mathbb{R}$. So, $v_i(d \cdot \theta_i)$ denotes the benefit that individual i of type $\theta_i \in \Theta_i$ receives from a decision $d \in D$. Thus $v_i(d \cdot \theta_i) > v_i(\hat{d} \cdot \theta_i)$ indicates that i of type θ_i prefers decision d to decision \hat{d} .

The fact that i 's preferences depend only on θ_i is referred to as private values. In private values settings θ_i represents information about i 's preferences over the decisions.

3.5.6 Decision Function

Example (a public project): Imagine a society is to decide on whether to build a public project at a cost c or not. For instance, the project can be a public swimming pool, a park or a public library. The cost of the public project should be equally divided. Here

$D = \{0, 1\}$ with 0 representing not building the project and 1 representing building the project.

Although various relations between players require various decision functions, a decision function must be efficient to accomplish a state that is Pareto-optimal.

3.5.7 Decision Rules and Efficient Decisions

As clear from the above instances, the decision a society prefers to make will heavily depend on the θ_i 's. For example, a public project should only be built if the total value it generates is more than its cost.

A decision rule is a mapping $d: \Theta \rightarrow D$, indicating a choice $d(\theta) \in D$ as a function of θ .

As a result, a decision is efficient if the value of each player from this decision is more than the value of any other decision to him/her. So a decision rule $d(\theta)$ is efficient if

$$\sum_i v_i(d(\theta) \cdot \theta_i) \geq \sum_i v_i(d' \cdot \theta_i)$$

for all θ and $d' \in D$.

This concept of efficiency pertains to maximization of total value and thus coincides with Pareto efficiency only when utility is transferable across individuals. Transferability is widely treated in most of the literature.

Efficiency of a decision pertains to the rules and configurations of making it. For instance, if the costs of a project are more than its payoff, that decision is not considered efficient.

In the public project example (Example 1), the decision rule where $d(\theta) = 1$ when $\sum_i \theta_i > c$ and $d(\theta) = 0$ when $\sum_i \theta_i < c$ (and any choice at equality) is efficient. Payments and payoff of players are essential to make an efficient decision.

3.5.8 Transfer Functions

In order to offer the incentives essential to make efficient choices, it may be required to tax or even subsidize individuals. To see the role of such transfers, consider the example of the public project above. Any individual i for whom $\theta_i < \frac{c}{n}$ prefer not to see the project built and any individual for whom $\theta_i > \frac{c}{n}$ prefer not to see the project built. Suppose the government decides to poll individuals to ask for their θ_i 's and then build the project if the sum of the announced θ_i 's is bigger than c . This would result in an efficient decision if the θ_i 's were announced truthfully. Still, individuals with $\theta_i < \frac{c}{n}$

have an incentive to under-report their values and state they view no value in a project, and individuals for whom $\theta_i > \frac{c}{n}$ have an incentive to over-report and state that they have a very high value from the project.

This could lead to a wrong decision. To get a truthful revelation of the θ_i 's, some adaptations need to be made so individuals are taxed or subsidized based on the announced θ_i 's and individuals announcing high θ_i 's expect to pay more. Adaptations are made by a transfer function $t : \Theta \rightarrow \mathbb{R}^n$. The function $t_i(\theta)$ represents the payment that i receives (or makes if it is negative) based on the announcement of types θ .

3.5.9 Social Choice Functions

A pair (d, t) will be referred to as a social choice function, and at times denoted by f . So $f(\theta) = (d(\theta), t(\theta))$. The utility that i receives if $\hat{\theta}_i$ is the announced vector of types (that operated on by $f = (d, t)$) and i 's true type is θ_i is

$$u_i(\hat{\theta}_i, \theta_i, d, t) = v_i(d(\hat{\theta}) \cdot \theta_i) + t_i(\hat{\theta}_i)$$

This formulation of preferences is believed to be quasi-linear.

3.5.10 VCG Mechanism

The mechanism applied in this study is VCG. VCG stands for the initials of the names of the three inventors of this mechanism: *Vickrey-Clarke-Groves*. Bidders offer bids that include their valuations for the items, without knowing the bids of the other individuals taking part in the auction. The auction system arranges the items in an acceptable manner by charging each person the damage they cause to other bidders. Moreover, it provides bidders with an incentive to bid their true valuations by ensuring that the best strategy for each bidder is to bid their true valuations of the items. It is a generalization of a Vickrey auction¹⁴ for multiple items. The auction is named after William Vickrey, Edward H. Clarke and Theodore Groves for their studies that generalized the idea. The VCG auction is a particular application of the more general VCG mechanism. While the VCG auction is intended to make an optimal allocation of items, VCG mechanisms permit for the choice of a socially optimal outcome out of a set of outcomes.

¹⁴ A *Vickrey auction* is a type of sealed-bid *auction*. Bidders submit written bids without knowing the bid of the other people in the *auction*. The highest bidder wins, but the price paid is the second-highest bid.

3.5.11 Specifications of VCG

Dominant strategy implementation

A mechanism (Λ, g, T) implements choice function f in dominant strategies if, $\forall \theta \in \Omega$, there exists a strategy profile σ such that for each $i \in I$, σ_i is a dominant strategy and $g(\sigma(\theta)) = f(\theta)$. Solutions based on the other equilibrium concepts are still satisfactory in some environments.

Nash equilibrium implementation

A mechanism (Λ, g, T) implements choice function f in the Nash equilibrium if, $\forall \theta \in \Omega$, there exists a strategy profile σ that is a Nash equilibrium and $g(\sigma(\theta)) = f(\theta)$.

The implementation goal that we will focus on throughout this thesis is that of an efficient social choice function. We use the term efficient to describe a mechanism that achieves this.

Budget Balance

Social choice function $f(\theta) = (x(\theta), p(\theta))$ is budget-balanced if for all preferences $\theta = (\theta_1, \dots, \theta_I)$.

$$\sum_{i=1}^I p_i(\theta) = 0$$

In fact, no net transfers exist out of or into the system. Put together, allocative efficiency and budget-balance indicate Pareto optimality.

A social choice function will be weakly budget-balanced if:

Social choice function $f(\theta) = (x(\theta), p(\theta))$ will be weakly budget-balanced if for all preferences $\theta = (\theta_1, \dots, \theta_I)$

$$\sum_{i=1}^I p_i(\theta) \geq 0$$

In fact, there can be a net payment made from agents to the mechanism, but not the reverse.

Efficient

A mechanism can be called efficient if it incorporates a social welfare angle which can optimize choice function. This definition might seem a little too general, but we will make clear the intended equilibrium concept throughout this study. For example, by saying that a mechanism is “efficient in dominant strategies,” we mean that it implements an efficient choice function in dominant strategies.

3.5.12 Direct and Indirect Mechanisms and the Revelation Principle

It is difficult to readily conceptualize the space of possible mechanisms. This is because a distinct mechanism exists for each set of behaviors or actions which allow the agents to perform. But an interest subset of this space includes direct mechanisms, which means the only action each agent can perform is communication of a claim about his private type. In a direct mechanism, the action space is defined implicitly and thus, the function that favors outcomes is in fact a choice function.

3.5.13 Direct Mechanism

A tuple (f, T) , where:

- $f: \Theta \rightarrow O_i$ is a choice function.
- $T = (T_1, \dots, T_n)$, where for each $i \in I$,

$T_i: \Theta \rightarrow \mathfrak{R}$ is a transfer payment function (with payments made to agent i).

Recall that each agent i 's utility is a function of the outcome selected and the transfer payments specified. In the context of a direct mechanism (f, T) , we can write $u_i(\theta_i, f(\sigma(\theta)), T(\sigma(\theta)))$ to denote the utility i obtains when the agents have type profile θ and play strategy profile σ . Because of their simplicity, direct mechanisms are very appealing. Fortunately, if one is only concerned with implementation of a particular choice function, it will be without any loss of generality.

3.5.14 Indirect Mechanism

An indirect (revelation) mechanism include a tuple $(S_1, S_2, \dots, S_n, g(\cdot))$ where S_i is a set of possible actions for agent i ($i = 1, 2, \dots, n$) and $g: S_1 \times S_2 \times \dots \times S_n \rightarrow X$ is a function that maps each action profile to an outcome. The idea of an indirect mechanism is to provide a choice of actions to each agent and specify an outcome for each action profile. This induces a game among the players, and the strategies played by the agents in an equilibrium will indirectly reflect their original types.

In the next sections of this chapter, the process of mechanism design will be discussed. First, some examples to understand social choice functions and to appreciate the need for mechanisms will be provided. Next, the process of implementing social choice functions through mechanisms will be described.

To begin with, however, the critical concept of revelation principle will be introduced. Then the different properties that a social choice function needs to satisfy will be presented.

3.5.15 Revelation Principle

If there exists a mechanism that implements choice function f in dominant strategy in the Nash or Bayes-Nash equilibrium, then there will exist a direct mechanism that implements f in the same equilibrium concept, where the equilibrium strategy for each agent is to report his type truthfully. The veracity of the revelation principle can be intuitively verified by imagining, for any indirect mechanism in which agents perform some arbitrary actions leading up to an outcome choice, a direct mechanism analogue in which all such actions are “simulated” by the center after the agents communicate their types. The possibility of this is implicitly embedded in the definition of the mechanism concept, as the center can choose an arbitrary action-choice function g that maps agent actions to outcomes. The revelation principle is a fundamental tool in mechanism design, as it allows the mechanism designer to focus their attention onto direct mechanisms when implementing a particular choice function.

This principle has proved critical to the discovery of the main negative and positive results in mechanism design. However, considering the ramifications of the revelation principle, care must be exercised not to conclude that direct mechanisms are the only mechanisms ever worth implementing. While direct mechanisms have very noticeable attributes, there may be indirect mechanisms in certain settings that also implement an intended choice function, but with preferable computational and/or privacy properties.

Direct mechanisms require agents to completely reveal private types (preferences). In some cases, it may be computationally very challenging for an agent to even figure out exactly what their preferences are, or there may be issues of trust that can make agents hesitate to completely share such preferences even when they can be observed. Nonetheless, in most scenarios discussed in this thesis, the context of direct mechanisms is applicable for its conceptual clarity and its benefits that normally outweigh the potential costs.

3.6 An Example of Using VCG Mechanism for Public Projects

Strategy Proof Mechanism for the Public Project Problem: The Clarke payments by each agent for each type of profile along with their utilities will be computed. First, consider the type profile $(20, 20)$. Since $k = 0$, the values derived by either agent are zero. Hence, the Clarke payment by each agent is zero, and the utilities are also zero. Then consider the type profile $(60, 20)$. Note that $k(60, 20) = 1$. Agent 1 derives a value of 35 and agent 2 derives a value of -5 . If agent 1 is not present, then agent 2 is left alone and the allocation will be 0 since its willingness to pay is 20. Thus, the value to agent 2 when agent 1 is not present is 0. This means

$$t_1(60, 20) = -5 - 0 = -5.$$

This indicates that agent 1 will pay an amount of 5 units in addition to 25 units, which is its contribution to the cost of the project. The above payment is consistent with the marginal contribution of agent 1, which is equal to:

$$\begin{aligned} (60 - 25) + (20 - 25) - 0 = \\ 35 - 5 = 30. \end{aligned}$$

We can now determine the utility of agent 1, which will be

$$\begin{aligned} U_1(60, 20) &= V_1(60, 20) + t_1(60, 20) \\ &= 35 - 5 = 30. \end{aligned}$$

To compute $t_2(60, 20)$, we first note that the value to the agent 1 when agent 2 is not present is $(60-50)$. Therefore

$$t_2(60, 20) = 35 - 10 = 25.$$

This means agent 2 receives 25 units of money; of course, this is besides the 25 units of money it pays towards the cost of the project. Now

$$\begin{aligned} U_2(60, 20) &= v_2(60, 20) + v_2(60, 20) \\ &= -5 + 25 \\ &= 20. \end{aligned}$$

Similarly, the payments and utilities of the agents for all the type profiles can be computed. This mechanism is ex-post individually rational, assuming that the utility for not participating in the mechanism is zero.

3.7 Summary

In this chapter, we elaborated on the methodology of the research. Here, the theoretical foundations of the method, the main structure of game theory and mechanism design were discussed in depth. Furthermore, conditions of a mechanism design were reviewed, and finally the VCG mechanism as the mechanism applied in this study was revised based on a sample.

4 Report and Result Analysis

4.1 Mechanism Design For Crowdfunding and Dominant Strategies

Crowdfunding has been briefly defined as a system with a number of funders who intend to fund novel projects and ideas. The underlying premise is a crowdfunding portal with many projects proposed by a number of entrepreneurs (project owners) and a crowd of funders looking for appropriate projects to fund. Therefore, the result of any project is based on the reaction of funders and project owners. The result can be one of a few permutations – either the “failure in funding”, “success in funding but failure of project”, “success in funding and success of project but with a low quality”, or “success in funding and success of project with high quality.”

As per a game theory pattern, the players in a game are the funders and entrepreneurs. The behavior of each player is, in fact, the strategy selected by the player in the game and the result of the project can be defined as the consequence of the game.

In this chapter, a crowdfunding system will be designed. Moreover, the payoff of each player will be defined, just as different available strategies will be expanded. Dominant strategies which are Pareto-optimal will then be described. Finally, a mechanism based on mechanism design theory will be defined to drive a Pareto-optimal strategy.

4.2 The Game of Funders-Entrepreneurs in Crowdfunding

4.2.1 Game Assumptions

The primary assumptions underlying the game include the following:

- The players are: *funders* as agents who play to choose the optimal way to fund and *project owners* (or entrepreneurs) as principals who need funders to fund their projects.
- A project cannot be initiated if the entrepreneur cannot find adequate funds equal to the required amount of project announced by him/her.
- The entrepreneur can be considered as the leader of the game and he/she starts the game by announcing his/her project.
- Success of funding indicates the amount of the project announced by entrepreneurs.
- If funding turns out to be successful, the entrepreneur starts the project. The result of a project can be either of these: *failure of project*, *success of project but one of low quality*, *success of project with appropriate quality*.

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- The quality of the project can be enhanced if the amount of funding is more than the announced minimum amount of project.
- The funders' strategies in the game include: 1 – no investment, 2 – low investment $minf^{15}$ (the lowest funding by funders just to reach to the minimum amount) and 3 – high investment $maxf^{16}$ (funding more than minimum need of project).
- The strategies of entrepreneurs include: 1 – success of the project with the best quality S^{17} and 2 – success– of the project with a bad quality UNS^{18} 3 – cheating in a project by principal CH .¹⁹
- The main purpose of funders is the highest payoff. The main purpose of entrepreneurs is also completing the project with highest payoff.
- Game is without opposite interactions – payoffs of players are not opposed to each other; they can closely cooperate and the game may thus be considered as a win-win.
- The game is not a zero-sum game.

4.2.2 Players

Project Owner or Entrepreneur (Principal): The entrepreneur provides his/her idea in the crowdfunding system with sufficient details of the project. He/she also presents the essential amount of financing he/she needs. The entrepreneur looks for the maximum payoff (value maximization) in this project. The payoff of the project is a function of incomes and costs of the project.

$$\pi = f(TR, TC) \quad (4.1)$$

π = payoff of project TR = Total Revenue TC = TotalCost

T = Total amount needed for runing the project

$$T = \sum_{i=1}^n t_i \quad (4.2)$$

t = a part of amount which is funded by one funder

In order to maximize the payoff, the entrepreneur may select one of the following strategies. As he/she is the leader of the game, he/she starts the game by presenting his/her idea; then he/she waits to see the strategy of funders.

¹⁵ minimum financing.

¹⁶ maximum financing.

¹⁷ best quality.

¹⁸ bad quality or unsuccessfulness.

¹⁹ cheating.

$$\text{entrepreneur strategy} = \begin{cases} \text{Strategy1 : Can be successful completion} \\ \text{Strategy2 : Can fail in completing the project} \\ \text{Strategy3 : Can cheat} \end{cases}$$

Funders: Funders provide funds for the project. Funders naturally look for the best payoff (value maximization). Funders provide a portion (usually a small part) of the amount of financial resources that are needed for the project. The utility of a funder depends on the payoff of the project and also his/her private valuation of the project. The utility function for funders is:

$$u_i = f(v_i \cdot t_i) \text{ That: } \frac{du_i}{dt_i} < 0 \text{ so } \begin{cases} \sum_{i=1}^n t_i > T \ \& \max f(\text{Strategy 1}) \\ \sum_{i=1}^n t_i > T \ \& \min f(\text{Strategy 2}) \end{cases} \tag{4.3}$$

$U = \text{utility}$ $v = \text{private value}$ $\frac{du_i}{dt_i} = \text{changing in utility by changing of fund}$

4.2.3 Payoff Table of Players and Game Equilibrium

A payoff table of players is required in order to define the equilibrium of the game. The assumption is a game which can be started by the entrepreneur as the leader of the game, whereby the leader presents his/her idea in the crowdfunding system. Funders decide to fund a project based on their own private valuation. Six types of strategies are possible according to payoffs of players as listed below:

- a. high funding – successful project
- b. low funding – successful project
- c. high funding – unsuccessful project
- d. low funding – unsuccessful project
- e. high funding – cheating
- f. low funding – cheating

Optimal strategies for funders are strategies that succeed with the lowest funding. Therefore, the priority sequence of optimal strategies for a funder are b, a, d, c, f, e.

