Crowdfunding technological innovations: Interaction between consumer benefits and rewards

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ABSTRACT

This research aims to examine how consumer benefits stated in the project title and the number of rewards in the crowdfunding context interactively impact the number of backers and funding success for technological innovations. The authors collected data of 674 technological projects from kickstarter.com. Data collection was completed at two points of time, Time 1 (projects were still active) and Time 2 (funding periods were over). Findings between them were highly consistent. Two coding assignments were used. First, two independent raters assessed consumer benefits claimed in the project title; second, the research team coded the number of reward levels in each crowdfunding project and the number of rewards included in each reward level. In total, 134,492 rewards across 4509 reward levels were recorded. The authors find that the number of backers increases the likelihood of funding success. Additionally, consumer benefits increase the number of backers. The average number of rewards affects the number of backers in an inverted-U shape, and it also moderates the relationship between consumer benefits and the number of backers in an inverted-U shape.

1. Introduction

This study examines how two factors, consumer benefits and rewards, impact success in crowdfunding technology projects. While technological innovations are many corporations' strategic focus, small businesses have also contributed numerous innovative products to the consumer market. Recent examples include: Ollie, app-controlled racing robot by Sphero (sphero.com); and SPUD, high resolution portable display by Arovia (arovia.io) – both are entrepreneurial innovations in the technology sector. However, development of technological innovations requires substantial financial resources (Radas et al., 2015). A main difference between large and small businesses in terms of new product development is availability of financial resources (Antolín-López et al., 2015; Radas et al., 2015). While large firms are more likely to have stable R&D expenditure, new ventures often find it challenging to obtain sufficient financial support to convert their innovative ideas into actual products (Ahlers et al., 2015; Colombo et al., 2015). Thanks to the Internet and sharing economy, a new channel of entrepreneurial finance has emerged in recent years: crowdfunding.

Crowdfunding is defined as an open call to consumers over the Internet for financial resources in the form of monetary contribution either as donation or in exchange for rewards (Belleflamme et al., 2014). It is a new channel of micro-financing and has emerged in recent years. Those individual consumers who offer financial support to

innovation projects are called backers. Global crowdfunding raised $16.2 billion in 2014 with a growth rate of 167% (Massolution, 2015). Crowdfunding, though fairly new, has become a promising means for many entrepreneurial firms to raise monetary resources for their development and management of innovations.

Ironically, despite the fast growth of this industry, a majority of technology projects failed to reach their funding goals. According to Kickstarter, a leading crowdfunding website, over 34,000 technology projects were launched on this platform as of May 2018, but fewer than 20% of them were successfully funded (kickstarter.com). This success rate is the lowest among all product categories, underlining the challenge in crowdfunding practices for technological innovations. While technology is one of the most popular categories in the crowdfunding platform, such a low success rate leads to a practical question, which is also the motivation of this research: What factors can attract backers to support those technology projects?

Attracting backers is not an easy task. A variety of new product ideas are posted on crowdfunding websites every day, diluting backers' attention and making it even more difficult to attract backers to support those projects. Hence, the fact of too many projects but not enough backers significantly limits the likelihood of funding success. As such, a number of real-world practices have provided crowdfunding guidelines, one of which is the key role of the first impression plays in attracting backers (gladitood.com; indiegogo.com).

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Considering the backer's funding behavior as a decision-making process, it is suggested that the preliminary step of this process, which is the generation of a first impression or initial interest, can trigger his or her interest in a crowdfunding project. This effect can have a vital impact on the funding success, as it will either encourage or discourage backers to further explore more facts about a project. When a backer is browsing a crowdfunding website, the webpage does not display detailed descriptions for each project; instead, only project titles are listed as the first piece of information. A good impression will result in backers' clicking on a project title, which allows them to read more content of this project; on the other hand, a dissatisfied impression will eventually lose backer attention. Accordingly, in line with real-world practices (gladitood.com; indiegogo.com), it is suggested that the project title generates the backer's first impression, which leads to his or her initial interest. Consider two examples of project titles below.

Example One: "Social Networking APP for Android/IOS/PC" (example adopted from www.kickstarter.com)
Example Two: "Time and cost saving member administration software" (example adopted from www.kickstarter.com)

Both projects above are technological innovations, but the key difference between them is that while Example One describes the technology itself, Example Two states what it can do for consumers: time and cost saving. The latter highlights consumer benefits of this technology. Indeed, prior research has suggested that technological innovations are composed of two fundamental parts: technology and consumer benefits (Chandy and Tellis, 1998, 2000). While the technology itself reflects a technical aspect, it must be able to deliver utilities to consumers (Sorescu and Spanjol, 2008). This second component is particularly important in crowdfunding, because backers are essentially consumers over the Internet and crowdfunded technologies are consumer products. In this sense, the action of backing resembles consumer behavior. Following this logic, this study examines how consumer benefits, as a basic facet of technological innovations, stated in the project title as the first impression can affect the number of backers for technological projects in crowdfunding.

As consumer benefits mirror an implicit promise of the technology's utilities to consumers, backers are likely to seek for redeeming the benefits in their funding decision. Most technological innovations are crowdfunded via reward-based platforms, such as kickstarter.com and indiegogo.com, where backers are given rewards for their monetary support (Ahlers et al., 2015; Hobbs, Grigore and Molesworth, 2016). Rewards, which often are the product being developed, fulfill the backer's needs of redeeming consumer benefits brought by a given innovation (Ahlers et al., 2015; Mollick, 2014). As a result, this study further examines the interaction of consumer benefits and rewards, and suggests that the number of rewards moderates the relationship between consumer benefits and the number of backers.

Kickstarter was adopted as the empirical context and a total of 674 technology projects were collected at two different points of time: Time 1 – during funding period; Time 2 – when funding period ended. Based on two types of coding work respectively on project titles and rewards, it is found that consumer benefits stated in the project title increase the number of backers, and that the number of rewards moderates this relationship in an inverted-U shape and meanwhile directly affects the number of backers in an inverted-U shape. In addition, results between Time 1 and Time 2 are highly consistent, suggesting consumer benefits and rewards function steadily across the funding period.

