# The role of project owners' and potential backers' implicit social ties in crowdfunding project success

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## Abstract

**Purpose** – In this study, the authors sought to investigate how the implicit social ties of both project owners and potential backers are associated with crowdfunding project success.

**Design/methodology/approach** – Drawing on social ties theory and factors that affect crowdfunding success, in this research, the authors developed a model to study how project owners' and potential backers' implicit social ties are associated with crowdfunding projects' degrees of success. The proposed model was empirically tested with crowdfunding data collected from Kickstarter and social media data collected from Twitter. The authors performed the test using an ordinary least squares (OLS) regression model with fixed effects.

**Findings** – The authors found that project owners' implicit social ties (specifically, their social media activities, degree centrality and betweenness centrality) are significantly and positively associated with crowdfunding projects' degrees of success. Meanwhile, potential project backers' implicit social ties (their social media activities and degree centrality) are negatively associated with crowdfunding projects' degrees of success. The authors also found that project size moderates the effects of project owners' social media activities on projects' degrees of success.

**Originality/value** – This work contributes to the literature on crowdfunding by investigating how the implicit social ties of both potential backers and project owners on social media are associated with crowdfunding project success. This study extends the previous research on social ties' roles in explaining crowdfunding project success by including implicit social ties, while the literature explored only explicit social ties.

**Keywords** Crowdfunding, Implicit social ties, Project success, Project owner, Project backer, Project size, Kickstarter, Twitter, Social media

**Paper type** Research paper

## 1. Introduction

Over the past decade, crowdfunding has become popular, attracting the attention of academics and practitioners. Crowdfunding can be defined as a type of crowdsourcing that enables entrepreneurs of all types social, cultural, artistic, or for-profit to raise capital from a crowd so that they can pursue new ventures or causes (Hong *et al.*, 2018; Mollick, 2014). Yet, despite the crowdfunding market's overall rise, some crowdfunding projects cannot achieve



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their fundraising goals successfully (Mollick, 2014; Wang *et al.*, 2018). For example, on Kickstarter, one of the world's largest crowdfunding platforms, 40.35% of total projects have achieved their fundraising goals as of January 2023 (Kickstarter.com, 2023). Accordingly, researchers have taken a significant interest in understanding crowdfunding projects' success, increasing the number of studies that explore the various factors associated with crowdfunding project success.

Most popular crowdfunding platforms, such as Kickstarter and Indiegogo, enable users to share crowdfunding campaign pages on social media platforms (Thies *et al.*, 2016). Social media's popularity has also attracted scholars' attention. Some studies have investigated the link between social media and crowdfunding project success. In some studies, researchers have found that social media use plays an important role in crowdfunding project success (Efrat and Gilboa, 2020; Lu *et al.*, 2014; Mollick, 2014; Saxton and Wang, 2014). For instance, campaigns on social media could help crowdfunding projects establish large social media footprints and tap into project owners' and potential backers' social media networks to secure crowdfunding (Hong *et al.*, 2018; Mollick, 2014).

Any crowdfunding transaction involves three types of actors: the crowdfunding project's creator (the project owner), the person who funds the project (the project backer) and the crowdfunding platform itself (Belleflamme *et al.*, 2014; Madrazo-Lemarroy *et al.*, 2019; Mollick, 2014; Schwienbacher, 2018). In prior research on crowdfunding project success, scholars have mainly investigated factors related to project owners or crowdfunding platforms (Agrawal *et al.*, 2015; Belleflamme *et al.*, 2014; Kim and Zhang, 2017; Koch and Cheng, 2016; Madrazo-Lemarroy *et al.*, 2019; Mollick, 2014). Some recent studies have explored project backers' motives for contributing to crowdfunding projects and project backers' roles in crowdfunding success (Clauss *et al.*, 2018; Efrat and Gilboa, 2020; Tan and Reddy, 2021). In their literature review, Cai *et al.* (2021) also highlighted the roles of both project owners and backers in crowdfunding project success. They found that external and internal social capital across the structural, relational and cognitive dimensions affects crowdfunding campaigns, such as the social capital of project owners and backers. However, prior studies have rarely empirically validated both project owners' and backers' different roles in crowdfunding project success.

In earlier research, scholars have also found that social ties are positively associated with crowdfunding project success (Borst *et al.*, 2018; Madrazo-Lemarroy *et al.*, 2019) particularly project owners' social ties (Agrawal *et al.*, 2015; Colombo *et al.*, 2015; Kim and Zhang, 2017; Koch and Cheng, 2016; Lu *et al.*, 2014; Zheng *et al.*, 2014). However, such researchers have focused on using social media data related to explicit social ties. Explicit social ties form on social media platforms when users explicitly add other individuals to their networks (Reafee *et al.*, 2016). For example, on Facebook, users can connect with other users via the "friend" functionality. Meanwhile, on Twitter, users can specifically follow other users via the "follow user" function.