The best strategies for entrepreneurs are those which support a higher funding of the project. He/she also prefers to have the lowest cost in the project to increase his/her profit (payoff). As a result, the priorities for the entrepreneur to select are e, f, a, b, c, d.

The payoff table of strategies is described in Table 5.

Table 5: The Payoff of Players in a Crowdfunding System.

		Entrepreneurs		
		successful	unsuccessful	cheating
Funders	Maxf	MXF-S	MF-UNS	MF-CH
	Minf	MIF-S	MIF-UNS	MIF- CH

As illustrated in the payoff table, the equilibrium of this game according to the priorities of both sides is MIF-CH which is minimum funding by the funder and cheating by the entrepreneur. This equilibrium point of the game between funders and entrepreneurs is thus not optimal. This situation is the natural result of any trade system without a mechanism which is unable to reduce the asymmetry of information.

One of the most significant reasons why many crowdfunding systems fail to achieve success in real activities is this non-optimal equilibrium of both players in a game. This is the natural consequence of individual preference of both players in a real situation, as any player looks only for his/her maximum payoff without considering the interest of other side.

From the funders' perspective, cheating or failure of the entrepreneur is a rational strategy if the funders and entrepreneurs do not know each other, or if the history of failure or cheating is not collected and disclosed in the system. It is widely accepted as fact that when players in the game (in systems without history) do not know each other, they can hardly trust each other and thus they predict a failure or cheating. Moreover, the best strategy for funders is avoiding participation or at least providing minimum investment. In this context, the range of activities (funding or participating) in these systems is naturally very low. It is technically shown in the game design in Table 5.

To achieve optimal equilibrium, it is essential to mobilize the crowdfunding system with additional variables. The concept of "Fame" is a new factor that could be added to the system in order to design a better game which is based on this concept. The result of this new game will be analyzed to find a new equilibrium. In the following sections, the concept of "Fame" will be defined, and the mechanism of this new system of crowdfunding will be designed. Finally, a new game will be designed and the new optimal equilibrium of the new game will be investigated.

4.2.4 "Fame"

"Fame" can be defined as *"the state of being known or recognized by many people because of your achievements, skills, etc."* by the Cambridge Dictionary. The word "Fame" originates from the Latin word "fama" which means fame or reputation. In

the present study of our designed crowdfunding system, “Fame” refers to the credit standing of every individual who is a member of the system. “Fame” is systematic, quantifiable and computable reputation which is a clear signal to other members of the social network within the crowdfunding platform to become better acquainted with the users. This credit will be formed for all users based on *their banking (financial) credit, social credit, participation (activities) history* and *their success in previous transactions*.

As “Fame” represents the reputation of the users within the system’s social network, it therefore refers to the individual’s decisions in fields of investment, loan payment, being a guarantor, voting on others, and any other transactions in the system. The credit points dedicated to each financial transaction will be determined through the policies and procedures of the crowdfunding system set by the owners and policymakers within the credit-scoring framework. “Fame” is the outcome of this credit-scoring process and therefore is influenced by each transaction of every single user.

In this research, “Fame” is a general function of four parameters:

$$Fame = f(\text{banking transactions, social credit, participation, success})$$

The details of the “Fame” are discussed in Appendix A. However, “Fame” is conceived of here as a new parameter to be included in the mechanism of decision making for the users in the system. “Fame” is basically assumed to be a calculated parameter in the crowdfunding system which is transparent and can be accessed by all participants. The method of calculating the “Fame” index and the parameters which are included in the calculation of “Fame” depend on the decisions and policies of policymakers of the crowdfunding system. It may be changed time by time in any system as well. But a general view of this calculation will be designated in Appendix A as the suggestion for the “Fame” index in this research.

The new system of crowdfunding should guarantee the presence, calculation and accuracy of “Fame” in the system. The concept of “Fame” can be easily seen in some current social networks and websites. For instance, the eBay website has a percentage number allocated to every seller to show their history of previous transactions as a means of “positive feedback.” This percentage is based on the feedback of buyers in preceding transactions. Therefore, a new buyer can know the number of previous sales of any seller as well as the feedback of buyers for each deal to know the seller better.

As another example, hotel booking websites like Tripadvisor.com, booking.com and Agoda.com display the collective feedback of previous guests of each hotel, providing a clear ranking for hotels based on their feedback that can also allow new guests to read the comments and history of any particular hotel. It also includes an average number of how many guests gave feedback and the hotel ranking.

The concept of “Fame” is close to these types of existing collective feedback in the examples provided above. A numeric and computable system for “Fame” is also considered in this new crowdfunding system. The main state-of-the-art capability of

this system involves the concept of “Fame” which encompasses all decisions of the user. They check the “Fame” of others when they want to decide to collaborate/participate or interact with them. They also consider their own “Fame” in every transaction and desire to contribute to it. “Fame” could potentially reduce asymmetric information in the system, as it is a clear systematic signal to all dealers (signaling). The problem of asymmetric information and its two theoretical solutions (signaling and screening) for reducing it were explained in Chapter 2.

4.2.5 Specifications of “Fame” in the Crowdfunding System

- “Fame” is a number between $-\infty$ and $+\infty$. It indicates the reputation/credit of a user in the system can be from any negative or positive number.

$$-\infty \leq fame \leq +\infty$$

- When any user enters this new system, his/her “Fame” is zero. Their “Fame” will be increased or decreased in the system based on the user’s activities.
- In this system (as it will be further explained in Appendix A) four general concepts are used to produce “Fame”: 1 – Financial/banking credit record, 2 – Social credit, 3 – Network participation and activities, 4 – Success
- A new user can increase his/her “Fame” by increasing each of these four factors. One natural way to rapidly increase “Fame” is through banking credit. Users can deposit credit in the system to demonstrate their financial power. This includes a banking deposit, or any banking or financial guarantee. Financial power is a type of “Fame” and is a signal to other players in the system to exhibit a user’s wealth.
- It is assumed that all users in the system are “*homo economicus*,” or “economic man” This means that “the users are hypothetical individuals who act rationally, with complete knowledge, but entirely out of self-interest and the quest to maximize personal utility.” (Persky 1995, p. 46)
- Utility maximization for a user in a crowdfunding system is a combination of self-value maximization and self-“Fame” maximization. As “Fame” is systematically supported by the system and also is considered by users of the system in decision-making, both value and “Fame” are emphasized by users in a utility function. This is because a user of this system cannot work without “Fame.” Zero or low “Fame” of a user is a signal to other funders to not invest in, or even interact with, this user. So, without “Fame”, there is no value in this system for the users. The user has to increase their “Fame” quotient to increase their value in a “Fame”-based crowdfunding system.
- Subjective value of any project for funders is directly related to the “Fame” of the owner of the project. Therefore, the subjective value of funders depends heavily

on the “Fame” function of an entrepreneur. This indicates that the “Fame” of the entrepreneur is a very critical element for a funder when it comes to deciding on funding a project.

- Both entrepreneurs and funders can increase their “Fame” by collaborating in a successful project; i.e., a successful project can increase the “Fame” of both the entrepreneur and the funder.
- Negative “Fame” is destructive for any user and is a direct signal to other users to avoid any participation with an infamous user. Even one negative “Fame” in the history of “Fame” activities of any famous user is considered extremely harmful by other users (We can see this in the examples of ebay.com for sellers, and booking.com for hotels, where negative reviews adversely impact the decision-making process of potential customers.)
- The impact of negative “Fame” in a transaction on a famous user with a positive historical “Fame” is seriously damaging.
- The history of “Fame” for any user is kept in the system within the user’s profile and is available for other users to review.
- As “Fame” information is available to other users, it is a reliable indication for funders and entrepreneurs to reduce moral hazards and cheating risks.

4.3 Mechanism Design

4.3.1 Mechanism of Crowdfunding

In this section, a mechanism of the dominant strategies will be designed to achieve the optimal equilibrium. It will be designed in normal a situation (without “Fame”) in the first part. Subsequently, a mechanism of crowdfunding with the inclusion of “Fame” will be designed. The results of two mechanisms (with “Fame” and without “Fame”) will be then compared. The main assumptions for both models are as follows:

- The number of potential funders and entrepreneurs in our crowdfunding system are theoretically unlimited, and there is no limitation on the number and share of funders to fund a project.

$$N = \{1, 2, 3, \dots, n\}$$

N = number of funders in crowdfunding system

- The entrepreneur presents his/her project in the system in three parts:
 1. The details of the project including the nature of project, the timeline, the business plan of project and, most importantly, the expected return of the project including forecasting direct yield, indirect awards and so on
 2. The minimum pledge level of each funder to participate in the project (p)

3. The target level of investment which is needed (T); target level is equal to the cost of running the project
- There are two probabilities for the project which is shown by K. if K = 1, project starts, the probability of it will be α .

If K = 0 project does not start; probability of it will be $(1 - \alpha)$

$$K = \{ 1, 0 \}$$

K = social chose function

$$Project = \begin{cases} K = 1, & P = \alpha \\ K = 0, & P = (1 - \alpha) \end{cases}$$

p = probability of running the project

α = Probability of p

- Starting the project (K = 1) the entrepreneur needs to collect the funds for the project to the target level (T). So if n_1 funders fund t units of funds in a project, the necessary situation to start is (4.4) equation.

$$n_1 \cdot t \geq T \quad (4.4)$$

T level is the minimum amount that the entrepreneur needs to handle the project, but if the collective funds are more than T, the entrepreneur has the chance to use this extra amount to improve on quality. Therefore, if the funding of the project is more than T, the quality of project can be better than the primary standard assumption.

- Some funders from an infinite number of funders agree to take part in the project. Probability of this participation is a binomial distribution (4.5) as below:

$$\rho (n_1 : \text{if } k=1) = \binom{N}{n_1} \alpha^{n_1} (1 - \alpha)^{N - n_1} \quad (4.5)$$

ρ = the probability of n funders that say “ok” to running the project

- The mechanism is a weak balance as $\sum_{i=1}^{n_1} t_i < 0$; the payoff sum is not positive. In addition, the source of payment is payments from funders and there is no other external source of funding which is our assumption of mechanism efficiency.
- The way to understand the types of players in this mechanism is direct. The utility function of player i is a function of his/her subjective value of the project and his/her payments to the project.
- To make our equation simpler, it is assumed that the strategy of each player is not influenced by other players, meaning that each player has a dominant strategy.

- All players are rational and they have individual rationality, meaning that negative utility is not permissible.
- The result of the mechanism should prepare the situation in which at least one player gains a better situation. These assumptions should allow a search for Pareto-optimal equilibrium.

4.3.2 Mechanism of Crowdfunding Without “Fame”

To design the mechanism of our crowdfunding system, we use the VCG mechanism. As mentioned earlier, there are two types of players in the system: entrepreneurs (principals) and funders (agents). The payoff for funders in the mechanism is their utility of the project. This utility function is a function of K which is *social choice function*, while value of project for each funder and the cost of funding for each funder is as in equation (4.6)

$$u_i = U(K, v_i, t_i) \quad (4.6)$$

The subjective value of each funder is a function of his/her type²⁰ and the payoff of the project. The payoff can be either equity or goods which will be developed during the project, or a share in ownership of the project, or a share of ownership of the returns of the project. Equation (4.7)

$$v_i = v(\theta_i, z) \quad (4.7)$$

θ = type of funders z = the final production after running the project

So, the utility function of each funder is as equation (4.8)

$$u_i = K(v_i - t_i) \quad (4.8)$$

Therefore, the payoff of all funders is the sum of utilities of all participant funders as equation (4.9):

$$\sum_{i=1}^{n_1} u_i = K \cdot \rho \cdot N \cdot \sum_{I=1}^{n_1} (v_i - t_i) \quad (4.9)$$

As we assume individual rationality as one of the assumptions of the project, the utility function of a player should not be negative. So, we have equation (4.10):

$$u_i > 0 \xrightarrow{\text{yields}} \sum_{i=1}^{n_1} u_i > 0 \xrightarrow{\text{yields}} v_i > t_i \xrightarrow{\text{yields}} K = 1 \quad (4.10)$$

²⁰ As it is explained in Chapter 3, players have specific preferences which are actually their private information and are named by “type.”

If $K=1$ means the utility of this project for that funder is positive (as $v_i > t_i$) because his/her preference requires a positive payoff. Accordingly, if $u_i > 0$ then the aggregate of u_i is also larger than zero.

It indicates that the utility function of all funders is positive. The explanation for this situation is that when a project is funded by funders, the subjective value²¹ of each funder is more than the cost of funding for that particular funder, and thus the accumulative utility of the group of funders increases. Therefore, funders vote positively for this project and the minimum target of funds for this project can be collected.

On the other side of the game, there exists an entrepreneur whose purpose is to maximize the profit of the project (value maximization).

$$\pi = TR - TC \quad (4.11)$$

π = profit of entrepreneur TR = total revenue TC = total cost

The return of the project for the entrepreneur is from funds which can be equal to or more than the target level of project. TC is the announced target amount of funds which are needed for project.

$$TR(T) \geq TC \quad (4.12)$$

If returns on the project (some of funds) are equal to the cost of project, the net profit of the project for the entrepreneur is zero. If funds are more than T , the net profit will be positive.

$$\pi = K.N.\rho. \sum_{i=1}^{n_1} t_i - TC \quad (4.13)$$

$$\pi = \begin{cases} \pi = 0, & \text{if } K.N.\rho. \sum_{i=1}^{n_1} t_i = TC \\ \pi > 0, & \text{if } K.N.\rho. \sum_{i=1}^{n_1} t_i > TC \end{cases} \quad (4.14)$$

If the payoff of the entrepreneur is equal to zero, the probability of cheating in the project increases. Therefore, there is the risk of cheating or fraud in this mechanism.

4.3.3 Mechanism of Crowdfunding with “Fame”

In this mechanism, again the players are funders and entrepreneurs. The payoff of funders is their utility of the projects. All players are rational and the utility function should also be positive.

²¹ The *subjective value* advances the idea that the value of a good is determined by the importance an acting individual places on a good for the achievement of his desired ends.

$$u_i = U(K, v_i, t_i) \quad (4.15)$$

The subjective value of funders in this mechanism is a function of funder types, final payoff, and the “Fame” of the project. As “Fame” of the project can be considered as a function of “Fame” of the entrepreneur, it can be said that subject value is a function of the entrepreneur’s “Fame” (Equation 4.18).

$$\hat{v} = v(\theta_i, Z_i, fame) \quad (4.16)$$

As “Fame” can be positive, zero or negative, we have the equation (4. 17)

$$\hat{v}_i = v_i + f(fame) \begin{cases} a) & \text{if } f(fame) = 0 & \xrightarrow{\text{then}} & \hat{v}_i = v_i \\ b) & \text{if } f(fame) < 0 & \xrightarrow{\text{then}} & \hat{v}_i < v_i \\ c) & \text{if } f(fame) > 0 & \xrightarrow{\text{then}} & \hat{v}_i > v_i \end{cases} \quad (4.18)$$

- a) In time t_1 , the entrepreneur enters crowdfunding system but he/she does not have any “Fame” yet. In such circumstances, the funders’ reactions are identical to those in a crowdfunding mechanism without “Fame.” Hence, payoff and aggregate net surplus are completely similar to a “no Fame” crowdfunding system. However, the difference lies in the entrepreneur’s tendency to accumulate “Fame” for himself/herself to be famous in future. As a result of this, these types of entrepreneurs typically inspire more confidence that their proposal will pay off and are also more conscientious about making their project a success in order to receive good feedback and “Fame.” On the other side of the spectrum, funders rarely trust newcomers. Therefore, newcomers have to begin with smaller projects to accrue “Fame” in the system. There is, however, another alternative for newcomers to enhance their “Fame”: that is by bringing banking or social credit from the outside into the system.

It can be concluded that with “Fame” crowdfunding systems, the risk of cheating/fraud and failure decreases even for newcomers, simply because they are motivated to be more conscientious about their results and “Fame.” Therefore, the outcome of new projects can be more successful with such a mechanism in place.

- b) If the “Fame” of any entrepreneur is negative, an obvious signal is raised to all players of the system to remain alert to potential moral hazard and fraud risks. An entrepreneur with negative “Fame” can be defined as a person who has a poor or unsuccessful history of activities. Funders can delve deeper into the details of the entrepreneur’s history to understand the reasons behind their negative “Fame.” The infamous entrepreneur might have a history of cheating or fraud, thereby indicating that he is not to be entrusted with the funding of a project.

Another reason to avoid partnerships with infamous entrepreneurs is the negative impact of a failed project on the funders' "Fame." If a funder funds an unsuccessful project, his/her "Fame" will decrease. Hence, very few funders are interested investing in a project with an infamous entrepreneur. This will therefore decrease the number of failed projects and infamous entrepreneurs in the system.

- c) The third situation is the most probable, whereby an entrepreneur has positive "Fame." Greater "Fame" signifies a better history of activities, success in previous projects, and more social credit – all of which attract funders to fund famous entrepreneurs' projects. Funders can predict a successful project with less risk from a highly positive "Fame." In addition, the entrepreneur does his/her best to complete the project. Success in the project can enhance the "Fame" for both parties, helping each other to sufficiently fund and efficiently manage the project by the entrepreneur. A typical interaction of funders in this situation is to seek out famous entrepreneurs with the highest return. Examples are ebay.com or booking.com where users usually look for hotels with the best feedback and lower prices.