This research contributes to extant literature in several ways. First, crowdfunding is an emerging area. In spite of increasing attention to this field, empirical research has been limited. In line with the crowdfunding research agenda (Bruton et al., 2015), this research attempts to fill in this gap and provide meaningful implications to both academics and practitioners. Specifically, backer attention to crowdfunding projects was considered as a process consisting of multiple steps, the first of

which is to generate a first impression or initial interest, which is triggered by the project title. Second, past studies of crowdfunding have not reached consensus on the role of rewards. This research attempts to resolve some of the conflicting views and give a micro look at the reward issue based on a detailed coding assignment. The interaction between consumer benefits and rewards results in an overview of backer motivation and underlines the importance of synergy between the two in the backer's funding decision. Last, previous crowdfunding studies focus primarily on social platforms such as kiva.org (e.g., Allison et al., 2015) and social projects such as healthcare, human rights, and education (e.g., Parhankangas and Renko, 2017). It is argued that their findings may not fully apply to commercialized platforms (i.e., reward-based platforms) and commercialized categories (i.e., technology). Thus, findings of this research fill in this gap.

2. Research background

2.1. Crowdfunding

Innovations are equally important to small businesses as they are to large corporations (Tanev and Bailetti, 2008). However, entrepreneurs often lack financial resources for technology development. Crowdfunding, which emerged in the past several years, is becoming increasingly popular as a channel of monetary support. Crowdfunding is defined as an open call for financial resources in the form of either donation or exchange over the internet (Belleflamme et al., 2014). This two-sided market has brought entrepreneurial firms and backers together in the online environment (Martinez and Walton, 2014; Zvilichovsky, Inbar, and Barzilay, 2015). On crowdfunding platforms, entrepreneurs are able to request contribution from backers, who are willing to offer money as donation, lending, or exchange for ownership or rewards. Based on different mechanisms in the crowdfunding system, those platforms are categorized as being donation-based, lending-based, equity-based, and reward-based (Kuppuswamy and Bayus, 2015). Technological innovations, the focus of this research, are mostly crowdfunded via the reward-based platform, which was adopted as the empirical context.

The crowdfunding industry experienced a soaring growth in the past several years (Massolution, 2015). Along with the fast-changing environment in technology-based industries, crowdfunding websites, such as Kickstarter and Indiegogo, have been enjoying popularity among entrepreneurs for their technological innovations. However, many projects on crowdfunding platforms fail to reach their funding goals (Kuppuswamy and Bayus, 2017). This is especially crucial in some crowdfunding settings where the "All or Nothing" funding rule is employed (kickstarter.com). This rule requires that project creators receive funds only when the goal is reached; otherwise, no fund will be collected at all, even if it is $1 short. This critical issue enlightens scholarly interest in the way project creators should promote their projects in order to reach their funding goals.

To study the roadmap in the crowdfunding process, researchers have identified a few factors that affect funding success. For instance, Zvilichovsky et al. (2015) find that characteristics of project creators, such as backing history, have an impact on funding success; Kuppuswamy and Bayus (2017) discover a pattern where backer support increases when a project approaches its funding goal; Mollick (2014) conclude that project creators who demonstrate their preparedness for the project are more likely to have their campaigns crowdfunded. Other factors such as social network or social media impacts (Colombo et al., 2015; Zheng et al., 2014), linguistic cues in project descriptions (Allison et al., 2015), and platform characteristics (Cholakova and Clarysse, 2015) have been previously studied.

A majority of past studies focus on a key factor for funding success: attracting backers. In line with this perspective, this research examines factors that affect the number of backers. Differently, however, in this article backers are viewed as consumers, and their funding behavior is

considered as consisting of a series of online consumer decisions (Kucuk and Krishnamurthy, 2007). The preliminary decision is to generate initial interest in the project. In this sense, this research shows that the first impression, which is mirrored by the project title, can cause the backer's initial interest.

First impression is particularly important in human-to-machine interaction (Tuch et al., 2012), such as crowdfunding. Past research has suggested that people are inclined to generate an overall attitude towards a website based on their first impression of the website after a short-time visit (Crutzen et al., 2012; Lindgaard et al., 2006). It is also suggested that people often engage in multitasking while being online (Crutzen et al., 2012), limiting their attention to a particular target. As a result, the initial appearance of a website is often a criterion which people use to make judgement (Lindgaard et al., 2006). On a crowdfunding website, project titles are listed together in a crowd; thus, it is important that a project title can be distinguishable and offers a positive impression (gladitood.com; indiegogo.com). Because technological innovations must provide benefits to consumers, this research examines how consumer benefits claimed in project titles facilitate attracting backers in technology projects.

While consumer benefits induce backers' interest in how the technology will make their lives different, rewards are often the actual products provided to backers to make the benefits fulfilled. A majority of technology projects are crowdfunded via the reward-based platform, and rewards have been viewed as a main incentive for backers to pledge money (Belleflamme et al., 2014). Previous research also finds that projects are more likely to reach their funding goals by a margin of 5–10% if they offer good types of rewards (Qiu, 2013); and the projects that are not funded well by crowd usually have fewer reward levels (Mollick and Nanda, 2015).

In spite of merits of rewards, recent studies have not reached consensus with regards to the effect of rewards in crowdfunding. While some researchers highlight a positive effect of rewards (Mollick and Nanda, 2015), others find that rewards yield a lesser effect (Carr, 2013) or even a negative effect (Allison et al., 2015). It is suspected that the mixed findings are due to two reasons. First, conceptualizations of rewards vary across past studies. While some research examines rewards as linguistic cues (e.g., Allison et al., 2015), others view them as backer motivation for funding behavior (e.g., Cholakova and Clarysse, 2015). Second, because of varying conceptualizations, operationalizations of rewards and associated research methods differ. Some researchers adopt experiment to investigate the backer's insights (Cholakova and Clarysse, 2015), some use text analysis of project descriptions (Allison et al., 2015), and a majority examine reward levels directly from crowdfunding websites (Carr, 2013; Mollick and Nanda, 2015; Zvilichovsky et al., 2015).