Subjective value of funders is a function of payoff and "Fame." Therefore, the total payoff for a funder in a successful project is more than a "no Fame" investment.

$$\frac{\partial \hat{v}_i}{\partial fame} > 0 \quad (4.19)$$

The utility function of the entrepreneur is also a function of income/cost as well as the additional "Fame" of a project. If he/she can succeed in the project, they gain additional "Fame."

$$\pi = \pi (TR, TC, \Delta fame) \quad (4.20)$$

$$\Delta fame = fame_a - fame_b \quad (4.21)$$

Therefore, the "Fame" of the project impacts on the crowdfunding mechanism in two parts:

1. Utility function of funders are impacted by "Fame," so the valuation of a project by funders is different as seen in equations (4.22) and (4.23)

$$\hat{v}_i = v(\theta_i, z, f(fame)) \quad (4.22)$$

$$\hat{v}_i = v_i + f(fame) \quad (4.23)$$

So, the utility function is represented by equation (4.24):

$$\hat{u}_i = K(\hat{v}_i, t_i) \quad (4.24)$$

Funding in a crowdfunding system is by a crowd of funders, so the sum of utilities is as below:

$$\sum_{i=1}^{n_1} \hat{u}_i = K.N.\rho. \sum_{i=1}^{n_1} (\hat{v}_i - t_i) \quad (4.25)$$

$$\sum_{i=1}^{n_1} \hat{u}_i = K.N.\rho. \sum_{i=1}^{n_1} (v_i + f(\text{fame}) - t_i) \quad (4.26)$$

$$\sum_{i=1}^{n_1} \hat{u}_i = \sum_{i=1}^{n_1} u_i + K.N.\rho. \sum_{i=1}^{n_1} f(\text{fame}) \quad (4.27)$$

Projects with zero “Fame” or negative “Fame” are rare. Moreover, the negative “Fame” could result in a negative utility function in equation (4.27).

We assume a positive “Fame” for designing the mechanism in this part. $f(\text{fame}) > 0$. Therefore, “Fame” has a positive impact on utility function: $\sum_{i=1}^{n_1} \hat{u}_i > \sum_{i=1}^{n_1} u_i$. Thus, the payoff for funders in a “with-Fame crowdfunding” system is higher than in the conventional system.

- As mentioned, entrepreneurs are able to view the impact of their behavior on their “Fame” score, as the history of “Fame” is also made available to all funders in the system. As a result, even one failure can be troublesome for a famous entrepreneur and thus potentially reduce the amount of funding for his/her future projects. Considering this, we can predict a higher effort and enthusiasm on the part of the entrepreneur to succeed. Payoff is “Fame” + income – costs, as below:

$$\hat{\pi} = TR - TC \quad (4.28)$$

$$\hat{\pi} = K.N.\rho. \sum_{i=1}^{n_1} t_i - TC + \Delta \text{fame} \quad (4.29)$$

$$\hat{\pi} = \pi + \Delta \text{fame} \quad (4.30)$$

The entrepreneur strives to achieve success in order to increase his/her “Fame.” This implies that, in a deficit situation, he/she might prefer to invest by himself/herself or try harder with more enthusiasm to succeed. Generally, we can assume in the system that a famous player selects the strategy of success. So, we can predict that equation (4.31) is always positive.

$$\pi = \begin{cases} \pi > 0, & \text{if } K.N.\rho. \sum_{i=1}^{n_1} t_i < TC \text{ because } : \Delta \text{fame} > 0 \\ \pi > 0, & \text{if } K.N.\rho. \sum_{i=1}^{n_1} t_i > TC \text{ because } : \Delta \text{fame} > 0 \end{cases} \quad (4.31)$$

4.3.4 Aggregate Net Surplus

Aggregate net surplus is the aggregate of payoff for all players in the mechanism. Technically, it is the *aggregate of profit of all stakeholders in a mechanism*. In the present study, the stakeholders in a crowdfunding mechanism are assumed to be funders and entrepreneurs.

A Pareto-optimal condition is accessible only if the Aggregate Net Surplus of the mechanism can be maximized. Aggregate Net Surplus function of the crowdfunding mechanism is the sum of payoffs of all players in the mechanism. Equations (4.32) and (4.33):

$$S_{(v|z)} = \pi + \sum_{i=1}^{n_1} u_i(K, V_i, t_i) \quad (4.32)$$

S = net aggregate surplus

$$S = \rho \cdot n_1 \cdot \left[t(1-n) + \sum_{i=1}^{n_1} v_i \right] - TC \quad (4.33)$$

In addition, the Aggregate Net Surplus in a “with Fame” crowdfunding mechanism is the sum of payoffs of all players. As a result:

$$\hat{S} = \hat{\pi} + \sum_{i=1}^{n_1} \hat{u}_i \quad (4.34)$$

$$\hat{S} = \pi + \Delta fame + \sum_{i=1}^{n_1} u_i + K.N.\rho \cdot \sum_{i=1}^{n_1} f(fame) \quad (4.35)$$

As illustrated in equation (4.35), $\hat{S} > S$. “Fame” has a positive impact in the equation $\Delta fame$ in first part (entrepreneur side) as well as $\sum_{i=1}^{n_1} f(fame)$ for funders. Therefore, the aggregate net surplus of a “with Fame” crowdfunding system is much larger than a “without Fame” system (Multiply payoff).

$$\hat{S} = S + \Delta fame + K.N.\rho \cdot \sum_{i=1}^{n_1} f(fame) \quad (4.37)$$

4.4 Conclusion

The results of mechanisms are summarized in Table 6.

It can be seen that the mechanism of crowdfunding “with Fame” leads to a better result compared to a “no Fame” mechanism for both sides of the game. The reasons are:

Table 6: Comparison of the Fame Crowdfunding Payoff and Crowdfunding.

	Funders payoff	Entrepreneur payoff	Net aggregate surplus
Crowdfunding	$\sum_{i=1}^{n_1} u_i = K \cdot \rho \cdot N \cdot \sum_{i=1}^{n_1} (v_i - t_i)$	$\pi = K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} t_i - TC$	$S = \rho \cdot n_1 \cdot \left[t \cdot (1-n) + \sum_{i=1}^{n_1} v_i \right] - TC$
Crowdfunding with "Fame"	$\sum_{i=1}^{n_1} \hat{u}_i = \sum_{i=1}^{n_1} u_i + K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} f(\text{fame})$	$\hat{\pi} = \pi + \Delta \text{ fame}$	$\hat{S} = S + \Delta \text{ fame} + K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} f(\text{fame})$
Result	$\sum_{i=1}^{n_1} \hat{u}_i > \sum_{i=1}^{n_1} u_i$	$\hat{\pi} > \pi$	$\hat{S} > S$
Comparison	Crowdfunding with "Fame" payoff > crowdfunding without fame payoff		

- The utility of players in a “Fame” crowdfunding system is higher than in one without “Fame.” Therefore, the motivation of players to enter this system is higher, thus increasing funding in the system.
- As an entrepreneur’s history and track record are incorporated into the system, the risk of cheating, fraud and moral hazards are lower, thus decreasing the probability of failure in the system.
- There is a clear signaling system in this mechanism to players which is both demonstrable and performance-based, resulting in a decrease in information asymmetry.
- Entrepreneurs try harder to succeed with their project in order to gain more “Fame.” This implies that even in cases where funds fall short of what is needed they may devise ways and means of finishing the project successfully to avoid negative “Fame.” It can generally be stated that the dominant strategy of entrepreneurs is success.
- The aggregate net surplus in the crowdfunding system encompasses three parts: aggregate net surplus of a “without Fame” crowdfunding system, changes in the “Fame” of funders and “Fame” function of entrepreneur as in equation (4.36)

$$\hat{S} = S + \Delta fame + K.N.p. \sum_{i=1}^{n_1} f(fame) \quad (4.37)$$

- Aggregate net surplus in a “with Fame” system is more than without “Fame” mechanism. There is a multiple increase in the payoff compared to a system without “Fame.”
- This multiple payoff is implied in verse 96 of chapter 7 of the Qur’an and the concept of Barakah:

If the people of these communities had (dynamically and actively) believed and had taqwā (were fully conscious and aware of Allāh) We would have opened for them barakāt (blessings) from the heavens and the earth.

- The concept of Barakah refers to a mechanism instituted by Allah to provide multiple payoffs for any act of righteousness, i.e., those that are fully compliant with the prescribed rules in the Qur’an. A reading of the Quranic verses related to this concept suggests that this is an automatic process. For example, the Qur’an says: “whosoever comes with a beautiful deed, for him there is ten like it” (6:160). This is an unconditional assertion that seems to suggest that the manifold return will accrue automatically.
- Conceptually it can be concluded from this verse that if people of a community had Iman (believed) and Taqwa (were fully compliant with the rules of behavior prescribed in the Qur’an) Allah gives their acclaims multiple payoff. As we can see in equation (4.37).

- The message of this verse is clearly seen in this equation: A Muslim who has Iman and Taqwa and is fully compliant and does so to please Allah because he/she behaves as he/she is ordered to in the Qur'an. He/she does not directly work for reputation or fame. But being compliant with the rules of Islam makes them more credible in their commitment to the project, thus raising the levels of trust in him/her in the community. The higher the degree of rule compliance, the stronger the degree of credible commitment.

$$\hat{S} \geq S \xrightarrow{\text{yields}} \begin{cases} \text{if } f(\text{fame}) > 0, & \hat{S} > S \\ \text{if } f(\text{fame}) = 0, & \hat{S} > S \end{cases} \quad (4.38)$$

if $f(\text{fame}) = 0$ but project is succesful

→ $\Delta \text{fame} > 0$ as entrepreneur collect a succesful feedback

Coming back to the reputation mechanism theory, Dellarocas (2015) believes the ability to build a reputation allows the long-term player to improve his payoffs in such settings. Intuitively, a long-term player who has a track record of playing a given action (e.g., cooperate) often enough in the past acquires a reputation for doing so and is “trusted” by subsequent short-term players to do so in the future. However, why would a profit-maximizing long-term player be willing to behave in such a way, and why would rational short-term players use past history as an indication of future behavior? To explain the phenomena, Kreps, Milgrom, Roberts and Wilson (1982), Kreps and Wilson (1982), and Milgrom and Roberts (1982) introduced the notion of “commitment” types. Commitment types are long-term players who are locked into playing the same action. An important subclass of commitment types are Stackelberg types: long-term players who are locked into playing according to the Stackelberg action. The Stackelberg action is the action to which the long-term player would credibly commit if he could. In the above “online auction” example, the Stackelberg action would be to cooperate. Cooperation is the action that maximizes the seller’s lifetime payoffs if the seller could credibly commit to an action for the entire duration of the game. Therefore, the Stackelberg type in this example corresponds to an “honest” seller who never cheats. In contrast, an “ordinary” or “strategic” type corresponds to an opportunistic seller who cheats whenever it is advantageous for him to do so. (Dellarocas 2015)

- In general, reputation effects benefit the most patient player in the game; i.e., the player who has the longest time horizon (discounts future payoffs less) is usually the one who is able to reap the benefits of reputation. Fudenberg and Levine (1992) show that this result holds even when players can observe only noisy signals of each other’s actions, so that the game has imperfect public monitoring. They prove that, if short-term players assign positive prior probability to

the long-term, player who is a Stackelberg type, and if that player is sufficiently patient, then an ordinary long-term player achieves an average discounted payoff close to his commitment payoff (i.e., his payoff if he can credibly commit to the Stackelberg action). In order to obtain this payoff, the ordinary player spends long periods of time choosing the Stackelberg action with high probability (Dellarocas 2015).

- Dellarocas says that during the initial phase of a repeated game, it is common that some players realize lower or even negative profits, while the community “learns” their type. In those cases, players will only attempt to build a reputation if the losses from masquerading as a Stackelberg type in the current round are offset by the present value of the gains from their improved reputation in the later part of the game. In trading environments, this condition usually translates into the need for sufficiently high profit margins for “good quality” products so that the promise of future gains from sustaining a reputation is persuasive enough to offset the short-term temptation to cheat. This was first pointed out by Klein and Leffler (1981).
- In addition to the above, a new game can be designed with the new results of a new mechanism to examine the new equilibrium of the game between the funder and entrepreneur.

The Game of Entrepreneur- Funder in a “Fame” Crowdfunding System

As mentioned above, the utility function of an entrepreneur and even funders are influenced by “Fame” in the new scenario. Therefore, the dominant strategy of the entrepreneur and the funders can be considered as value maximization plus “Fame” maximization. The entrepreneur attempts to accomplish the project successfully as this will allow him to gain profit as well as “Fame”. As “Fame” is critical for the accretion of funding in his future projects, it can be argued that the possibility of success in his subsequent projects increases. On the other hand, if any strategy dramatically reduces his/her “Fame” (in cases such as cheating or fraud), he/she will discard this strategy and rather turn to the one which can enhance the value and “Fame” simultaneously. Accordingly, it can be said that success in a project is the dominant strategy of entrepreneurs in this new game.

From the funders’ perspective, they are interested in the “Fame” of entrepreneurs to decide on a project, but they are also aware of the positive impact of a successful project based on their own “Fame”. As a result, they will not only make their best effort to select the best projects but will also try to help entrepreneurs to succeed, which means that they are willing to invest more in the project to guarantee its success. The primary result of this process is a multiplier effect in the volume of fund in the “Fame” of project leading to $f(\text{Fame})$:

$$f(\text{fame}) = \text{volume of fund} \times \text{fame of project} \quad (4.39)$$

So, from funders' point of view, most funding in a successful project:

- guarantee the success of project in order to collect profit and “Fame”,
- multiply the “Fame” of the entrepreneur which can be added to the “Fame” of the funder.

Therefore, the dominant strategy of the funder in this game is maximum funding.

Finally, as it is shown in Table 7, the equilibrium in this game is *maxf-successful*. In fact, the game will produce a Pareto-optimal state with the selection of the first strategy by the entrepreneur.

Table 7: Payoff of Players in a “with Fame” Crowdfunding Game.

		Entrepreneur		
		successful	unsuccessful	Cheating
funders	Maxf	MXF-S	MF-UNS	MF-CH
	Minf	MIF-S	MIF-UNS	MIF-CH

Source: own illustration.

5 Proof of Concept

5.1 Case Studies of an Implemented Platform

The concept of “reputation mechanism” is widely used in many popular social networks like booking.com and eBay, but it is not comprehensively prevalent in financial solutions (like crowdfunding) yet. “Fame” as a comprehensive index is also a new application in the crowdfunding system, which explains the paucity in time series analysis or cross-sectional data to test the hypothesis of the research. We therefore adapted the mechanism of the dissertation to a practical system with real world-scenario application. For the purpose of this study, we designed and develop an Islamic crowdfunding website www.famedfund.com in parallel with the dissertation. Famedfund.com applies a full implementation of the “Fame” index idea to clearly demonstrate the difference between a crowdfunding system with “Fame” compared to older “without Fame” crowdfunding systems. Additionally, we included some sample projects in the system to further illustrate these differences. All utility functions and Net Aggregate Surplus equations are reviewed in different samples. We have included simulation tables and samples of projects in Appendix F and review two simple samples in this part.

Sample 1

There is a new IT project in our crowdfunding system which has been proposed by a professional entrepreneur. The amount of funds requested by the entrepreneur is US\$10,000. The cost of the project for the entrepreneur is US\$8,000. The entrepreneur has announced that the percentage of profit sharing is 50/50 between the entrepreneur and the funders. We assume two scenarios here:

1. The project will conclude with success.
2. The project will fail.

A total of forty funders funded this project as per Table 8.

We assume the “Fame” of the entrepreneur prior to the project as F_0 , and the changes to his/her “Fame” after the project as $\Delta fame_0$. The “Fame” of the funders before this project is also F_1 to F_{40} and the changes to their “Fame” after the project are $\Delta fame_1$ to $\Delta fame_{41}$. (All assumptions tables are in Appendix F.)

We can see the calculations below:

The pledge amount of the project is US\$10,000. As the project is successful and the profit sharing percentage is 50%, the share of the entrepreneur and funders from the profit is US\$1,000 apiece. So, $TC = 8,000 + 1,000$ (profit of funders) = 9,000 USD

Table 8: Funders and Projects.

Funder x1 ²² to x10	US\$10 for each funder ²³
Funder x11 to x20	US\$90 for each funder
Funder x21 to x30	US\$200 for each funder
Funder x31 to x40	US\$400 for each funder
Funder x41	US\$3000 for funder 40

Δ Fame of funders are from two parts in this sample: Participation credit and success credit; therefore, in a successful project scenario the fame of funders is as per Table 9.

Table 9: The participation amount, profit and fame of funders in a successful project.

Funder No.	Participation amount (US\$)	Profit of project (US\$)	Participation credit	Success credit	Fame
1	10	1	3.2	3.6	6.8
2	10	1	3.2	3.6	6.8
3	10	1	3.2	3.6	6.8
4	10	1	3.2	3.6	6.8
5	10	1	3.2	3.6	6.8
6	10	1	3.2	3.6	6.8
7	10	1	3.2	3.6	6.8
8	10	1	3.2	3.6	6.8
9	10	1	3.2	3.6	6.8
10	10	1	3.2	3.6	6.8
11	90	9	57.6	64.8	122.4
12	90	9	57.6	64.8	122.4
13	90	9	57.6	64.8	122.4
14	90	9	57.6	64.8	122.4
15	90	9	57.6	64.8	122.4
16	90	9	57.6	64.8	122.4
17	90	9	57.6	64.8	122.4
18	90	9	57.6	64.8	122.4
19	90	9	57.6	64.8	122.4
20	90	9	57.6	64.8	122.4
21	200	20	256	288	544
22	200	20	256	288	544

²² X1 to x41 are 41 investors who fund projects in this sample.