The interest of this study resides in how organization of rewards in each crowdfunding project can affect the number of backers. Accordingly, rewards are defined and measured as the average number of products that backers will receive for their pledge via the reward-based platform. Although several past studies have examined rewards on crowdfunding websites, all of them focus only on the reward level, which potentially limits understanding of the overall effect of rewards. On the other hand, this study argues that there are two fundamental components involved in the reward organization: reward levels and rewards in each level. These two concepts are illustrated in Fig. 1A and Fig. 1B, which respectively show two project examples adopted from kickstarter.com. In each crowdfunding project, the project creator designs multiple reward levels and each reward level contains different rewards. Fig. 1A and Fig. 1B each have two reward levels, but each reward level contains different numbers of rewards. To be more specific, Example One has 3 rewards in the first reward tier and 4 s. The average number of rewards is 3.5. On the other hand, Example Two has 2 rewards in first reward tier and 3 s. The average number of rewards is 2.5. As such, even though they have the same number of reward levels, the average number of rewards between them differs. Past research

focuses on only the number of reward levels; yet this research provides a micro look at rewards by coding the number of rewards in each reward level, which takes into consideration the actual content in each level.

2.2. Technological innovations and consumer benefits

An innovation is the development of a new or significantly improved product or process. A stream of research examines innovations solely from a technological perspective; however, such a conceptualization may not be sufficient, because it does not capture the entire scope of innovations when consumer benefits are more prevalent than technological counterparts in determining new product success (Garcia and Calantone, 2002; Sorescu and Spanjol, 2008).

In line with this logic, a body of research suggests that the conceptualization of innovations should include marketing typology in addition to the technology component (e.g., Calantone et al., 2006). For example, Garcia and Calantone (2002) acknowledge technology discontinuity and marketing discontinuity as two bases for innovation categorization; Chandy and Tellis (1998, 2000) define innovations with two common dimensions: newness of technology and customer need fulfillment; and meta-analysis has also found that both customer- and technology-related factors can impact new product success (Evanschitzky et al., 2012; Henard and Szymanski, 2001). While the former reflects radicalness of the technology embedded in the innovation, the latter focuses on the extent to which benefits offered by this innovation to its users or customers.

In addition, many researchers examine new product performance in terms of consumer benefits offered by those products compared with existing products (e.g., Cui and Wu, 2016; Lowe and Alpert, 2015), and find that more benefits will result in better financial performance (Cui and Wu, 2016; Calantone et al., 2006). Consistently, innovation scholars generally agree that customer-based measure should be used to assess new product performance (Molina-Castillo and Munuera-Alemán, 2009). Such a standpoint "allows for a multidimensional view of innovativeness" (Sorescu and Spanjol, 2008: 116).

Another viewpoint that highlights consumer benefits as a dimension of technological innovations is derived from the consume behavior (CB) literature. CB research focuses on factors that influence consumer perceptions of new products, such as new product evaluation (Grant and Tybout, 2008), product preference (Moreau et al., 2001), and adoption intention (Antioco and Kleijnen, 2010). A theoretical foundation of those studies is that consumer perception of newness of an innovation depends on the extent to which it offers benefits to its users (Goode et al., 2013; Zhao et al., 2009). In this sense, from the consumer perspective, assessment of new products is not entirely determined by associated technologies per se, but also benefits resulting from those technologies.

Because backers in the crowdfunding setting are essentially consumers over the Internet, they seek innovations that offer utilities to them. Thus, consumer benefits stated by the project creators are likely to increase backer motivation. This study investigates how consumer benefits stated in the project title can influence the number of backers in crowdfunding projects, and how consumer benefits interact with rewards to affect the number of backers and funding success. The conceptual framework is displayed in Fig. 2.

3. Hypothesis development

Backers are a key for funding success. Thus, the baseline hypothesis suggests that the number of backers, at least to some extent, impacts funding success:

H1. The number of backers is positively related to the likelihood of funding success.

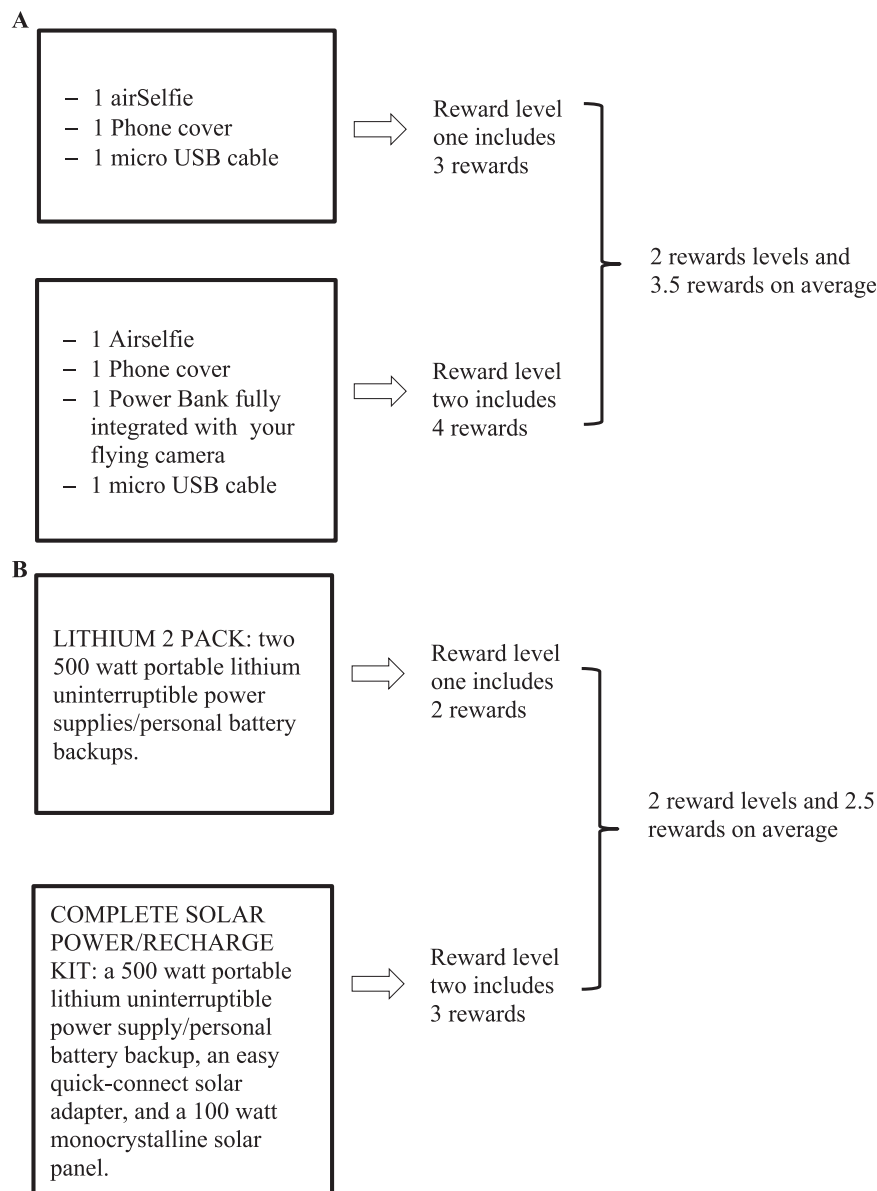Technological innovations are new products that bring benefits to

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A

- − 1 airSelfie
- − 1 Phone cover
- − 1 micro USB cable

⇨ Reward level one includes 3 rewards

2 rewards levels and 3.5 rewards on average

- − 1 Airselfie
- − 1 Phone cover
- − 1 Power Bank fully integrated with your flying camera
- − 1 micro USB cable

⇨ Reward level two includes 4 rewards

B

LITHIUM 2 PACK: two 500 watt portable lithium uninterruptible power supplies/personal battery backups.

⇨ Reward level one includes 2 rewards

2 reward levels and 2.5 rewards on average

COMPLETE SOLAR POWER/RECHARGE KIT: a 500 watt portable lithium uninterruptible power supply/personal battery backup, an easy quick-connect solar adapter, and a 100 watt monocrystalline solar panel.

⇨ Reward level two includes 3 rewards

Fig. 1. A. Example One. Project title: AirSelfie. Notes: To simplify the example, we adopted only two reward levels, although this project included more than two levels. Example was adopted at https://www.kickstarter.com/projects/1733117980/airselfie?ref=category_popular. B. Example Two. Project title: Tiny High Output Renewable (THOR) Box. Notes: To simplify the example, we adopted only two reward levels, although this project included more than two levels. Example was adopted at https://www.kickstarter.com/projects/batterybackuppower/portable-light-weight-long-life-lithium-battery-ba.
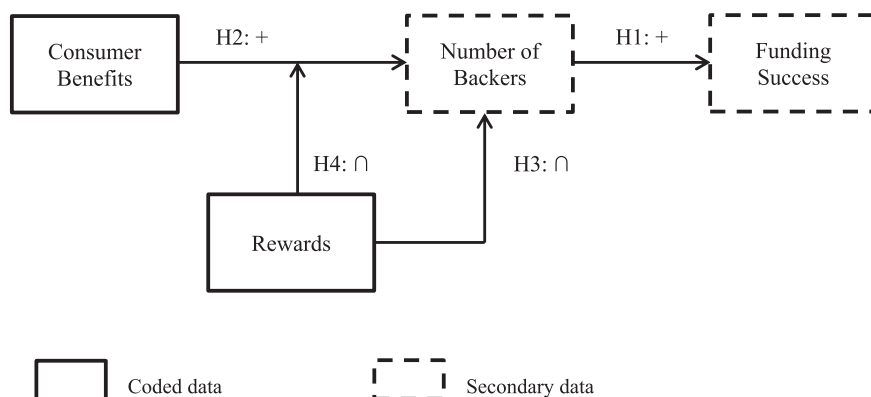
Consumer Benefits —— H2: + ——▶ Number of Backers —— H1: + ——▶ Funding Success

H4: ∩   H3: ∩

Rewards

☐ Coded data   ⊡ Secondary data

Fig. 2. Conceptual framework.

consumers (Chandy and Tellis, 1998, 2000; Sorescu and Spanjol, 2008). As mentioned earlier, a stream of research on technological innovations views consumer benefits as a facilitator which increases usefulness of innovations. Because backers are essentially consumers, motivation behind their funding behavior is to use new products to resolve consumer problems. Thus, a high level of consumer benefits will catalyze backer interest in the crowdfunding project. In addition, the psychology literature has long emphasized the role of first impression in information processing (e.g., Hamilton et al., 1980). It is generally agreed that a positive impression formation can increase people's favorable judgement and motivation to participate in the online community (Marlow et al., 2013; Weisbuch et al., 2009). As the first impression, a project title initially attracts backers and triggers their interest and involvement. While consumer benefits increase in the project title, backers' impression of the technology's usefulness improves, which in turn increases likelihood of their pledging money to the project. Thus, it is expected that:

H2. Consumer benefits stated in the project title are positively related to the number of backers.

Rewards intuitively are viewed as catalyst for backers in terms of pledging money to crowdfunding projects. Almost all technology projects listed on crowdfunding platforms offer rewards to backers in order to induce them to pledge money. Self-determination theory generally suggests that rewards reflect extrinsic motivation (Ryan and Deci, 2000). Human behavior can be driven by external reciprocal gain of the action (Kowal and Fortier, 1999; Lin, 2007). The external gain represents tangible benefits people can obtain. Consistently, recent crowdfunding research has found that backers may consider pledging money as an exchange. They expect to receive the products when providing monetary support to those projects (Gerber et al., 2012). As such, rewards seem to represent tangible benefits, which motivate potential backers to pledge money to crowdfunding projects.

Yet, it is contended that when the number of rewards is too high, its effect turns opposite. When the number is high, project creators are establishing a highly controlled environment, because they are perceived to use rewards merely as return for backers' financial support or portray a promising business (Allison et al., 2015; Harackiewicz et al., 1984). In addition, cognitive evaluation theory, the extension of self-determination theory, suggests that individuals have needs for self-direction, but a controlled environment restricts such needs (Allison et al., 2015; Deci and Ryan, 1985). Meta-analysis has found that too many extrinsic rewards can undermine individuals' intrinsic motivation to participate in various activities (Deci et al., 1999). Thus, being surrounded by an excessively controlled environment are likely to reduce backer interest and thus lessen attractiveness of the project. Furthermore, when the number of rewards is overwhelmingly high, information will be overloaded and evaluation of rewards becomes a complex task. If so, the high information processing demand is likely to end individuals' active learning (Paas et al., 2004) and participation (Jones et al., 2004). In this regard, when the number of rewards is too high, it will discourage backers to support the crowdfunding project. As a result, it is expected that:

H3. The number of rewards is related to the number of backers in an inverted-U shape.