²³ In this column we have the amount of investment of each funder for example in the first row each funder from funders x1 to x10 fund US\$10 in the project.

Table 9 (continued)

Funder No.	Participation amount (US\$)	Profit of project (US\$)	Participation credit	Success credit	Fame
23	200	20	256	288	544
24	200	20	256	288	544
25	200	20	256	288	544
26	200	20	256	288	544
27	200	20	256	288	544
28	200	20	256	288	544
29	200	20	256	288	544
30	200	20	256	288	544
31	400	40	1,024.00	1,152.00	2,176.00
32	400	40	1,024.00	1,152.00	2,176.00
33	400	40	1,024.00	1,152.00	2,176.00
34	400	40	1,024.00	1,152.00	2,176.00
35	400	40	1,024.00	1,152.00	2,176.00
36	400	40	1,024.00	1,152.00	2,176.00
37	400	40	1,024.00	1,152.00	2,176.00
38	400	40	1,024.00	1,152.00	2,176.00
39	400	40	1,024.00	1,152.00	2,176.00
40	400	40	1,024.00	1,152.00	2,176.00
41	3000	300	13,440.00	15,120.00	28,560.00
sum	10000	1000	26,848.00	30,204.00	57,052.00

The “Fame” of an entrepreneur in a successful project is also an aggregate of participation credit and success credit as the following:

Table 10: Profit and “Fame” of entrepreneur in a successful project.

Entrepreneur No.	Amount of project (US\$)	Profit of project (US\$)	Participation credit	Success credit	Fame of Failed Project	Total (US\$)
45	10,000	1,000	4,400	61,600	–	66,000.00

$$\text{Total Fame} = \text{Success credit} + \text{Participation credit}$$

Let us review Table 11 for this case.

As is clear from the table above, the payoff of all players in this project is higher than a “without Fame” situation, and as “Fame” is valuable for the players’ reputation in future transactions, all players care about it in the game. The “Fame” of the entrepreneur increases to around 57,000, while the cumulative “Fame” for funders in this project is 66,000.

Table 11: Comparison of payoff in a “with Fame” and “without Fame” mechanism.

	Funder payoff	Entrepreneur payoff	Net aggregate surplus
Crowdfunding “without Fame”	$\sum_{i=1}^{n_1} u_i = K, \rho, N, \sum_{i=1}^{n_1} (v_i - t_i)$ $\sum_{i=1}^{n_1} u_i = \text{US\$1,000}$	$\pi = K, N, \rho, \sum_{i=1}^{n_1} t_i - TC$ $\pi = 10,000 - 8,000 - 1000$ $= \text{US\$1,000}$	$S = \rho, n_1, \left[t(1-n) + \sum_{i=1}^{n_1} v_i \right] - TC$ $S = 1,000 + 1,000$ $= \text{US\$2,000}$
Crowdfunding with “Fame”	$\sum_{i=1}^{n_1} \hat{u}_i = \sum_{i=1}^{n_1} u_i + K, N, \rho, \sum_{i=1}^{n_1} f(\text{fame})$ $\sum_{i=1}^{n_1} \hat{u}_i = \text{US\$1,000} + 57,052 \text{ Fame}$	$\hat{\pi} = \pi + \Delta \text{fame}$ $\hat{\pi} = \text{US\$1,000} + 66,000 \text{ Fame}$	$\hat{S} = S + \Delta \text{fame} + K, N, \rho, \sum_{i=1}^{n_1} f(\text{fame})$ $\hat{S} = \text{US\$2,000} + 123,052 \text{ Fame}$

As we can see clearly in this sample, the increase in “Fame” of funders in a successful project is not linear. The funding of funder X41 is US\$3000 compared to fund X1 at US\$10 – which is larger by – 300 times. $X41 \text{ funding} = X1 \text{ funding} * 300$ ($10 * 300 = \text{US}\$3,000$).

The “Fame” of X41 after the conclusion of the project is increased to 28,560; compared to the “Fame” of X1, which is 6.8. Therefore, we can see that the “Fame” of X41 is increased by 4200 times more than X1: $X41 \text{ Fame} = 4200 * X1 \text{ Fame}$ ($28560 = 4200 * 6.8$).

We can conclude that the funders in the “with Fame” game are influenced to invest more, as they understand that their “Fame” will increase manifold in proportion to an increase in their investments.

This was a certainty that we included in our new game and is evident in the real life example of the case study.

Moreover, other users of the www.famedfund.com platform that have either given positive feedback on the project or vouched for this particular entrepreneur also increased their “Fame” due to their participations on the site as well as their support for a successful project. Any user who has “liked” the project also received 10 “Fame” points. Therefore, based on this formula, it can be concluded that vouching for a project has also increased the “Fame” of users:

The “Fame” of vouching for a successful project = Amount of “Fame” which is vouched for * coefficient of success (which is 4 in this calculation).

Therefore, not only do the entrepreneurs and funders increase their “Fame” in a successful project, but the other users of the crowdfunding system also influence their own “Fame” through their social activity on the system. These activities are also meaningful in the signaling part of the system. Therefore, Famefund.com has systematically encouraged its users to increase signaling in the system, thus reducing information asymmetry, not just through the main players of a game (entrepreneur and investors) but also by creating activity amongst the observers of the system.

Sample 2

In this part, a sample of a failed project will be reviewed. Table 12 shows the results of an instance where the entrepreneur does not successfully complete the project and the project fails.

$$\text{Total Fame} = \text{Create Project Fame} + \text{Fame of Failed Project}$$

Therefore, as failure decreases the “Fame” of an entrepreneur in the case of an unsuccessful project, the likely strategy of an entrepreneur is to seek success in order to accrue more “Fame” to improve their reputation. Let us review Table 14 for this case.

Table 12: Results of unsuccessful projects and project failures.

Funder No.	Participation amount	Participation-credit	Failed-credit	“Fame”
1	10	3	-6	-2.8
2	10	3	-6	-2.8
3	10	3	-6	-2.8
4	10	3	-6	-2.8
5	10	3	-6	-2.8
6	10	3	-6	-2.8
7	10	3	-6	-2.8
8	10	3	-6	-2.8
9	10	3	-6	-2.8
10	10	3	-6	-2.8
11	90	58	-108	-50.4
12	90	58	-108	-50.4
13	90	58	-108	-50.4
14	90	58	-108	-50.4
15	90	58	-108	-50.4
16	90	58	-108	-50.4
17	90	58	-108	-50.4
18	90	58	-108	-50.4
19	90	58	-108	-50.4
20	90	58	-108	-50.4
21	200	256	-480	-224
22	200	256	-480	-224
23	200	256	-480	-224
24	200	256	-480	-224
25	200	256	-480	-224
26	200	256	-480	-224
27	200	256	-480	-224
28	200	256	-480	-224
29	200	256	-480	-224
30	200	256	-480	-224
31	400	1024	-1,920.00	-896
32	400	1024	-1,920.00	-896
33	400	1024	-1,920.00	-896
34	400	1024	-1,920.00	-896
35	400	1024	-1,920.00	-896
36	400	1024	-1,920.00	-896
37	400	1024	-1,920.00	-896
38	400	1024	-1,920.00	-896
39	400	1024	-1,920.00	-896
40	400	1024	-1,920.00	-896
41	3000	13440	-25,200.00	-11,760.00
	\$10,000.00	26,848.00	-50,340.00	-23,492.00

Table 13: The “Fame” of an entrepreneur as a result of an unsuccessful project.

Entrepreneur No.	Create Project “Fame”	“Fame” of Project Successful Project	“Fame” of Failed Project	Total
46	4,400	–	(19,800)	(15,400.00)

Finally, Table 15 shows the result of this project in two scenarios: Success and Failure.

We can clearly see the difference between success and failure in the utility function of the users of the system.

Utility function of funder:

In a successful scenario: US\$1,000 + 66,000 “Fame”

This is bigger than the utility function in the case of a failed project:

In a failed scenario: US\$0 – 15,400 “Fame”

This is also greater than the utility function of a “without Fame” system:

“Without Fame” utility function: US\$1,000

US\$1,000 + 66,000 “Fame” > US\$1,000 > US\$0 – 15,400 “Fame”.

As previously distinguished, “Fame” is crucial to gain a better reputation as reputation this helps the user gain more trust, and consequently, greater funds for investment in the future. Therefore, it can be said that “Fame” increases the *net present value*.

5.2 The Story of www.famedfund.com

Famedfund.com was developed completely based on the premise of this dissertation to implement the “Fame” concept in a real financial framework. The analysis and development of the website started from May 2016 and after around one year of computer programming, the website and platform www.famedfund.com were ready for launch in June 2017 in two languages, Persian and English.

The regulations of the Central Bank of Iran require any type of Financial and Banking transaction to be carried out via a bank or financial institution, under the supervision of the central bank. This also extends to crowdfunding transactions, and thus, we were compelled to work under the purview of a bank or the Stock Exchange of Iran for the launch of the platform. We began our negotiations with some banks in Iran such as Bank Melli, which is the largest Islamic bank in the world, to launch www.famedfund.com under the auspices of their bank, and have also approached the Stock Exchange of Iran to utilize the platform as an Islamic

Table 14: Comparison of Payoff in a “with Fame” and “without Fame” mechanism.

	Funders pay-off	Entrepreneur pay-off	Net aggregate surplus
Crowdfunding	$\sum_{i=1}^{n_1} u_i = K \cdot \rho \cdot N \cdot \sum_{i=1}^{n_1} (v_i - t_i)$ $\sum_{i=1}^{n_1} \hat{u}_i = -\text{US}\$10,000$	$\pi = K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} t_i - TC$ $\pi = \text{US}\$0$	$S = \rho \cdot n_1 \cdot \left[f(1-n) + \sum_{i=1}^{n_1} v_i \right] - TC$ $S = -10,000$
Crowdfunding with “Fame”	$\sum_{i=1}^{n_1} \hat{u}_i = \sum_{i=1}^{n_1} u_i + K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} f(\text{fame})$ $\sum_{i=1}^{n_1} \hat{u}_i = -\text{US}\$10,000 - (32,492) \text{ Fame}$	$\hat{\pi} = \pi + \Delta \text{fame}$ $\hat{\pi} = \text{US}\$0 - (15,400) \text{ Fame}$	$\hat{S} = S + \Delta \text{fame} + K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} f(\text{fame})$ $\hat{S} = -\text{US}\$10,000 - (47892) \text{ Fame}$

Table 15: Success and Failure in two scenarios.

Scenario	Funders payoff	Entrepreneur payoff	Net aggregate surplus
Success	US\$1,000 and + 57,052 Fame	US\$1,000 and + 66,000 Fame	US\$ 2,000 and 123,052 Fame
Failure	-US\$10,000 and -32,492 Fame	US\$0 and -15,400 Fame	-US\$10,000 and -47,892 Fame

risk-sharing investment platform for SME businesses. Meanwhile, to test the platform in a real situation, we invited the 800 staff from our company, TOSAN, to become users of our crowdfunding system. To-date there are a number of real projects that have been presented on the platform, which have garnered interest from investors. For more information, visit www.famedfund.com/discover to learn more about the progress of these projects.

6 Summary and Conclusion

6.1 Summary of the Research

Crowdfunding

Crowdfunding is a fast-developing method of mobilizing funds for financing projects, and can be defined as an investment conducted by a group of individuals (crowd) rather than traditional financial institutions. Crowdfunding is gaining popularity because of the availability of channels which allow *direct communication between entrepreneurs and investors* via an internet platform, without of the inclusion of any intermediaries such as banks. In crowdfunding, each individual within the crowd of funders provide a small amount of investment, instead of a small group of experienced investors providing a large sum of money. Crowdfunding has the potential to boost entrepreneurship by expanding the pool of investors from whom funds can be raised beyond the traditional circle of owners, relatives and venture capitalists.

Financial Inclusion

Islamic banks have come under growing censure for not offering services to low income social groups. Such criticism is substantiated by the fact that more than 60% of Muslims live in poverty, with the majority being in Asia, and excluded from banking services. It is therefore imperative that these economically-deprived Muslims receive financial assistance, to help raise their standards of living. Given the growing wave of social unrest across the Middle East and North Africa, and the heavy toll it has already exacted on some financial sectors in the region, Islamic banks would be well advised to start addressing the financial needs of low-income individuals. Moreover, it could even work to the benefit of banks and their shareholders, as this largely-neglected demographic of Muslim society represents a potentially enormous new market for Islamic banks: a market that institutions in some less-developed Muslim countries have already begun to tap by providing microfinance to growing ranks of micro-entrepreneurs. Crowdfunding is one of the best new innovative financial tools to expand financial inclusion in Muslim communities.

Islamic Crowdfunding

As we discussed in section 2.4, risk sharing is the essence of Islamic finance, and trust is a key necessity in facilitating the sharing of risk between partners of a deal. Reputation and credibility are the core requirements in creating trust. We also clearly see verse 96 in chapter 7 of the Qur'an that refers to Iman and Taqwa, being

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the fundamentals of achieving Barakah in Muslim communities. Hence, it can be said that there is an obvious mutual harmony between the spirit of Islamic finance and the idea behind crowdfunding. Furthermore, the marriage of Shariah and crowdfunding seems to be a natural fit in creating a diverse gamut of Islamic crowdfunding applications. Different Islamic contracts that are applicable to different types of crowdfunding are listed in Table 16.

Table 16: Different Islamic contracts for different types of crowdfunding.

Types of crowdfunding	Islamic contract	Description
Equity-based crowdfunding	Musharakah	Issuing of Shares
Shared-profit crowdfunding	Musharakah	Profit sharing
Shared-revenue crowdfunding	Musharakah	Musharakah Sukuk or Musharakah
Donation-based crowdfunding	Hibah, Qard al Hassan	Or Ujra
Social lending	Qard al Hassan	
Debt-based crowdfunding	Qard al Hassan	If it is a zero-interest loan
Peer-to-peer lending	Qard al Hassan	If it is a zero-interest loan, however, this is generally the hardest category of crowdfunding to comply with Shariah

Equity-Based Crowdfunding

In this research, we focused on equity-based crowdfunding as one of the aspects of financial crowdfunding, which is also the preferred mode of Shariah-compliant crowdfunding. This type of crowdfunding involves inexpensive issuance of shares through the internet, where investors can acquire stocks in corporations for a small amount of money, with a claim over the company's future cash flow. It has proved to be a viable form of corporate finance, enabling even companies which have failed to get funds from angel investors, government programmes, friends or family alike, to gain access to funding. Crowd investing deals with the financing of corporate growth and innovation.

Musharakah Risk-Sharing Contract

Equity-based crowdfunding replicates the concept of a Musharakah risk-sharing contract in Islamic finance. Musharakah is often perceived to be the preferred mode

of Islamic financing, because it adheres most closely to the principle of risk sharing. Partners contribute capital to a project and share its risks and rewards. Profits are shared between partners on a pre-agreed ratio, but losses are shared in exact proportion to the capital invested by each party. Thus, a financial institution provides a percentage of the capital needed by its customer with the understanding that the financial institution and customer will proportionately share the profits and losses in accordance with a formula agreed upon before the transaction is carried out. This provides an incentive to invest wisely and take an active interest in the investment. Most of the currently implemented Islamic crowdfunding platforms which have been launched in the real world are truly based on Musharakah. In this research, we have also chosen Musharakah as the preferred contract for our risk-sharing crowdfunding system; and consequently, all concepts, regulations and limitations of a Musharakah contract should be considered as part of that system. The mechanism designed in Chapter 4 is also on a Musharakah contract platform.

Information Asymmetry

There are some specific and sensitive risks in a crowdfunding paradigm. The main risks associated with crowdfunding are fraud (the money is not used for the declared purpose), loss due to project failure, lack of liquidity, moral hazard and operational risk. The main source of risk in a Musharakah contract and a crowdfunding system is information asymmetry. Information asymmetry is a situation in which one party in a transaction has more or superior information compared to the other. Asymmetric information in financial markets can include any or all of the following: *Adverse selection, moral hazard, or monitoring costs.*

A broad range of categories in market design mechanisms exist which have been deployed in crowdfunding or other online market settings and may be effective in reducing information-related market failures in equity crowdfunding. These are signalling, screening, rules and regulation, collateral and guarantee, due diligence, and reputation (“Fame”).

Reputation Mechanism

One of the newest ways of solving the problem of information asymmetry is via a reputation mechanism. The primary objective of the reputation mechanism is to enable efficient transactions in communities where cooperation is compromised by post-contractual opportunism or information asymmetries. If the community follows a norm by punishing traders with bad historical behaviour for instance by refusing to buy from them, and if the present value of punishment exceeds the gains from cheating, then the threat of public revelation of a trader’s cheating behaviour in the current round provides rational traders with sufficient incentives to cooperate.

A reputational mechanism has been designed in this research specifically for the crowdfunding system to eliminate moral hazard and reduce information asymmetry. The role of reputation is important as a mechanism for establishing trust to address the risk of fraud in online transactions. While there are various mechanisms to deal with fraud, reputation is one of the best candidates – and arguably one of the more effective ones.