As mentioned earlier, obtaining rewards is a way for backers to redeem benefits claimed by the project creators. When the number of rewards increases, backers are more likely to receive benefits they are pursing. In this sense, rewards should enhance the effect of consumer benefits on the number of backers. However, when the number of rewards is too high, the structure and content of rewards become overwhelmingly complex. A highly complex schema increases information load, which in turn requires extra information processing and cognitive effort by backers (Eppler and Mengis, 2004; Paas et al., 2004). However, human brain cannot process too much information at the same

time (Crutzen et al., 2012). Prior research has suggested that when individuals are involved in extensive information processing, they tend to draw attention to certain information but neglect other (Bodenhausen and Lichtenstein, 1987; Larson, 2009). In addition, a high processing demand will be likely to force individuals to simplify their responses (Jones et al., 2004), which may lessen the effect of first impression generated by the project title. As such, too many rewards are likely to lead backers to overly focus on rewards but neglect the consumer benefits they are looking for. Accordingly, it is suggested that when the number of rewards is moderate, it facilitates the positive effect of consumer benefits on the number of backers; however, when it is too low or too high, its moderation becomes weaker. As a result, it is proposed that:

H4. The number of rewards moderates the relationship between consumer benefits and the number of backers in an inverted-U shape.

4. Research method

4.1. Data collection

Technology category on kickstarter.com was adopted as the empirical context. At the time of data collection, technology was the most popular category in terms of the number of active projects. However, it is the least successful category because of its lowest success rate of below 20% among all categories. This resulted in over 80 million unsuccessful dollars, highest among all categories.

There were two objectives in the data collection process: (a) to minimize selection bias and (b) to test hypotheses from a longitudinal perspective. To do so, all active technology projects posted on kickstarter.com within a two-week period were collected, resulting in 800 cases. Since they were all projects available within this timeframe, this sample well represented the population of technological innovations. Because the initial data collection targeted only active projects, a second-wave data collection was implemented two months later when all projects' funding periods were over, and the final number of backers and funding success/failure were recorded. Thus, hypotheses were tested at both Time 1 (when funding was active) and Time 2 (when funding was completed). This method can provide additional insights into whether consumer benefits and rewards exert their effects across the funding period rather than merely from a post hoc perspective. Next, a filter procedure was implemented in order to remove disqualified projects, including canceled projects (75 cases), suspended projects (6), and projects that contained mostly non-English language (29) or did not offer any rewards (16). This procedure led to 674 usable cases for data analysis.

4.2. Measurement and data coding

Table 1 shows the details of measurement of each variable. In addition to secondary data obtained from kickstarter.com, several variables required coding work. Table 2 displays the correlation matrix including all variables.

4.2.1. Consumer benefits

Two trained independent graduate assistants who were blind to hypotheses were asked to rate their (dis)agreement on consumer benefits stated in the project title in a 1-to-5 scale (1 = strongly disagree; 5 = strongly agree). The inter-rater reliability was satisfactory ($\alpha = 0.761$). Then the average of the two raters' responses was computed to measure consumer benefits. Examples of low consumer benefits claimed in project titles included (examples adopted from www.kickstarter.com): "social media website and app"; "Full Surface Contact Twin Solar Cell"; "Social Networking APP for Android/IOS/PC". Those examples focused primarily on what were the new products. Examples of high consumer benefits included (examples adopted from

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Table 1
Examined constructs.

Variables	Nature of Variables	Measurement
Focal variables		
Consumer benefits	Coded	Two independent raters were asked to rate consumer benefits stated in the project title. Inter-rater reliability = 0.761
Rewards	Coded	The research team coded the number of rewards in each reward level for each crowdfunding project. In total, 134,492 rewards across 4,509 reward levels were recorded. We computed the average number of rewards across all reward levels in each project: average number of rewards = number of total rewards/number of reward levels. The average number was used for hypothesis testing. Log function was used for normality.
Number of backers	Secondary	Square root was used for normality, because some projects had no backers and log function did not apply to zero.
Funding success	Secondary	0 = failure (did not reach the funding goal); 1 = success (reached the funding goal)
Control variables		
Days to Go	Secondary	Days left in the funding period at Time 1
Funding period	Secondary	Days in the entire funding period
Funding goal	Secondary	Measured in US dollars. When foreign currency was used, it was converted to US dollars. Log function transformation was used for normality.
Location	Secondary	Two dummy variables were created for three location categories: North America, Europe, and others.
Currency	Secondary	0 = not US dollars 1 = US dollars
Project history	Secondary	Measured as the number of crowdfunding projects the project creator had on kickstarter.com previously. Square root was used for normality, because many project creators had no previous funding projects and log function did not apply to zero.
Technical language	Coded	Two independent raters were asked to rate technical language used in the project title. Inter-rater reliability = 0.821

www.kickstarter.com): "protects your home from intruders and dust"; "protects you from bike falls and thefts"; "Time and cost saving member administration software". Those examples focused primarily on how those new products benefited their users.

4.2.2. Rewards

Each project contained one or more reward levels. In each reward level, the project creator offers one or more rewards. The research team conducted coding work to count the number of rewards offered in each reward level. In total, the 674 projects included 4509 reward levels and 134,492 rewards. The average number of rewards for each project was computed and log function was used for normality, and it was adopted for data analysis. Fig. 1A and Fig. 1B include two examples. Fig. 1A show 3 rewards in the first reward tier and 4 s; thus, there are 7 rewards in total and the average number of rewards is 3.5. Fig. 1B show 2 rewards in the first reward tier and 3 s; thus, there are 5 rewards in total and the average number of rewards is 2.5.

4.2.3. Number of backers

The number of backers was obtained directly from kickstarter.com, and was recorded at both Time 1 and Time 2. Square root was used for normality transformation, because some projects had no backers and log function did not apply to zero.