“Fame”

We defined the concept of “Fame”, in order to implement the reputation mechanism in the crowdfunding system we designed. “Fame” refers to the credibility of every individual who is a member of the crowdfunding system. “Fame” is systematic, countable and computable (implicit and explicit) reputation, which is a clear signal to other members of the social network of crowdfunding to get to know better the users of social network. This credibility will be formed for all users of the system based on *their banking (financial) credit, social credit, participation (activities) history, and their success in previous transactions*. “Fame” has been innovated in order to represent the reputation of the users in the social network of the crowdfunding system. As a result, “Fame” is a reference for the individuals’ decisions in fields of investment, loan payment, being a guarantor, voting on others, and any other transaction in the system. The credibility points dedicated to each financial transaction will be determined through the policies and procedures of the crowdfunding system set by the owners and policymakers within the credit-scoring framework. “Fame” is the outcome of this credit-scoring process and is consequently under the influence of each transaction for every single user.

In this research, “Fame” is a general function of four parameters:

$$fame = f(\text{banking credit, social credit, participation, success})$$

Hence, in Chapter 4 we designed a mechanism in order to achieve the optimal equilibrium by using the concept of “Fame”.

Mechanism Design

The methodology of this research uses the mechanism design theory to design an optimal mechanism for Islamic crowdfunding. Mechanism design is a field in economics and game theory which assumes an engineering approach in designing economic mechanisms or incentives, toward desired objectives in strategic settings in which players act rationally. Since it starts at the end of the game, then goes backwards, it is sometimes known as reverse game theory.

VCG mechanism

The mechanism applied in this study is VCG mechanism. VCG stands for the initials of the name of the three inventors of this mechanism: *Vickrey–Clarke–Groves*. Bidders offer bids that include their valuations for the items, without knowing the bids of the other people taking part in the auction. The auction system arranges the items in an acceptable manner, whereby it charges each person the damage they cause to other bidders. Moreover, it provides bidders with an incentive to bid their true valuations, by ensuring that the best strategy for each bidder is to bid their true valuations of the items. It is a generalization of a Vickrey auction for multiple items.

In this research, the mechanism is first designed in a normal situation (“without Fame”). In the following mechanism, a crowdfunding system which includes “Fame” is designed. The results of two mechanisms (“with Fame” and without “Fame”) are then compared.

Utility Function of Entrepreneur and Funder “with Fame” and “without Fame”

We use the VCG mechanism to design the mechanism of our crowdfunding system. As mentioned, there are two types of players in the system: entrepreneurs (principals) and funders (agents). The payoff of funders and entrepreneurs in the mechanism is their utility of the project, and the utility functions of both sides are described in Chapter 4. The result of the calculations is presented in Table 17.

It can be seen that the mechanism of crowdfunding “with Fame” has a better result compared to the “no Fame” mechanism for both sides of players. Some of the reasons for this are:

- The utility of players in the “Fame” crowdfunding system is higher than one without “Fame”. Therefore, the motivation of players to enter this system is stronger and hence the funding will increase in this system.
- As there is history and track record in the system, the risk of cheating, frauds, moral hazards, hence the probability of failure will decrease in the system.
- There is a clear signaling system in this mechanism to players which is both demonstrable and performance-based; as a result, information asymmetry decreases in this system.
- Entrepreneurs try harder to succeed in their project in order to gain more “Fame”. This implies that even in cases where funds fell short of what is needed they may devise ways and means of finishing the project successfully to avoid negative “Fame”. It can be generally stated that the dominant strategy of entrepreneurs is success.
- Success in the project can enhance the “Fame” for both the entrepreneur and funder. Indeed, both of them are helping each other with the funder looking to sufficiently fund the project, and the entrepreneur efficiently managing the project.

Table 17: Comparison of the Fame Crowdfunding Payoff in a “with Fame” and “without Fame” mechanism.

	Funders payoff	Entrepreneur payoff	Net aggregate surplus
Crowdfunding	$\sum_{i=1}^{n_1} u_i = K \cdot \rho \cdot N \cdot \sum_{i=1}^{n_1} (v_i - t_i)$	$\pi = K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} t_i - TC$	$S = \rho \cdot n_1 \cdot \left[t(1-n) + \sum_{i=1}^{n_1} v_i \right] - TC$
Crowdfunding with “Fame”	$\sum_{i=1}^{n_1} \hat{u}_i = \sum_{i=1}^{n_1} u_i + K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} f(\text{fame})$	$\hat{\pi} = \pi + \Delta \text{fame}$	$\hat{S} = S + \Delta \text{fame} + K \cdot N \cdot \rho \cdot \sum_{i=1}^{n_1} f(\text{fame})$
Result	$\sum_{i=1}^{n_1} \hat{u}_i > \sum_{i=1}^{n_1} u_i$	$\hat{\pi} > \pi$	$\hat{S} > S$
Comparison	Crowdfunding with “Fame” payoff > crowdfunding without fame payoff		

- Funders usually do not trust newcomers. Thus, newcomers have to start with small projects to collect “Fame” in the system.
- There is another alternative for newcomers to enhance their “Fame” – that is, by bringing banking or social credit from outside the system. Thus crowdfunding systems can readily provide newcomers with more facilities.
- “Fame” crowdfunding systems decrease the risk of cheating/fraud and failure even for newcomers, simply because they are more cautious about their results and “Fame.” Therefore, the outcome of new projects may ultimately be more successful in such a mechanism.
- If the “Fame” of any entrepreneur is negative, a clear signal is relayed to all players of the system to be alerted on potential moral hazard and fraud risks. An entrepreneur with negative “Fame” can be defined as a person who has a bad or unsuccessful history of activities. Funders can read all details of their history to know the reasons for their negative “Fame”. The infamous entrepreneur might have committed fraud or cheating or had some failures in the past, thereby indicating that he is not a professional and trusted entrepreneur /manager of the project.
- Funders’ unwillingness to partner with an infamous entrepreneur is due to the negative impact a failed project will have on the funders’ “Fame”. If a funder funds in an unsuccessful project, his or her “Fame” will decrease, which is why very few funders are interested to invest in a project with an infamous entrepreneur.

Aggregate Net Surplus

Aggregate net surplus is the aggregate of payoff for all players in the mechanism. Technically, it is the aggregate of profit of all stakeholders in a mechanism. In the present study, the stakeholders of a crowdfunding mechanism are assumed to be funders and entrepreneurs.

A Pareto-optimal state is accessible only if the Aggregate net surplus of the mechanism can be maximized. The equation for aggregate net surplus in the crowdfunding system encompasses three parts: Aggregate net surplus of a “without Fame” crowdfunding system, changes in the “Fame” of funders and the “Fame” function of the entrepreneur as the equation (4.36)

$$\hat{S} = S + \Delta fame + K.N.\rho. \sum_{i=1}^{n_1} f(fame) \quad (4.37)$$

Aggregate net surplus in a “with Fame” system is more than a “without Fame” mechanism.

$$\hat{S} \geq S \xrightarrow{\text{yields}} \begin{cases} \text{if } f(\text{fame}) > 0, & \hat{S} > S \\ \text{if } f(\text{fame}) = 0, & \hat{S} > S \end{cases} \quad (4.38)$$

if $f(\text{fame}) = 0$ but project is succesful

→ $\Delta \text{fame} > 0$ as entrepreneur collects a succesful feedback

Barakah, Iman and Taqwa

The aggregate net surplus in a “with Fame” system is higher than in a “without Fame” mechanism. The payoff for a “Fame” system is increased by multifold compared to a “without Fame” mechanism.

This situation of multiple payoff and the concept of Barakah are referred to in verse 96 of chapter 7 of the Qur’an when Allah said:

If the people of these communities had (dynamically and actively) believed and had taqwā (were fully conscious and aware of Allāh) We would have opened for them barakāt (blessings) from the heavens and the earth.

The concept of Barakah refers to a mechanism instituted by Allah to provide multiple payoffs to any act of righteousness; i.e., those that are fully compliant with the prescribed rules. A reading of the Quranic verses related to this concept suggests that this is an automatic process. For example, the Qur’an says: “Whosoever comes with a beautiful deed, for him there is ten like it.” (6:160) This is an unconditional assertion that seems to suggest that the manifold return will accrue automatically.

We can conceptually conclude from this verse that if people of a community had Iman (believe) and Taqwa (aware to their reputation and “Fame”) Allah gives them a multiple payoff. This is expressed in equation (4.37).

6.2 Summary of Results

We have found that reputation mechanism is key to solving information asymmetry. The implementation of reputation is complex in a real market situation, as there are technical needs like a credit-scoring platform, reputation indexes, and comprehensive solutions to include all users. Crowdfunding is a Web 2.0-based platform which is actually a closed system. Therefore, the implementation of a reputation mechanism at the heart of this system is appropriate (as it can be seen with ebay.com or booking.com). We introduce our reputation index as “Fame” to make it more comprehensive. As previously emphasized, “Fame” is a function of users’ banking (financial) credit, social credit, participation (activities) history and their success in previous transactions.

As we observe in our equation in Chapter 4, the result of utility function for both funders and entrepreneurs is improved in a “with Fame” mechanism.

For the entrepreneur:

$\hat{\pi} = \pi + \Delta fame$ For the funder:

$$\sum_{i=1}^{n_1} \hat{u}_i = \sum_{i=1}^{n_1} u_i + K.N.\rho \cdot \sum_{i=1}^{n_1} f(fame)$$

Therefore:

$$\hat{\pi} > \pi \quad \text{And} \quad \sum_{i=1}^{n_1} \hat{u}_i > \sum_{i=1}^{n_1} u_i$$

Furthermore, the aggregate net surplus in this research shows the aggregate of pay-offs of all stakeholders in a community and, as can be seen below, an increase in aggregate net surplus for all users results in a manifold increase in the system.

As

$$S = \rho \cdot n_1 \cdot \left[t(1-n) + \sum_{i=1}^{n_1} v_i \right] - TC$$

and

$$\hat{S} = S + \Delta fame + K.N.\rho \cdot \sum_{i=1}^{n_1} f(fame)$$

but

$$\hat{S} > S$$

so

Aggregate Crowdfunding “with Fame payoff > aggregate crowdfunding without Fame” Payoff.

Therefore, we can mathematically say that the tendency of a community to collaborate in a “with Fame” crowdfunding system increases compared to a “without Fame” system.

How do the findings contribute to the existing knowledge base in the areas/topics?

(Dellarocas (2015)). believes that online reputation mechanisms harness the remarkable ability of the web to not only disseminate, but also to collect and aggregate information from large communities at a very low cost, in order to artificially construct large-scale word-of-mouth networks. Best known so far as a technology for building trust and fostering cooperation in online marketplaces, these mechanisms are poised to have a much wider impact on organizations.

We also show in this research that whenever “Fame” or reputation is systematically important in a web-based community, it also becomes an important index in all decisions. Whether all members of the social network consider the “Fame” of other users in their transactions with them, and/or a system can: 1. keep the history of “Fame” (explicit solicited feedback) and also 2. analyze “implicit feedback” in order to offer it to the community to consider,

$$\hat{v}_i = v_i + f(\text{fame}) \begin{cases} a) & \text{if } f(\text{fame}) = 0 & \xrightarrow{\text{then}} & \hat{v}_i = v_i \\ b) & \text{if } f(\text{fame}) < 0 & \xrightarrow{\text{then}} & \hat{v}_i < v_i \\ c) & \text{if } f(\text{fame}) > 0 & \xrightarrow{\text{then}} & \hat{v}_i > v_i \end{cases}$$

Funders logically prefer famous entrepreneurs to not famous ones or newcomers in order to maximize their utility function. In this regard, Dellarocas believes that during the initial phase of a repeated game, it is common that some players realize lower or even negative profits, while the community “learns” their types. In those cases, players will only attempt to build a reputation if the losses from masquerading as a Stackelberg type in the current round are offset by the present value of the gains from their improved reputation in the later part of the game (Dellarocas 2015).

Moreover, we show mathematically that utility functions of both sides of a transaction (funders and entrepreneurs) are increased in a “with Fame” crowdfunding mechanism. We can see the consistency of this result with the outcomes of another research. Dellarocas showed that reputation has positive effects on the benefit of the most patient player in the game – i.e., the player who has the longest time horizon (discounts future payoffs less) is usually the one who is able to reap the benefits of reputation. Fudenberg and Levine (1992) showed that this result holds even when players can observe only noisy signals of each other’s actions, so that the game has imperfect public monitoring. They show that, if short-term players assign positive prior probability to the long-term player being a Stackelberg type, and if that player is sufficiently patient, then an ordinary long-term player achieves an average discounted payoff close to his commitment payoff (i.e., his payoff if he could credibly commit to the Stackelberg action). In order to obtain this payoff, the ordinary player spends long periods choosing the Stackelberg action with high probability. As a financial system (crowdfunding system) is generally a long-term game, the payoff of crowdfunding players (literally long-term players) will increase through this signaling system.

6.3 Policy Implications

The implementation of a reputation mechanism in a social network is not difficult. There are many popular websites that have used the concept of reputation in their platforms such as Google, eBay, booking.com and TripAdvisor. However, the reputation mechanism could be based on explicit feedback or implicit analysis.

One of the main differences between our findings from this research and other recent research and websites, is the importance of defining a reputation index (“Fame” index) for all users of a social network. For example, as can be seen on eBay, buyers usually provide feedback for sellers. The identity of the buyers and their reputation is not clear. In the case of booking.com as well, the identity and reputation of the guests who rate the hotels are not known.

Generally, in a social network, and especially a crowdfunding platform, defining “Fame” for every user (funders and entrepreneurs) automatically increases the significance and comprehensiveness of “Fame” in the community. In this case, all users will be sensitive to the consequence of all their activities, even when it comes to voting or blogging on any social network. Consequently, it can be the best reputation mechanism in a community by means of universality and ubiquity.

The policies of a social network can be directly implemented by the “Fame” index focusing on considerations and important issues for policymakers in a community. As is indicated in Appendix A, there is enough data in a crowdfunding platform to formulate a “Fame” index. In our index, Fame is a function of banking credit, social credit, success credit and participation credit.

As a summary of policy implications, we can review the below matters:

- Islamic finance activists and policymakers should care about Fintech and recent innovations in financial technology and try to find Shariah-compliant tools to address these Fintech innovations like crowdfunding and blockchain as there is a growing orientation towards these technological trends worldwide.
- Islamic crowdfunding could be compliant with Shariah across different Islamic contracts such as Qard al Hassan, Hibah and Musharakah. As financial crowdfunding is seeing staggering growth in the market, there will be a natural demand in the market for Islamic crowdfunding. As a policy, Islamic finance scholars should provide Shariah-compliant structures for different crowdfunding systems to accelerate the use of crowdfunding in Muslim communities as a tool of financial inclusion.
- The problem of information asymmetry must be addressed in both crowdfunding and Musharakah contracts. The infrastructure of social networks could potentially provide a reputation mechanism to eliminate asymmetric information. There is a huge potential for Islamic finance to use social networks in order to extend trust, decrease asymmetric information and consequently increase Islamic finance activities in line with the true spirit of Islam such as risk-sharing contracts.

Signaling and screening structures are a part of this architecture that should be considered in the design of any Islamic crowdfunding system.

- One of the best ways to solve the problem of information asymmetry is by using a reputation mechanism. “Fame” is more comprehensive than reputation as it contains explicit and implicit indexes to formulate the reputation mechanism. “Fame” should be defined and used for all community users and not

only sellers (entrepreneurs) but also buyers (funders). Therefore, the “Fame” mechanism could be comprehensively implemented in a community.

The “Fame” index should address the policies, considerations and targets of policymakers of a community. In our research, “Fame” is a function of banking credit, social credit, success credit and participation credit.

The primary objective of a reputation mechanism is to enable efficient transactions in communities where cooperation is compromised by post-contractual opportunism (moral hazard) or information asymmetry (adverse selection).

If a “Fame” mechanism can be properly implemented in a social network, it can mathematically be shown that the aggregate net surplus will increase in the community.

6.4 Limitations of the Research

Two types of limitations posed a challenge to the research at hand. First, as the concept of Islamic crowdfunding is very new in the world of Islamic finance, there were not enough popular samples of Islamic crowdfunding for the basis of this research. However, as a means of actualizing the research idea, and separate from the research itself, we developed a crowdfunding website based on the design of a start-up especially for Islamic crowdfunding, with “Fame” as the main premise. The website address is www.famefund.com. (See Appendix E for more details on the website), and we are hopeful that [famefund.com](http://www.famefund.com) can serve as a real platform to test the idea of “Fame” in real Islamic communities and we hope other researchers can expand the menu of application of this platform in the future.

The second limitation was the availability and quality of data, such as proper time series or cross-sectional data, to test the hypothesis in Islamic crowdfunding through data-driven algorithms. As a proof-of-concept for this dissertation, the situation of some projects was simulated in the research to comprise the results in “with-fame” and “without-fame” situations. Perhaps in the future, enough data for Islamic crowdfunding will be available for researchers to do so. May FameFund be one of these data sources Insha’Allah!

6.5 Directions for Future Research

This study has been an initial attempt to find a way to mitigate the problem of information asymmetry in Islamic Musharakah-based crowdfunding. Mechanism design and reputation mechanism were developed to address this, enabling the study to be extended in many directions. In addition to the potential areas identified above, the following could be considered for future extension of the research:

- Only a sample of the “Fame” index was reviewed in this research to show that there are enough attributes in a crowdfunding system to form the “Fame” index. Perhaps future researchers can expand the “Fame” index based on different policies in Islamic communities. Information asymmetry, value maximization, financial inclusion, Maqasid al Shariah, expansion of risk-sharing finance and so on may be the premise for future researchers to define and formulate the “Fame” index (reputation).
- Another direction for future research could be the expansion of the reputation mechanism theory to other Islamic products and Islamic financial institutions. As trustworthiness is a prescribed rule in Islam (Qur’an: chapter 5: verse 1), and it has been shown that reputation mechanism can strongly reduce the problem of information asymmetry, it is vital to design a reputation mechanism to promote trust in Islamic finance. As an instance, the “Fame” index may be designed and developed for Islamic banks, for Islamic credit cards, and the Islamic stock market. Reputation mechanism is an inexpensive approach to developing Shariah-compliant expansion in Islamic finance.
- Islamic crowdfunding is indeed a very new concept and more research is needed on this innovative and growing instrument of finance. Other directions in which future research can follow may include investigating other types of crowdfunding (such as peer-to-peer lending) and the way towards Shariah compliance in Islamic communities.

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Appendices

Appendix A

“Fame” index

The calculation of “Fame” could be different in different systems and situation; policy-makers of any new social network of crowdfunding can define their new ways of calculation based on their own paradigm of social network. Parameters, multipliers and formulas may be changed in order to influence the users to be more active/ or to push them for some specific projects. In what follows, there is a sample of parameters and calculations for “Fame” in crowdfunding social network. As discussed in Chapter 4, there are four main categories of parameters as banking credit, social credit, success credit and participation credit which are described in a sample as below.

A sample of suggestive numeric framework to calculate “Fame”:

1. Banking Credit
 - Wealth of customer in the bank
 - Financial credit scoring: classification of customers in a bank or financial organization base on internal financial items like average of balance of customer’s accounts, amount of financial transactions, turn over, number of transactions.
 - Credit scoring of customers based on external information systems like central bank information, credit bureaus, loans of other banks, tax payments.
 - Customer segmentation and scoring of customers including depositors, borrowers, shareholders, current account holders, users of card readers and point of sales of bank.
 - Credit scoring of customer as he/she is using insurance or his/her wealth in the stock market.
2. Social Credit
 - Membership in social networks
 - Social activity of customer in social networks like
 - Voting
 - Previous funding
 - Blogging, posts, photos, videos and . . .
 - Number of friends, inviting friends to social network of crowdfunding
 - Collaboration in marketing campaigns of bank
 - Suggestions and subjugations
 - Blogging on new projects and new users
 - Answering to questions of other users
 - Financial transaction through crowdfunding system
3. Participation Credit
 - Participation in crowdfunding as
 - charity funding
 - lending

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- Musharakah investment
 - And any other types of funding
 - Support of projects as
 - Guarantee of projects
 - Guardian of project
 - Vote to projects
 - Participation as a project owner or entrepreneur to present new projects to funders
4. Success Credit
- Successful accomplishing of previous projects as entrepreneur
 - Guarantor of previous successful projects
 - Funder of previous successful projects
 - Guardian of previous successful projects
 - Supporter of previous successful projects
 - Voter of previous successful projects

$$\text{Banking Credit} = A(x) = a_1 \text{ Average of Accounts} + a_2 \text{ Balance of Account} + a_3 \text{ Number of transactions} + a_4 \text{ average of amounts} + a_5 \text{ Loan credit scoring} + a_6 \text{ Check inquiry rating of CBI} + a_7 \text{ customer segmentation} + a_8 \text{ money transfer Inside famedfund.com}$$

Table A.1: Calculation of Multipliers in Banking Credit.

calculation	multiplier	impact	item	no
$1 < x < 10,000,000 \Rightarrow 2 * x$ $10,000,000 < x < 100,000,000 \Rightarrow 4 * x$ $100,000,000 < x < 1,000,000,000 \Rightarrow 6 * x$ $1,000,000,000 < x < 10,000,000,000 \Rightarrow 8 * x$ $x > 10,000,000,000 \Rightarrow 10 * x$	$a_1 = 2$	+	Average of accounts balance for the last 3 months	1.
$1 < x < 10,000,000 \Rightarrow 2 * x$ $10,000,000 < x < 100,000,000 \Rightarrow 4 * x$ $100,000,000 < x < 1,000,000,000 \Rightarrow 6 * x$ $1,000,000,000 < x < 10,000,000,000 \Rightarrow 8 * x$ $x > 10,000,000,000 \Rightarrow 10 * x$	$a_2 = 2$	+	Balance of account	2.
$1 < x < 100 \Rightarrow 1 * x$ $100 < x < 200 \Rightarrow 2 * x$ $200 < x < 300 \Rightarrow 3 * x$ $400 < x < 500 \Rightarrow 4 * x$ $x > 500 \Rightarrow 5 * x$	$a_3 = 1$	+	Number of transactions	3.

Table A.1 (continued)

calculation	multiplier	impact	item	no
$1 < x < 100,000,000 \Rightarrow 2 * x$ $100,000,000 < x < 1,000,000,000 \Rightarrow 4 * x$ $1,000,000,000 < x < 100,000,000,000 \Rightarrow 6 * x$ $x > 100,000,000,000 \Rightarrow 10 * x$	$a_4 = 1$	+	Aggregate Amount of transactions	4.
If NPL > 0 \Rightarrow NPL * x	$a_5 = \pm 2$	+/-	Loans Credit scoring of central bank	5.
Amount of Bad cheque * X	$a_6 = \pm 2$	+/-	Cheque inquiry system of central banks	6.
1. borrower 2. current account holder 3. shareholder 4. point of sale holder 5. corporate 6. private customer 7. individual customer 8. personnel of bank and its affiliates	$a_7 = 2$	+	Customer segmentation	7.
$1 < x < 100,000,000 \Rightarrow 2 * x$ $100,000,000 < x < 1,000,000,000 \Rightarrow 4 * x$ $1,000,000,000 < x < 100,000,000,000 \Rightarrow 6 * x$ $x > 100,000,000,000 \Rightarrow 10 * x$	$a_8 = 2$	+	Transfer inside of social network	8.

$$\begin{aligned}
 \text{Success Credit} = B(x) = & b_1 \text{successful projects as entrepreneur} + \\
 & b_2 \text{successful projects as funder} + b_3 \text{successful projects as guarantor/} \\
 & \text{supporter/voter/guardian} + \\
 & b_4 \text{unsuccessful projects as entrepreneur} + \\
 & b_5 \text{unsuccessful projects as funder} + \\
 & b_6 \text{unsuccessful projects as guarantor/supporter/voter/guardian}
 \end{aligned}$$

Table A.2: Calculation of Multipliers in Success Credit.

Calculation	multiplier	impact	item	no
x * no	$b_1 = 8$	+	Number of successful projects as entrepreneur	1.
x * no	$b_2 = 2$	+	Number of successful projects as funder	2.
x * no	$b_3 = 2$	+	Number of successful projects as guarantor/supporter/voter/ guardian	3.
x * no	$b_4 = -10$	-	Number of unsuccessful projects as entrepreneur	4.
x * no	$b_5 = -5$	-	Number of unsuccessful projects as funder	5.
x * no	$b_6 = -3$	-	Number of unsuccessful projects as guarantor/supporter/ voter/guardian	6.

$$\begin{aligned} \text{Participation.Credit} = C(x) = & c_1 \text{ Funding in charities} + \\ & c_2 \text{ Funding as Qard Hassan Loan} + c_3 \text{ Reward base funding} + \\ & c_4 \text{ Investment in successful projects} + \\ & c_5 \text{ Investment in unsuccessful projects} \end{aligned}$$

Table A.3: Calculation of multipliers in Participation credit.

calculation	multiplier	impact	item	no
Fund(i)/total fund * X	$c_1 = 5$	+	Funding in charities	1.
Fund(i)/total fund * X	$c_2 = 4$	+	Funding as Qard Hassan Loan	2.
Fund(i)/total fund * X	$c_3 = 4$	+	Reward base funding	3.
Fund(i)/total fund * X	$c_4 = 2$	+	Investment in successful projects	4.
Fund(i)/total fund * X	$c_5 = -1$	-	Investment in unsuccessful projects	5.

$$\begin{aligned} \text{Social Credit} = D(x) = & d_1 \text{ Friend invitation} + d_2 \text{ blogging} + \\ & d_3 \text{ Blogging on new projects} + d_4 \text{ Voting to projects} + \\ & d_5 \text{ Message in social network} + d_6 \text{ Voting to other users} + \\ & d_7 \text{ Participation in marketing campaigns} + d_8 \text{ Answering to the questions} + \\ & d_9 \text{ Photo/video/posts} + d_{10} \text{ Start of membership} + \\ & d_{11} \text{ Financial transactions in social network} \end{aligned}$$

Table A.4: Calculation of Multipliers in Social Credit.

calculation	multiplier	impact	item	no
Invited friends no * X	$d_1 = 1$	+	Friend invitation to the social network	1.
Blogging no * X	$d_2 = 2$	+	blogging	2.
Blogging no * X	$d_3 = 2$	+	Blogging on new projects	3.
Voting no * X	$d_4 = 2$	+	Voting to projects in social network	4.
Message no * X	$d_5 = 0.1$	+	Message in social network	5.
Voting no * X	$d_6 = 1$	+	Voting to other users	6.
No * X	$d_7 = 1$	+	Participation in marketing campaigns	7.
No * X	$d_8 = 2$	+	Answering to the questions of other users	8.
No * X	$d_9 = 0.5$	+	Photo/video /posts	9.
10	$d_{10} = 10$	+	Start of membership in social network	10.
Transaction no * X	$d_{11} = 2$	+	Financial transactions in social network	11.

Table A.5: General multipliers.

parameter	multiplier	Title
A	3	Banking credit
B	6	Success credit
C	4	Participation credit
D	1	Social credit
Fame = $A(x) * 3 + B(x) * 6 + C(x) * 4 + D(x) * 1$		

So, as a one look formula we can have Fame as below:

$$\begin{aligned}
 \text{Fame} = & 3(a_1 \text{ Average of accounts} + a_2 \text{ Balance of Account} + \\
 & a_3 \text{ Number of transactions} + a_4 \text{ average of amounts} + \\
 & a_5 \text{ Loan credit scoring} + a_6 \text{ Check inquiry rating of CBI} + \\
 & a_7 \text{ customer segmentation} + a_8 \text{ money transfer inside famedfund.com}) + \\
 & 6(b_1 \text{ successful projects as entrepreneur} + b_2 \text{ successful projects as funder} + \\
 & b_3 \text{ successful projects as guarantor/supporter/voter/guardian} +
 \end{aligned}$$

b_4 unsuccessful projects as entrepreneur + b_5 unsuccessful projects as funder +
 b_6 unsuccessful projects as guarantor/supporter/voter/guardian)
 $4(c_1$ Funding in charities + c_2 Funding as Qard Hassan Loan +
 c_3 Reward base funding + c_4 Investment in successful projects +
 c_5 Investment in unsuccessful projects) + (d_1 Friend invitation +
 d_2 blogging + d_3 Blogging on new projects + d_4 Voting to projects +
 d_5 Message in social network + d_6 Voting to other users +
 d_7 Participation in marketing campaigns + d_8 Answering to the questions +
 d_9 Photo/video/posts + d_{10} Start of membership +
 d_{11} Financial transactions in social network)

Appendix B

Table A.6: List of some Successful Crowdfunding Sites in Conventional Finance.

Name	URL	Type	Funding	Fee	Function	Country
AngelList	http://www.angel.co	Equity and Debt	AoN	Free	Startups	All
BankToTheFuture	http://www.banktothefuture.com	Equity, Debt, and Pledge	AoN	5% + \$2,785.12	Small Business	UK
CircleUp	http://www.circleup.com	Equity	AoN	Variable	Small Business	All
CrowdCube	http://www.crowdcube.com	Equity and Pledge	AoN	5% + \$2,785.12	Small Business	UK
CrowdSupply	http://www.crowdsupply.com	Pledge and Retail	AoN	8%	Retail Products	USA
EquityNet	http://www.equitynet.com	Equity	AoN	\$69+/month	Small Business	US
Fundable	http://www.fundable.com	Equity and Pledge	AoN	3.5% + Monthly Fee	Small Business	All
FundedByMe	http://www.fundedbyme.com	Equity and Pledge	KiA	5%	Small Business	Sweden
FunderHut	http://www.funderhut.com	Pledge	AoN or KiA	5% or 7.5%	Small Business	US
Fundly	http://www.fundly.com	Pledge	AoN or KiA	5.9–7.9% + Monthly Fee	Charity	All
FundRazr	http://www.fundrazr.com	Pledge	KiA	7.2% + \$0.30/transaction	Everything	Canada
GoFundMe	http://www.gofundme.com	Pledge	AoN or KiA	7.9% + \$0.30/transaction	Charity	All
IndieGogo	http://www.indiegogo.com	Pledge	AoN or KiA	4% or 9%	All	All

Table A.6 (continued)

Name	URL	Type	Funding	Fee	Function	Country
Innovestment	http://www.innovestment.de	Equity	AoN	8%	Small Business	Germany
Invesdor	http://www.invesdor.com	Equity	AoN	1% + VAC	Small Business	Northern Europe
Kickstarter	http://www.kickstarter.com	Pledge	AoN	8–10%	Creative	All
Kopernik	http://www.kopernik.info	Other	AoN	12–13%	3rd World Technology	All
Lending Club	http://www.lendingclub.com	Equity and Debt	AoN	1.11–5% + Processing Fees	Small Business	All
Mosaic Inc.	http://www.joinmosaic.com	Debt	AoN	1% a year	Solar Energy	All
Peoplefund.it	http://www.peoplefund.it	Pledge	AoN	8%	Creative	UK
PledgeMusic	http://www.pledgemusic.com	Pledge	KiA	15%	Music	All
Pozible	http://www.pozible.com	Pledge	AoN	6.4–8.4% + \$0.30/transaction	Creative	Australia
Prosper Marketplace	http://www.prosper.com	Debt	AoN	0.5–4.95%	Personal Loans	All
RocketHub	http://www.rockethub.com	Pledge	KiA	8–12%	All	All
Seedrs	http://www.seedrs.com	Equity and Debt	AoN	7.50%	Small Business	UK
Seedups	http://www.seedups.com	Equity	AoN	5%	Startups	USA, Ireland, UK
Sellaband	http://www.sellaband.com	Pledge	AoN	Free	Music	All
Sponsume	http://www.sponsume.com	Pledge	KiA	4%	Creative	All

Table A.6 (continued)

Name	URL	Type	Funding	Fee	Function	Country
Upstart	http://www.upstart.com	Debt	AoN	3% of raised, 1.5% of returns	Post-College Investment	All
YouCaring	http://www.youcaring.com	Pledge	KiA	2–3% + \$0.30/transaction	Charity	All
Zopa	http://www.zopa.com	Debt	AoN	Variable Borrowing Fee	Personal Loans	UK

Appendix C

Example of Islamic crowdfunding

Shekra is a crowdfunding platform and the first example of shariah-compliant equity-based crowdfunding (in Egypt) that links a closed network of investors with potential startups and companies. The idea of *Shekra* was born from the combination of two fields: *Islamic finance* and *startups*. Since the revolution, the entrepreneurial ecosystem has been very weak and access to funding very difficult. Therefore, the connection of entrepreneurs and investors can be beneficial for both, and have a positive impact on the social and economic development of the region.

Structure of *Shekra*:

- *Shekra* targets the segment of projects that need funding from between \$50,000 and \$300,000
- seeking to connect creative people with investors willing to invest in them
- *Shekra* enables its network members to distribute network member capital among multiple startups and minimize the overall risk by diversified portfolio.
- Potential startups are assessed based on an internal screening process.
- If the startups pass the screening phase, they sign an Entrepreneur Agreement with *Shekra*; if they lack essential skills or requirements, they can be supported to become *Shekra*-eligible.
- As soon as the startup becomes ready for the crowd, it will be posted on the *Shekra* Portal and promoted through their social media network services.

A short summary and the current funding status will be public, but access to details of the startup and its underlying concepts and ideas will only be available to investors within the *Shekra* Network.

- *Funding* is considered *successfully* completed when the target fund of a company is fully attained within the specified timeline, generally 60 days.
- Reports, progress, and monitoring will be on-line and payments mostly off-line.
- A minimum fee is charged to the startups for *Shekra*'s services, which include business plan support, due diligence, and monitoring.

Shekra defines itself as “Shariah-compliant”. *Shekra* wants to be sharia compliance through quality in order to develop a business model that is based on ethical principles and social responsibility.

- From a sector perspective, projects are required to obey Islamic principles and startups and companies are not allowed to raise additional capital in an interest-based or non-Shariah-compliant manner.

- From a legal perspective, investors take an equity stake in the project and gain returns based on the PLS principle, which ensures a fair distribution between shareholders and entrepreneurs.