4.2.4. Funding success

A dummy variable was created for funding success: 0 = failure; 1 = success.

4.2.5. Control variables

Project creators set various funding periods (in days) and funding goals, which were controlled for in model testing. Log function was used to transform the funding goal for normality. Because all projects were still active at Time 1, Days to Go was added in Time 1 models to control for days left in the funding period. Because at Time 1 all projects were still active, this control variable took into consideration the fact that they started funding period at different points of time. In addition, the country effect was controlled in two ways. First, two dummy variables were created for three locations: North America, Europe and others. Second, currency was controlled for: 0 = non-US dollars; 1 = US dollars. Also, the number of projects that each project creator launched previously on kickstarter.com was controlled for, because it may affect perceptions of his or her experience and trustworthiness. Last, since this research examined the technology category, many project creators used technical language in their project titles, which was likely to influence backer perceptions. Two independent raters were asked to rate agreement on technicalness of language used in each project title (1 = strongly disagree; 5 = strongly agree), resulting in a

Table 2
Correlation matrix.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. **Consumer Benefits**	1.950	1.126												
2. **Rewards**[a]	1.136	1.122	0.077*											
3. **Number of Backers** (Time 1)[a]	4.898	8.443	0.208**	0.256**										
4. **Number of Backers** (Time 2)[a]	6.669	11.426	0.207**	0.231**	0.937**									
5. **Funding Success**	0.258	0.438	0.194**	0.163**	0.591**	0.624**								
6. **Days to Go** (Time 1)	23.104	13.408	− 0.059	− 0.026	− 0.122**	− 0.038	− 0.052							
7. **Funding Period**	38.932	12.791	− 0.057	0.013	− 0.073†	− .075†	− .098*	0.385**						
8. **Funding Goal**[a]	9.768	1.658	0.084*	0.082*	0.161**	0.132**	− 0.240**	0.061	0.119**					
9. **Location_1**	0.645	0.479	0.036	0.033	0.002	0.027	0.062	− 0.013	− 0.025	− 0.037				
10. **Location_2**	0.274	0.447	− 0.045	− 0.039	− 0.016	− 0.040	− 0.105**	− 0.010	0.002	0.058	− 0.830**			
11. **Currency**	0.623	0.485	0.030	0.054	0.072†	0.098*	0.109**	− 0.013	0.006	− 0.027	0.787**	− 0.736**		
12. **Project history**[a]	0.267	0.617	− 0.002	− 0.022	0.079*	0.115**	0.147**	− 0.009	0.014	− 0.124**	0.058	− 0.068†	0.033	
13. **Technical language**	2.151	1.293	− 0.040	0.085*	0.223**	0.226**	0.211**	0.006	− 0.033	0.011	0.007	− 0.034	0.058	0.109**

† $p < .10$.
* $p < .05$.
** $p < .01$ (two-tailed).
[a] Variables were transformed for normality.

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Table 3
Results at Time 1 and Time 2.

	Dependent variable: number of backers						Dependent variable: funding success (0 = failure; 1 = success)			
	Model 1: control-only		Model 2: main effect		Model 3: moderation		Model 4: control-only		Model 5: main effect	
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
Main effects										
Consumer benefits			0.173^{**}	0.177^{**}	0.215^{**}	0.217^{**}			0.523^{**}	0.504^{**}
Rewards			0.293^{**}	0.276^{**}	0.300^{**}	0.283^{**}				
Rewards^2			-0.140^{**}	-0.148^{**}	-0.154^{**}	-0.161^{**}				
Moderation effects										
Consumer benefits × Rewards					0.099^{*}	0.107^{*}				
Consumer benefits × Rewards^2					-0.114^{*}	-0.108^{*}				
Control variables										
Days to Go	-0.114^{**}		-0.091^{**}		-0.092^{*}		-0.003		0.029^{*}	
Funding period	-0.050	-0.093^{*}	-0.043	-0.076^{*}	-0.041	-0.075^{*}	$-0.014^{\dagger}$	$-0.015^{\dagger}$	-0.014	0.000
Funding goal	0.182^{**}	0.155^{**}	0.139^{**}	0.114^{**}	0.141^{**}	0.115^{**}	-0.330^{**}	-0.330^{**}	-1.047^{**}	-1.174^{**}
Location_1	$-0.135^{\dagger}$	$-0.126^{\dagger}$	$-0.131^{\dagger}$	$-0.123^{\dagger}$	$-0.122^{\dagger}$	-0.115	$0.717^{\dagger}$	$0.715^{\dagger}$	0.200	0.349
Location_2	-0.005	0.000	0.000	0.003	0.009	0.010	0.557	0.553	0.615	1.030
Currency	0.166^{**}	0.189^{**}	0.149^{*}	0.172^{**}	0.147^{*}	0.169^{**}	-0.706^{*}	$-.708^{*}$	$-.237$	-0.061
Project history	0.081^{*}	0.115^{**}	0.080^{*}	0.112^{**}	0.077^{*}	0.110^{**}	0.340^{*}	0.342^{*}	0.074	0.130
Technical language	0.204^{**}	0.200^{**}	0.195^{**}	0.194^{**}	0.202^{**}	0.200^{**}	0.355^{**}	0.355^{**}	0.088	0.018
R^2	0.110	0.101	0.203	0.188	0.211	0.197				
F-value	10.305^{**}	10.675^{**}	15.317^{**}	15.384^{**}	13.565^{**}	13.486^{**}				
F change			25.630^{**}	24.138^{**}	3.335^{*}	3.248^{*}				

Notes: Models 1, 2 and 3 were based on ordinary least square. Models 4 and 5 were based on logistic regression.

† $p < .10$.

* $p < .05$.

** $p < .01$ (two-tailed).

satisfactory inter-rater reliability of 0.821.