Therefore, Shekra provides specific Shariah screening and legal formalities. In addition, once an idea attracts capital, Shekra acts as a partner and takes an equity stake in the projects, which ensures its long-term commitment, given the fact that the success of the projects is coupled with their own success. Shekra's seven founders have backgrounds in academia, venture capital, information technology, commercial law, aviation, sustainable development, green entrepreneurship, innovation, capacity building, investment, and banking. Shekra's future prospects are bright. So far, it has received about 150 projects, from which three were be selected for the first round. This large number of applications shows a great interest on the part of both startups and companies. Actually, the platform was limited initially to technology, but demand in other areas, such as services, industry, and agriculture, was so great that this limitation was dropped.

Appendix D

Crowdfunding impact in developing country

North America has the highest position in crowdfunding investment nowadays and forecasting shows that the volume of investment through crowdfunding is more than 10 billion dollar, UK and European countries has the next positions in crowdfunding.

But it is growing in developing countries as well. 2015 was an important year for crowdfunding in emerging markets, continuing its growth in both the number of platforms formed and the amount of money raised for campaigns. More important than the numbers, however, is the fact that the successful campaigns are having a real impact on the ground. Nowhere was this more apparent than in Nepal, where a devastating earthquake (and its aftershocks) killed over 8,500 and affected 5.6 million people in April. Hundreds of crowdfunding campaigns quickly sprung up on platforms like Indiegogo, CrowdRise, and GlobalGiving, allowing individuals to send money to their family members, diaspora groups to support their communities back home, and donors from around the world to pledge money to those affected by the disaster. International donors pledged millions of dollars to the cause, with early appraisals estimating over \$23 million raised. The global community came together later in the year as the Syrian refugee crisis once again pushed people to give. The crowd raised millions of dollars for those affected, with Kickstarter notably dropping its policy of not fundraising for charitable causes to raise \$1.7 million on its own. Against a backdrop of despair, crowdfunding offered a glimmer of hope, as evidenced by the story of Abdul Halim al-Attar, a single father who was photographed selling pens in Beirut while carrying his sleeping daughter on his shoulder. A campaign to help alAttar raised over \$185,000, which he used to start three businesses that now employ 16 refugees. With natural and manmade disasters unlikely to abate in the immediate future, we believe crowdfunding can be effective in helping those who are affected. Crowdfunding is well-suited for rapid response relief efforts as campaigns are highly localized and can be created in minutes. Crowdfunding also encourages more transparent evaluation methods, with campaign owners being accountable to the backers – the more the campaign creators update backers and show proof of the money’s impact, the more other backers will be encouraged to donate. In 2015, we learned just how big of an impact crowdfunding can have on disaster relief.

2015 was a highly successful year for crowdfunding in the developing world. In this section, we take a closer look at the previous year. We should not be surprised to find India, Philippines, Nepal, Mexico, and Kenya occupying the top five spots in terms of the amount of money raised in 2015.

India is an emerging leader in the crowdfunding world, and platforms there (especially in urban areas) have developed innovative solutions like cash pickups to accommodate the country’s cash on delivery culture. With the India’s regulators

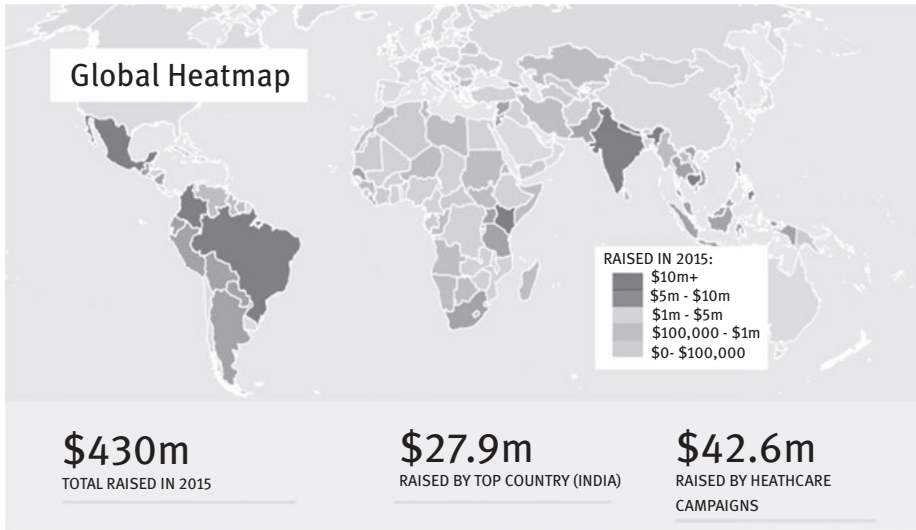


Figure A.1: Crowdfunding Distribution.
Source: own illustration.

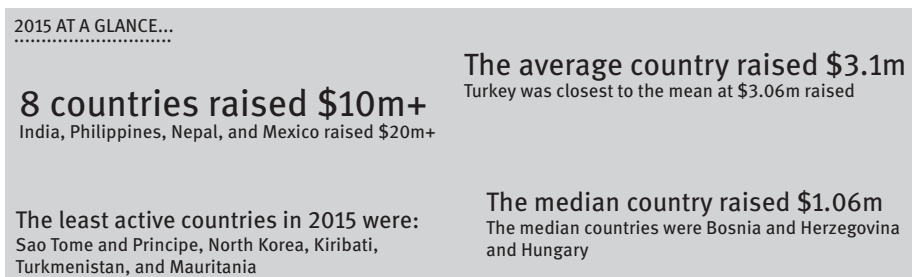


Figure A.2: Crowdfunding in Global.
Source: own illustration.

considering equity crowdfunding regulations, the nation's crowdfunding outlook is very bright going into 2016. The Philippines benefits from a wellconnected diaspora community, who fund projects back home. Nepal's high amount raised reflects the global outpouring of support following the disastrous earthquake that devastated the country in the spring. Mexico, for its part, is a highly entrepreneurial country, whose innovators have embraced the novel funding mechanism. Kenya, a mobile money pioneer, benefits from the work done by Kiva, as well as other platforms, to channel funds to the country's entrepreneurs. The top categories reflect some of the key trends in 2015. Health and housing campaigns, for example, are indicative of the crowdfunding dollars sent to campaigns aiming to

Top Countries

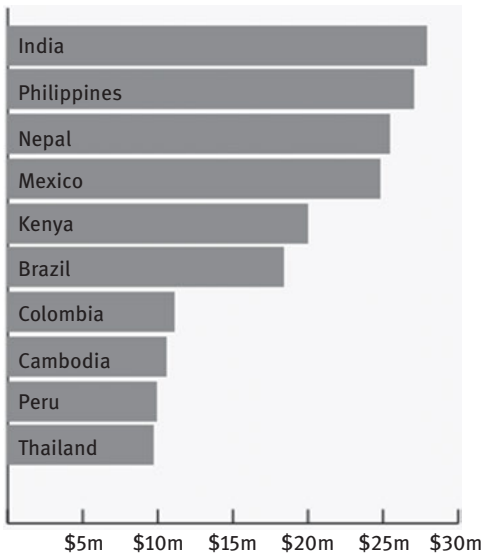


Figure A.3: Top Country in Usage of Crowdfunding.
Source: www.alliedcrowds.com.

help refugees. Agriculture campaigns, on the other hand, are popular on Kiva, one of the largest players in this space. Given the needs of the disadvantaged and the entrepreneurs in the developing world that are turning to crowdfunding, it is hardly surprising that the top two models in 2015 were donation- and lending-based crowdfunding, accounting for over 80% of the amount raised. In 2016, we expect these models to continue to lead the way, with equitybased campaigns increasing their share as governments create appropriate regulations for the sector.

In 2016, Asia is expected to keep its slight lead over the Americas as the top developing world crowdfunding region. In addition to the equity crowdfunding regulations that are being passed within the region (see section below), Asia is home to one of the emerging global crowdfunding leaders: India. Characterized by a young and tech-savvy population, as well as a growing middle class, Asia has truly tremendous crowdfunding potential. The Americas and Africa, however, are not far behind. With the continuing spread of crowdfunding campaigns, regulations, and entrepreneurs leading to mainstream awareness, crowdfunding is primed for a fruitful 2016 in emerging markets.

The global crowdfunding industry has come from humble beginnings to grow into a multi-billion industry in just a few years. Emerging markets are currently behind the rest of the world, making up just a fraction of the total amount raised in

Top Regions in 2016

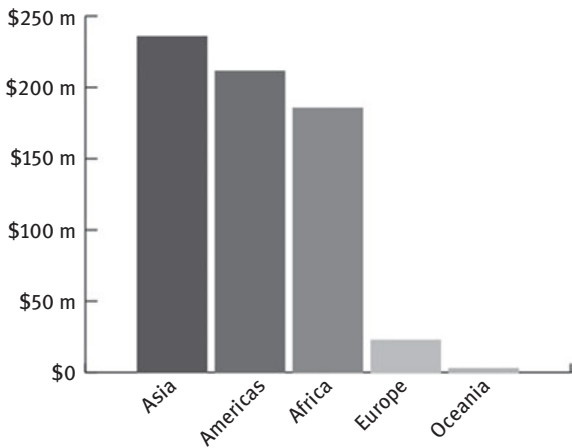


Figure A.4: Top Region.
Source: own illustration.

2015 (shown by the red sliver on the chart). But we believe the developing world is poised to make strong gains in the coming years, mirroring the progress in the developed world.

Global Crowdfunding Growth 2009–15

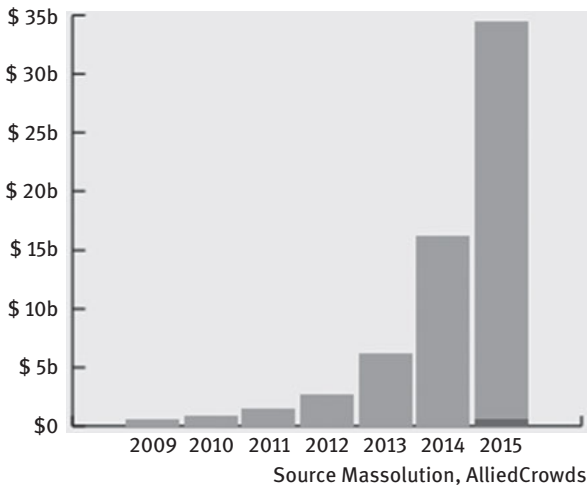


Figure A.5: Global Crowdfunding Growth.
Source: own illustration.

As highlighted throughout this report, equity crowdfunding has tremendous growth potential in the New Year. In 2016, we forecast equity crowdfunding campaigns to raise nearly \$80m, outpacing the growth of the wider crowdfunding industry (53% vs. 60%).

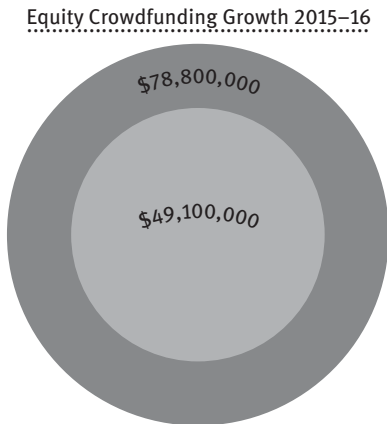


Figure A.6: Equity Crowdfunding Growth.
Source: Annual report, AlliedCrowds (2016),
“Developing World Crowdfunding, Prosperity through
crowdfunding”, p. 5.

Allied Crowd (2016), argue about Crowdfunding in this way that, both financial and non-financial, can play an important role in promoting the growth of the renewable energy industry in developing nations and recently released a report analyzing the crowdfunding efforts of developing countries. The report found that these 138 countries had raised \$430 million in 2015 with a forecasted \$660 million to be raised in 2016. The average amount raised per country was only \$3.1 million, yet India, the Philippines, Nepal, and Mexico each raised above \$25 million. Evidently these are small numbers when compared to the size of the crowdfunding industry around the world. However, it is exciting to see that this form of financing and investing is growing quickly, even in developing countries. (annual report, Allied Crowds 2016).¹

With support from governments and development organizations, crowdfunding could become a useful tool in the developing world as well. Crowdfunding is still largely a developed-world phenomenon but its potential to stimulate innovation and create jobs in the developing world has not gone unnoticed. Substantial reservoirs of entrepreneurial talent, activity, and capital lay dormant

In many emerging economies, even as traditional attitudes toward risk, entrepreneurship, and finance stifle potential economic growth and innovation.

¹ Annual report, AlliedCrowds (2016). “Developing World Crowdfunding, peosperity through Crowdfunding”.

The other topic in implementation of crowdfunding which is so important is education. Education of people in the community to know about the potential of crowdfunding. Developing economies have the potential to drive growth by employing crowdfunding to leapfrog the traditional capital market structures and financial regulatory regimes of the developed world. While many developing economies may have the potential to capitalize on this new funding mechanism, those that wish to implement crowdfunding ecosystems need to learn from the initial developed world experience to understand how crowdfunding functions, the “light touch” role that government and regulation should play, and the technological infrastructure requirements involved. Developing countries that manage this process successfully may be able to leapfrog the developed world, in both a regulatory and economic sense, by creating frameworks for early-stage finance that facilitate entrepreneurship, the fostering of innovative technology enterprises and the emergence of new competitive industries. It may be possible for developing nations to use emerging technology and business processes – including mobile technology, social media, lean-start-up methods of company formation, and crowdfund investing – to implement more efficient and effective entrepreneurial funding systems that are more advanced than the legacy systems prevalent in the developed world. This may influence more active angel investors and open up deal flow to a much wider audience that can more efficiently review broader investment opportunities. Countries that want to adopt crowdfunding must not only create enabling policy, but also, in some cases, address policies and regulations that currently make it burdensome to enter into, conduct, and end business operations (World Bank report)².

They can make a significant contribution. Instead of seeing these new platforms as a threat, they should proactively facilitate the growth of these networks. Either through direct funding or partnerships, financial services firms in developing markets can accelerate the crowdfunding phenomenon. Such participation might also benefit these firms in the form of new knowledge about trends, and expand opportunities to provide more traditional financial services to the newly successful entrepreneurs and business people. (Crowdfunding in developing countries: A catalyst for entrepreneurship and innovation Posted by Val Srinivas, Banking & Securities research leader, Deloitte Services LP, on October 8, 2014)³

² Crowdfunding’s Potential for the Developing World. 2013. infoDev, Finance and Private Sector Development Department. Washington, DC: World Bank.

³ <https://quicklookblog.com/2014/10/27/crowdfunding-in-developing-countries-a-catalyst-for-entrepreneurship-and-innovation/>.

Some examples of crowdfunding in different countries

We finally reviewed some successful experiences of crowdfunding frameworks in different countries in this part.⁴

The State of Crowdfunding in Austria

The Austrian crowdfunding market is slowly turning from a small market niche to a serious alternative to the traditional financing. The change owes its development to the introduction of a new legal framework, which came into effect in Austria on 1 September 2015. Since then, the number of crowdfunding projects and crowd based business models have increased rapidly.

Volumes

- Due to a blurred difference between online and offline fundraising, there is no data on *donation-based* crowdfunding.
- The *reward-based* market can be estimated for 2015 on €2.5 million.
- *Equity-based* crowdfunding started in 2013. Since then 70 projects have raised €11.1 million in funding. With six active equity platforms, in 2015 alone €8.1 million was raised.
- *P2P lending* is the fastest growing crowdfunding model.
- There are no exact numbers, but some businesses raised millions with this model, e.g. the company “Grüne Erde” leveraged €7.7 million via their customers.

Banks & Investors

Some of the large banks in Austria have their own reward-based or donation-based crowdfunding platforms. Overall, the banking sector becomes more and more interested in crowdfunding, as it can be seen as a valuable tool for risk minimization. In economically difficult times when banks may not be lending freely, equity-based crowdfunding may be a viable alternative for raising capital for start-ups and small businesses, and especially to combine these investments with traditional financing instruments.

The State of Crowdfunding in Belgium

Crowdfunding in the Belgian market is slowly but surely becoming a viable alternative for funding. Belgium can be considered a latecomer in the industry, but is

⁴ Current State of Crowdfunding in Europe An Overview of the Crowdfunding Industry in more than 25 Countries: Trends, Volumes & Regulations (2016); www.sbs.ox.ac.uk.

showing each year, a growth of approximately 100%. The Belgian market is primarily dominated by local platforms, with some impact from international players in the reward-based category.

Volumes

- Approx. €1 million was raised by *donation-based* crowdfunding in 2015.
- *Reward-based* crowdfunding counts for €6million, however, the exact amounts from Kickstarter and Indiegogo are not included.
- Approx. €2.5 million is raised by *equity-based* crowdfunding.
- *P2P lending* is not yet permitted by the regulators in Belgium. This creates a serious hurdle in financing options for starting and especially scaling companies.

Banks & Investors

In Belgium, banks are taking an active role in the domain of crowdfunding. However, banks have taken a different position. KBC bank has launched its proprietary platform for crowdfunding. Since their launch in 2014, they have funded 5 projects (at the end of 2015). BNP bank has a dual approach: they are partner to an equity crowdfunding platform, but have launched a reward-platform on their own brand. The attitude of investors is changing towards crowdfunding and investing in startups in general. One of the explanations for this is that platforms have a better selection and flow of projects. A second reason is the launch of the Belgian tax shelter: this new fiscal instrument allows deduction of 30 to 45% of the invested amount from taxes, with a maximum of 100k€ per month and only for specific companies. This measure is comparable to the UK's Seed Enterprise Investment Schemes and Enterprise Investment Schemes Measures. A third reason is that a growing number of business angels are spreading their investments from individual tracking and negotiations, to investments via crowdfunding platforms. This is a trend that is expected to further increase, comparable to evolution in countries such as UK where nearly 50% of seed investments are done via crowdfunding platforms.