5. Results

All hypotheses were tested at both Time 1 and Time 2 in order to validate the findings from a longitudinal perspective. Consistent control variables were adopted, but the only difference between Time 1 and Time 2 was an additional control variable in Time 1 model testing: Days to Go. All variables included in interaction terms were mean-centered (Aiken and West, 1991). H1 suggests that the number of backers increases funding success, and it was tested based on logistic regression. As Model 5 in Table 3 shows, the number of backers was significantly related to likelihood of funding success at Time 1 (b = 0.523, $p < .01$) and Time 2 (b = 0.504, $p < .01$). Thus, H1 is supported. H2 suggests that consumer benefits stated in a project title increase the number of backers. As Model 2 shows, consumer benefits were positively related to the number of backers at Time 1 (b = 0.173, $p < .01$) and Time 2 (b = 0.177, $p < .01$), supporting H2. H3 and H4 examine the inverted-U effects of rewards. Model 2 shows that the average number of rewards was related to the number of backers in an inverted-U shape at Time 1 ($b_{linear} = 0.293$, $p < .01$; $b_{square} = -0.140$, $p < .01$) and Time 2 ($b_{linear} = 0.276$, $p < .01$; $b_{square} = -0.148$, $p < .01$), supporting H3. The nonlinear effect of rewards is displayed in Fig. 3. Last, Model 3 shows that the number of rewards moderated the relationship between consumer benefits and the number of backers in an inverted-U shape at Time 1 ($b_{linear} = 0.099$, $p < .05$; $b_{square} = -0.114$, $p < .05$) and Time 2 ($b_{linear} = 0.107$, $p < .05$; $b_{square} = -0.108$, $p < .05$). Thus, H4 is supported. The moderation effect is displayed in Fig. 4.

6. Discussion

6.1. Theoretical implications

Crowdfunding, under the umbrella of micro-finance, is an emerging yet increasingly popular area. It has been serving entrepreneurs with a

Fig. 3. Direct effect of rewards. Notes: The graph shown above displays the inverted-U effect of the number of rewards on the number of backers, which is hypothesized in H3.

new channel of fundraising for their technological innovations. In spite of increasing attention, relatively few factors have been empirically examined in this domain (Bruton et al., 2015; Short et al., 2017). Past literature on micro-financing has focused on the predicting power of different project characteristics (e.g., Marom and Sade, 2013; Parhankangas and Renko, 2017). While crowdfunded innovations are consumer goods, it is unknown of how a technology's benefits can influence backer motivation in funding behavior. In line with the mainstream of crowdfunding research, this study examined factors that motivate backers to pledge money to technology projects. However, this study does not consider backers as "investors" or "contributors." Instead, they are viewed as consumers, and thus this study examines technological innovations from the consumer perspective – specifically, consumer benefits in the project title. Results show that high benefits can form a positive first impression which attracts backers. In this regard, it is suggested that backers have multiple roles in the crowdfunding process. As they are contributing money to technological projects in order to "help," backers also pursue personal interest in fulfilling their own consumer needs. As such, this research extends the
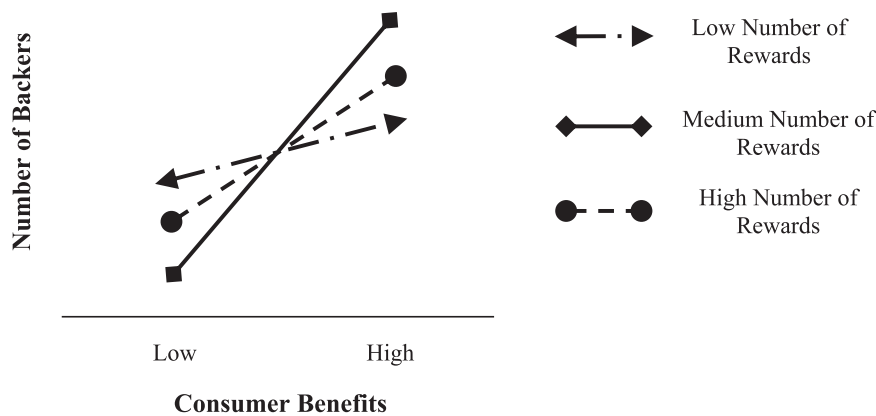
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Fig. 4. Moderation effect of rewards. Notes: The graph shown above displays the inverted-U effect of the number of rewards on the relationship between consumer benefits and the number of backers, which is hypothesized in H4. Because the relationship between consumer benefits and the number of backers is linear, the number of rewards moderates the linear effect of consumer benefits; thus, the three main effects shown in the graph are linear.

theoretical foundation used in the micro-financing context to interpret backer motivation.

In addition, past studies fail to reach consensus on the role of rewards, including positive, negative and non-significant effects. It is suspected that this is due to two reasons. First, extant literature shows inconsistent examinations and varying conceptualizations of rewards. While some studies focus on how reward-related language affects backer perception (Allison et al., 2015), others are interested in tangible rewards given to backers (Cholakova and Clarysse, 2015). Accordingly, measurement of rewards differs across those studies. While survey and experimental studies focus on backer perception and intention, secondary data allows investigation of how rewards can actually encourage or discourage backers. This study is based on secondary data to explore the effect of actual rewards. A general view of rewards, primarily based on the self-determination theory, implies its facilitating role in crowdfunding. However, past research often examines the reward levels, but overlooks rewards contained in each level. With detailed coding work, this research presents a micro look at the role of rewards within each reward level. Results indicate that the effect of rewards is rather curvilinear. This finding contests the assumption of "the more, the better" in past studies, and suggests that excessive rewards can discourage backers to support innovation projects.

Moreover, the conceptual model suggests that consumer benefits and rewards are not standalone factors determining funding success – synergy between the two is needed so that backer motivation is maximized. However, such synergy is not linear. The inverted-U moderation effect suggests that backers have limited attention to a given crowdfunding project. Although past crowdfunding studies have found a number of facilitators for funding success, it is not necessarily true that maximizing each factor's power will result in optimal outcomes, as backers cannot be perfectly motivated by those factors altogether. As such, it is suggested that while each theoretical lens uncovers certain influential factors, conclusion cannot be made without examination of their interactions.