The State of Crowdfunding in Croatia

From the Croatian perspective, crowdfunding is currently a big challenge. The greatest weaknesses are a small overall awareness of the possibility of crowdfunding, low use of Internet, poor development and mistrust of e-business. But still, in Croatia there is a clear interest in crowdfunding. Every year there is a slow progress in the amount of campaigns backed, started or successfully produced and funded by Croatians.

Volumes

- There are no data available for donation-based crowdfunding.
- The first reward-based crowdfunding campaign launched in 2011. The number of campaigns have increased in the following years, while the total collected yearly amount has doubled to €6.6 million in 2015.
- P2P lending is under strict regulation that makes the whole procedure complicated and expensive.

UNDP Croatia

UNDP Croatia came to the crowdfunding scene with its campaign for the Energy independent school Ostrog in Croatia at Indiegogo. After being successfully funded, UNDP Croatia recognized crowdfunding as a source for funding relevant social causes. It continued its work in crowdfunding with the Citizenergy project, aimed at creating a crowdfunding platform that will connect different campaigns related to renewable sources of energy in the world at one place. In 2015 UNDP started the first educational program on campaign production in Croatia – Crowdfunding Academy, in partnership with the social enterprise Brodoto, marketing agency for non-profits. Crowdfunding Academy currently mentors several crowdfunding campaigns in Croatia and keeps being one of the main crowdfunding promoters and educators in Croatia. In the end of 2015, the Academy had also reached a wider scope by creating a global educational program for UNDP offices around the world. The focus of that project was also on other alternative ways of financing, including alternative currencies, forecast-based financing, community bonds. Hence, UNDP has broadened its work and is, along with currently strengthening the crowdfunding scene in Croatia, working on world-wide alternative financing projects.

The State of Crowdfunding in Czech Republic

Among all forms of crowdfunding, currently the most common form is reward-based crowdfunding, which has existed in the Czech Republic for four years now and is growing every year. For example, the Hithit platform raised 80% more funds in 2015 than in 2014. The second most used form of crowdfunding in the Czech Republic (that is actually not publically perceived as a form of crowdfunding), is P2P consumer lending. It accelerated during 2015 when Zonky.cz was launched. This platform has built its public recognition on the emphasis that people who do not match the criteria of banks should nevertheless have a chance to get a loan. SymCredit and Pujcmefirme represent Czech P2P business lending. These platforms are slowly gaining the trust of the public Equity crowdfunding has not been an active form of financing in the Czech Republic so far. Just one campaign has been successfully funded.

Volumes

Despite a growing number of platforms and volumes generated, there has been no research in the Czech Republic to date. Consequently, the total numbers given below serve only as an illustration of the overall traffic and popularity of crowdfunding.

- In 2015 *reward-based* crowdfunding has raised approximately €1.7 million.
- *Equity-based* crowdfunding has only seen a €28,000 transaction, when Panezdroj platform sold its own equity. With the launch of Fund lift in 2016, the market is expected to grow.

Banks & Investors

Banks have not made any significant steps yet towards becoming an active player in the crowdfunding industry, as they might not consider it as a real opportunity or a competitor. One of the Czech branches of Raiffeissen bank tried unsuccessfully to run its own reward-based crowdfunding platform called “Odstartováno”. The successful exception is the direct investment from credit company Home Credit to Zonky P2P consumer lending platform. HomeCredit wanted to diversify its credit activities into trendy P2P loan financing. Investors have been mostly investing in Czech P2P consumer loans on Bankerat, Benefi or Zonky. Zonky has gained the biggest attention from the investors, as they have several thousand people queuing for investing into the loans on the platform. Investing in loans on the Zonky platform is significantly different from the other platforms because investors have to manually pick each of the projects they want to invest in. Czech investors are currently also investing on several international P2P platforms as Bondora, Mintos or Twino.

The State of Crowdfunding in Estonia

Estonia is a European frontrunner! Crowdfunding started in 2009 with a local P2P consumer lending platform called isePankur (now Bondora). In 2015, Estonia ranked second in Europe on total volume per capital. Although the Estonian market is only 1M+ people it has the potential to grow by virtual Estonians – attracted by the e-residency program that was recently launched by the Estonian government.

Volumes

Despite being ranked as second in Europe on total volume per capital, there are no exact statistics available on the total volume of the Estonian crowdfunding industry for 2015.

- *The donation based* crowdfunding platform Swedbank raised €1,1 million to date.
- *Since its launch in 2012, the reward-based* crowdfunding Hooandja.ee raised a total of €1.3 million.

- The first *equity-based* platform was officially launched in August 2015 and has raised €260,000 so far.

Banks & Investors

Banks have been mostly watching from the sides. Most banks operating in Estonia are subsidiaries of big Scandinavian banks. The exception is LHV bank, small relatively new and first in Estonia to experiment with coloured coins, cooperating with fintech star Transferwise (speeding up transfer and decreasing exchange rates). Some additional alternative financial players are offering payment and cards (Pocopay) and even a new credit institution has entered the market (Cofi under the trademark Inbank). Swedbank has been promoting crowdfunding both rewards and equity type and run their own donation platform – they've risen €1.1 million €so far – €0.8 million on the bank's side and €0.3million on the people's side. The banks have mixed feelings towards crowdfunding, according to the CEO of Crowdstates, Swedbank refuses to place any funds into real estate projects that have any sort of crowdfunding elements. Investor attitudes depend on their knowledge of investing and background. Newer investors usually start expanding their portfolio with crowdfunding and are optimistic about it while seasoned investors are mostly still cautious. Many sites probably wouldn't survive a more severe downturn with lost investor confidence and loan payments being delayed, or higher delinquency rates. At least in case of equity-based crowdfunding the site-related risks are taken out of the equation when the projects are funded.

The State of Crowdfunding in Finland

As in every other country, in Finland crowdfunding is an amoeba-like creature without a clear definition. Although not fully developed, the market's covers donation and rewards-based, as well as lending and investment-based crowdfunding. This makes it difficult for the general public to make a distinction between donations and investments, posing thus a challenge on the financial markets player. Legal status on investment-based crowdfunding is not clear either. A law on investment-based crowdfunding (equity and debt) is being prepared and is likely to enter into force in July 2016.

Volumes

There is little data available about the crowdfunding industry in Finland. On the platform of Invesdor, equity-based crowdfunding, €7 million was raised in 2015. A quadrupling since the volume in 2014 was only €1.4 million.

Banks

Banks' attitude towards lending and investment-based crowdfunding has changed dramatically within a few years. First, they were contemptuous. Then, they required a level playing field. Now the attitude is more of a cooperative kind – disrupt or be disrupted. Banks have realized that not only is crowdfunding a serious business but also, a threat to the conventional financial services business.

The State of Crowdfunding in France

France is among the first countries to embrace crowdfunding, with the first platforms (reward-based and lending without interest) launched in 2007/2008. Today, France counts for about 140 platforms. Since 2013 volumes in crowdfunding have been doubling. Despite witnessing a slowdown, donation and reward-based are still the most popular forms of crowdfunding, gathering around 80% of the fund providers. The lending platforms are growing rapidly due to the new regulation that enables an individual to lend with interest to an enterprise.

Volumes

Total amount raised in 2015 is nearly €300million, broken down into:

Donation-based crowdfunding: €8.3 million

Reward-based crowdfunding: €41.9 million

P2P consumer lending: €137.5 million

P2P business lending: €31.6 million (credit) & €24.1 million (bonds)

Equity-based crowdfunding: €50.1 million⁵

Banks & Investors

After a time of wait and doubt, the banks are slowly looking at crowdfunding with interest and close partnerships. The types of partnerships can be very different:

- Banks are forwarding projects to platforms they can't finance themselves in order to provide solutions for their clients' needs (e.g. Crédit Coopératif with Wiseed), some banks are launching and investing in crowdfunding platforms (Crédit Mutuel Arkéa and Prêt d'union).
- Sometimes they are lending to small and medium enterprises on crowdlending platforms (Groupama Bank and Unilend) or financing projects selected from reward crowdfunding platforms.

⁵ Source: Financement Participatif France, Baromètre du Crowdfunding 2015 by Compinnov.

- There are also examples of banks assessing the credit risks for financiers (SPEAR and Société Générale). Some are involved in the selection of the projects that can be financed on crowdfunding platforms (BNP Paribas and Wiseed).

The State of Crowdfunding in Germany

The first reward-based crowdfunding platforms in Germany started in 2010. This was when the term “crowdfunding” was brought to the broader public. Prior to that there were already some lending- and donation-based platforms on the market. A year later in 2011 equity-based crowdfunding started to evolve with the financing of startups. Over the next couple of years many crowdfunding platforms of different types entered the market, not all of them are still active. Today you can find more than 60 active platforms that have an operational base in Germany.

Volumes

No data is available for donation-based crowdfunding. Für Gründer reports the following volumes in 2015:

- Reward based crowdfunding: €9.8 million
- P2P consumer & business lending: €66.8 million
- Equity based crowdfunding: €37.3 million
- Crowdfunding.de reports that € 48.9 million is raised on equity-based platforms.

Appendix E

Famefund.com is a new equity-based crowdfunding website which is developed the idea of “Fame” in real situation. Some important pages are available here. You can explore it more through www.famefund.com.

Home | Project | Profile | Tweets | Sign Up | Login

Parham Alavi
 ★★★★★
 Last log in: 20/05/2015
 Participation in projects: 20
 457 Projects | 253 Following | Follower

Fame

Success : 460 Crowdfunding : 600
 Social Credit : 390 Bank Credit : 640

My friends (63) 9830 Total Fame:

	376 Fame
	412 Fame
	643 Fame
	637 Fame

All Friends

Friendship Requests

	Accept Request
	Accept Request

My Groups (2)

	436 Fame
	436 Fame

Membership Requests

	Membership Request
	Membership Request

Future Events

	436 Fame
	512 Fame

Popular Tweets

- #Wallet
- #Investment
- #Smart_Lock
- #Samanak
- #Financial
- #Financial_support
- #Bank_credit
- #Financing
- #taking_part

My Fame:

Daily Fame - 2015

Select the item to view the details of the fame

Daily Fame Details

Select the item to view the details of the fame

Detail of Bank Credit

Fame	Title
690	Clustering Customers
666	Customer Validation in Related System
684	Customer Tag

To see how to calculate the rating, [Click here.](#)

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- Arash Zahedi 138 Fame
- Mansour Baraki 678 Fame
- Mina Gardeshi 951 Fame
- Babak Ardalan 408 Fame

[More Detail](#)

#BoltivateLock allows you to monitor, lock and secure your home from anywhere in the world using your **smartphone** device.

It is the only product that is compatible with your pre-existing deadbolt lock that creates a wireless lock. Boltivate will notify you of any disturbances via an email and phone call, asking "Are you safe?" If the answer is yes, no action will be taken. However, if you are not safe, Boltivate will immediately alert the police.

LockDown allows you to lock all connected devices at one time with a push of a button. Simply log in to the Boltivate application, click LockDown, and initiate the LockDown. The LockDown alarm is initiated, and if any disturbances occur while you are away, you will be immediately notified via phone notification and email. Leave your home in comfort knowing your home is safe and secure.

Having 24/7 live support is an absolute essential at Boltivate. We believe that if our customer's can't contact us at anytime of the day, no matter what the circumstances are then we have failed. No matter what time it is, or what day it might be, we are dedicated to serving our customers no matter what.

LockDown allows you to lock all connected devices at one time with a push of a button. Simply log in to the Boltivate application, click LockDown, and initiate the LockDown. The LockDown alarm is initiated, and if any disturbances occur while you are away, you will be immediately notified via phone notification and email. Leave your home in comfort knowing your home is safe and secure.

Questions, comments or concerns? Contact our support team that is available 24/7, all year round. Additionally for customers who have spent \$200+ at Boltivate, we offer Dedicated Support; this is a department with fewer calls, and shorter wait times. Dedicated Support is a "fast-pass" to speak with an agent, or get any issue resolved almost immediately.

[Follow](#) [Guarantee](#) [Pledge](#)

Popular Tweets

- #Wallet
- #Investment
- #Smart_Lock
- #Samanak
- #Financial
- #Financial_support
- #Bank_credit
- #Financing
- #Taking_part

Report date	Title	Detail
08/04/2016	Completing the first phase	Detail
22/08/2016	Second phase scheduling	Detail
20/10/2016	Completing the first phase	Detail
02/05/2016	Second phase scheduling	Detail

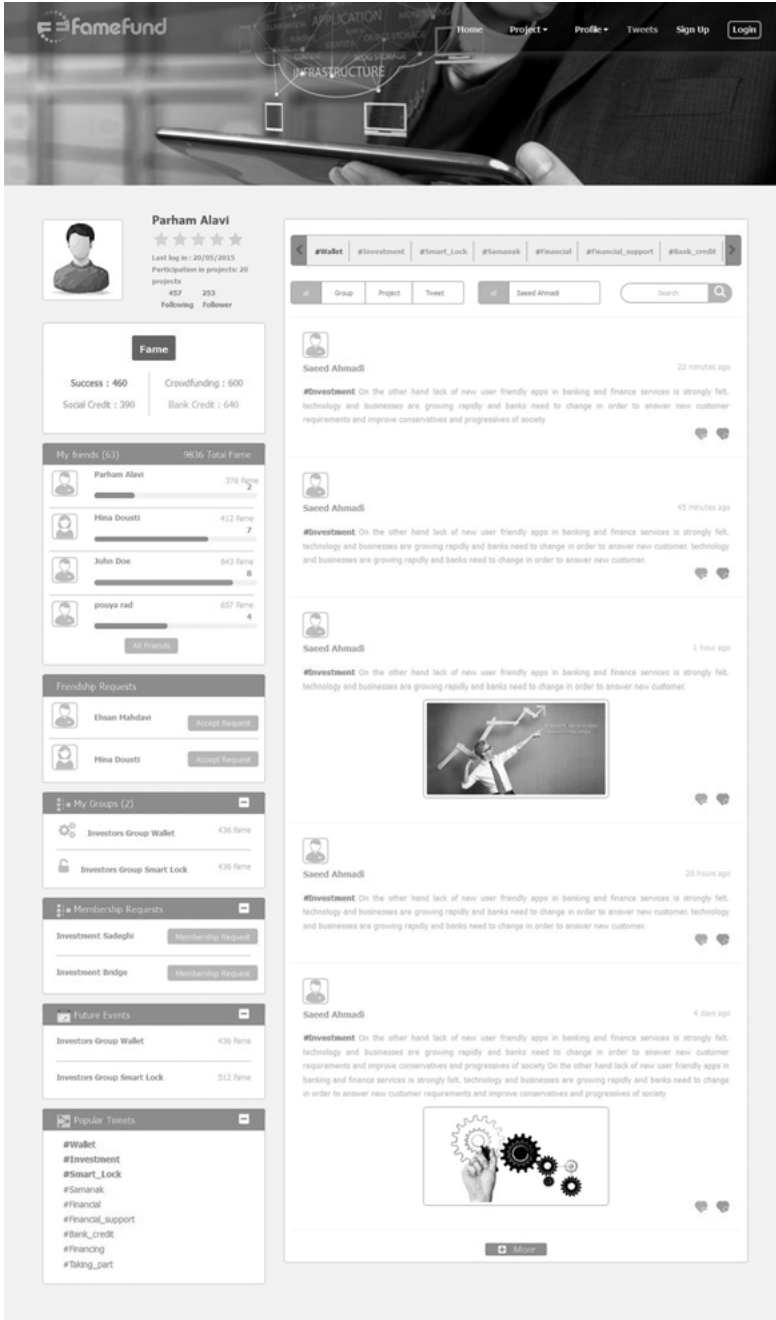


Figure A.7: Crowdfunding Profile – Activity Page. Actual screenshots from www.famefund.com. Source: www.famefund.com.

Appendix F

Details of samples for Chapter 5: proof of concept

Table A.7: Coefficients of Fame Function.

Title	Coefficient
Banking Credit	30
Social credit	10
Partnership credit	40
Success credit	60

Table A.8: Coefficients of Fame Function.

Fame Title	Effect Type	Coefficient(X)	Calculation
Participate in Equity Base Crowdfunding	+	80	(Total Pledge/Required Amount) *X*Y
ParticipateScore Detail	Coefficient(Y)		
1 \$ <= fund <= 10 \$	1		
10 \$ < fund <= 100 \$	2		
100 \$ < fund <= 300 \$	4		
300 \$ < fund <= 500 \$	8		
500 \$ < fund <= 1,000 \$	10		
1,000 \$ < fund <= 3,000 \$	14		
3,000 \$ < fund <= 5,000 \$	18		
5,000 \$ < fund <= 10,000 \$	24		
fund > 10,000 \$	30		

Table A.9: Success Credit.

FameTitle	EffectType	Coefficient	Calculation
Doing Project Successfully By creator	+	70	No*Coefficient
Doing Failed Project By creator	-	-15	No*Coefficient
Funding in success Project Fame	+	60	(Total Pledge/Required Amount)*X*Y
Funding in Failed Project Fame	-	-100	(Total Pledge/Required Amount)*X*Y