Last, many past crowdfunding studies focus on social platforms such as kiva.org (e.g., Allison et al., 2015) and social projects such as healthcare and human rights (e.g., Parhankangas and Renko, 2017). In spite of its importance, backers in social entrepreneurship are often motivated by the intention of helping and their funding behavior is often considered as donation. However, technological innovations are commercial goods and are mostly crowdfunded via reward-based platforms. Backers in such a context seek user benefits in their funding decision. As a result, it is suggested that previous findings in social entrepreneurship may not fully apply to commercial platforms (e.g., reward-based platforms) and commercial product categories (e.g., technology). This study examines interaction of two factors in a commercial category: consumer benefits and rewards, and thus findings can better apply to consumer goods on reward-based platforms (e.g., Kickstarter and Indiegogo).

6.2. Practical implications

Findings from this research provide small businesses with guidelines for their crowdfunding practices. First, addressing consumer benefits in the project title is the first step in the path to funding success. However, Table 2 showed that the mean of consumer benefits was merely 1.950 (out of 5), suggesting that most project creators did not do enough to highlight this factor to attract backers. Backers are like consumers in many ways, and thus their funding decision should be viewed as consumer behavior. They actively seek benefits that technologies can offer. Therefore, a sole explanation of "what is the technology" seems not enough to attract benefit-seekers. Instead, a message of "what consumer needs can be met" in the title is the first step to success. When backers understand how a technology is related to themselves, they are motivated to learn more about the project. A good practice for project titles could be in such a format as: product name + how helpful. The second part emphasizes consumer benefits, such as "keeps your eyes on the road while driving" (example adopted from www.kickstarter.com).

Second, this research finds that rewards do not fall into "the more, the better" scenario. Due to the inverted-U shape between the average number of rewards and funding success, a moderate number of rewards represent the optimal level. When there are too few rewards, it is not beneficial for potential backers to pledge, because backers believe that they will not get what they pay for. However, when too many rewards are given, a highly controlled environment is established. This will generate an impression: "I will give you a bunch of rewards, so you must want to pledge." As a result, consumers may experience a feeling that they are forced to make decision on pledging. This situation will result in a loss of potential backers, which eventually damages funding success. While Table 2 shows descriptive statistics, the variable of rewards was log-transformed. The actual mean of the original variable, which represents a moderate level of rewards, is 28.553. This moderate level mirrors an optimal point where rewards can exert the most facilitating effect. Rewards were calculated as an average (total rewards/ number of reward levels). The optimal point does not mean that project creators should place 28 rewards equally in every reward level. In fact, project creators typically increase the number of rewards as the pledge amount increases. In other words, when a backer pledges a higher amount, the reward tier moves up and the number of rewards he or she receives grows. Thus, it is recommended that project creators increase the number of rewards as the reward levels goes up, and meanwhile remain the average number of rewards at a moderate level due to its inverted-U effect.

Furthermore, crowdfunding is based on a virtual community, and therefore interactions between entrepreneurs and backers are somewhat limited. In this regard, the former have (almost) no chance of explaining the reward content in details. However, one mechanism behind the inverted-U effect of rewards is that the more rewards, the more complexity. This makes the design of reward structure

particularly important because a better structure reduces the backer's cognitive effort of digesting reward information. For example, it is easier to understand when rewards are listed in bullet points; on the contrary, if a project creator writes a long paragraph to describe many rewards, it is likely to create a chaotic structure, which increases the complexity of reward information. As such, it is recommended that project creators should make reward descriptions in a clear format. For example, the uses of bullet points and space between different rewards are precise ways to ensure backers to process the information effectively.

Last, extant literature has emphasized that innovation success depends on an organization's management of new product development process (Evanschitzky et al., 2012). While a new product development process consists of multiple steps, its first step – namely, idea generation – is part of the "fuzzy front end" and is often considered critical to new product success (Stevens, 2014). Crowdfunding provides a platform where entrepreneurs are able to convert their innovative ideas into actual new products. In addition, one way that crowdfunding differs from other fundraising channels is the power of crowd. As such, crowdfunding signals the market potential of those entrepreneurial innovations and thus it provides entrepreneurs with a venue to test their new product ideas (New York Times, 2015). In other words, funding success implies possible superior market performance when a technology is launched. In this regard, developing an understanding of factors that impact crowdfunding outcomes – in this study, consumer benefits and rewards – is also critical to fostering an innovation's market performance at the commercialization stage of new product development.

6.3. Limitations and future research

First, this study focused only on the technological innovations. Concerning technology is the most popular category but has the lowest rate of funding success, examining this category turns out to be crucial. However, effects proposed in the conceptual framework may differ when the context changes. For example, in the film category project titles rarely emphasize consumer benefits but focus on the movie theme, and rewards given to backers are less likely to be the movie itself. Thus, it is recommended that researchers consider exploring other categories which essentially differ from technological innovations, such as film, sports, fashion, and journalism.

Second, this research shows the number of backers is a key factor affecting funding success. However, other factors can impact funding success, such as amount pledged by each backer. For example, a project with fewer backers can more successful if each backer pledges more money. Accordingly, it is recommended that researchers take a step further to examine pledge amount in addition to the number of backers in the crowdfunding process.

Third, the starting point of this research is first impression. Equally important is the detailed information about the projects provided by the project creators. For instance, once first impression induces backers' interest, they are likely to explore more in the project descriptions. Thus, it is recommended that researchers adopt content analysis to investigate how factors embedded in project descriptions influence backer motivation and project popularity. Findings will provide additional managerial implications to small businesses regarding how to position their projects to achieve funding success.

6.4. Conclusions

This article discusses how consumer benefits and rewards interactively impact crowdfunding success for technological innovations. Data of 674 technology projects from Kickstarter, a leading crowdfunding website, was collected. Additionally, two coding assignments were implemented respectively for consumer benefits stated in the project title and rewards (including reward levels and reward content in

each level). It is found that a high level of consumer benefits results in an increase in the number of backers. Furthermore, because technological innovations are crowdfunded mostly via reward-based platforms, the role of reward structure is investigated. Results show that the average number of rewards directly affects the number of backers and meanwhile moderates the relationship between consumer benefits and the number of backers in an inverted-U shape. Last, the number of backers substantially increases the likelihood of funding success. Findings provide novel insights into crowdfunding from the consumer perspective and suggest that highlighting the technology's utilities is an effective way to attract backers. In addition, this study offers useful guidelines to practitioners regarding how to organize the reward structure to maximize its effect on funding success.

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