In some studies, researchers have argued that different kinds of social media ties cannot be measured adequately using factors related only to explicit social ties (e.g. total Twitter followers and total Facebook friends). Such scholars have suggested that social ties' roles in crowdfunding project success should also be examined through social media data that are not related to explicit ties, such as interactions (Borst *et al.*, 2018; Tosatto *et al.*, 2022). Implicit social ties are all the social connections derived from or represented by the data that a social media platform provides, excluding data related to explicit relationships. A variety of social media data such as interactions, user profiles and user metadata can be used to identify implicit social ties (Zhou *et al.*, 2014). Some recent studies have highlighted the implicit social ties' positive roles in various contexts, such as improving social recommendations' accuracy, designing better social recommendation systems and building trust (Ahmadian *et al.*, 2020; Li *et al.*, 2018; Weng *et al.*, 2021). Most studies on social ties in crowdfunding have been based

on explicit social ties. The link between implicit social ties and crowdfunding project success has remained largely unexplored. Specifically, research is lacking on how project backers' and owners' implicit social ties on social media are associated with crowdfunding project success. Accordingly, in the current study, we addressed this research gap by answering the following research question: *Are project owners' and potential project backers' implicit ties on social media associated with crowdfunding projects' success?*

To answer this question, drawing on social ties theory (Granovetter, 1973), we examined how project owners' and potential project backers' implicit social ties are related to crowdfunding project success with around 173,000 tweets related to 2,161 crowdfunding projects on Kickstarter. We identified implicit social ties from interaction data related to crowdfunding projects on Twitter. Specifically, we proposed that three variables are associated with crowdfunding project success. These variables measure project owners' and potential project backers' implicit ties in social media networks through dyadic connections. These variables were social media activities, degree centrality and betweenness centrality. Degree centrality and betweenness centrality have been suggested as important factors to measure implicit social ties via network analysis, which can measure people's positions and connections in social networks (Borgatti and Halgin, 2011; Marsden and Campbell, 2012). Moreover, we proposed that project fundraising goals (project size) moderate the relationships between implicit social ties and crowdfunding project success.

This study contributes to the crowdfunding literature by extending the research on social ties' association with crowdfunding project success. While previous studies have focused on explicit social ties (Borst *et al.*, 2018; Kim and Zhang, 2017), we include the implicit social ties of both project owners and potential project backers. Our investigation of the relationships between implicit social ties and crowdfunding project success provides new insights into these associations, complementing the literature's previous findings on explicit social ties (Mollick, 2014; Kim and Zhang, 2017; Borst *et al.*, 2018). This study's results show, as we expected, that project owners' implicit social ties (their social media activities, degree centrality and betweenness centrality) are positively associated with crowdfunding projects' degrees of success. However, contrary to our expectations, potential project backers' implicit social ties (their social media activities and degree centrality) are negatively associated with crowdfunding projects' degrees of success.

The remainder of this study is structured as follows. In Section 2, we outline the previous literature related to crowdfunding and social ties' roles in crowdfunding project success. Then, we discuss our proposed research model and hypotheses in Section 3 before presenting our research method in Section 4. Finally, we discuss our findings and conclude by identifying this study's theoretical and practical implications, as well as its limitations and potential avenues for future research.

## 2. Theoretical background

### *2.1 Crowdfunding*

Over the past decade, crowdfunding has become an essential means of raising capital to carry out projects that were previously impossible. According to Mollick (2014, p. 2), "crowdfunding refers to the efforts by entrepreneurial individuals and groups – cultural, social, and for-profit to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the Internet, without standard financial intermediaries." Crowdfunding platforms can be classified broadly as either equity-based or non-equity-based. Equity-based crowdfunding refers to online crowdfunding platforms through which backers gain equity ownership of crowdfunded projects via an online platform. On the other hand, non-equity-based crowdfunding involves reward-based

platforms, donation-based platforms and lending-based platforms through which backers do not acquire any equity in projects (Vulkan *et al.*, 2016). In this study, we focused on a non-equity-based crowdfunding platform. As we mentioned in the previous section, any crowdfunding transaction involves three different actors: crowdfunding platforms, project owners and project backers. In prior research, scholars have also investigated how factors related to each of these actors are associated with crowdfunding project success.

In a stream of the literature, researchers have focused on crowdfunding platforms or intermediaries. Some previous studies have examined how crowdfunding project success is associated with a platform's design, regulations and history (Deng *et al.*, 2022; Josefy *et al.*, 2017; Kaartemo, 2017). Meanwhile, other scholars have examined the associations of crowdfunding platforms' different funding models (Cumming *et al.*, 2020; Paschen, 2017), archetypes (Kromidha and Robson, 2016; Paschen, 2017), funding strategies and designs (Coakley *et al.*, 2022; Konhäusner *et al.*, 2021) and regulatory environments (Hornuf and Schwienbacher, 2017; Klöhn, 2018) with crowdfunding project success. Moreover, some scholars have investigated platforms' roles in explaining crowdfunding project success from other lens, such as reducing information asymmetries (Wang *et al.*, 2021), trust-building (Greiner and Wang, 2010) and the network effect (Thies *et al.*, 2018).

In another stream of the literature, researchers have focused on crowdfunding project owners, mainly investigating owners' roles in explaining crowdfunding project success. Some of these scholars have examined how project owners' social networks (Agrawal *et al.*, 2015; Moritz and Block, 2016) and geographical proximity (Saxton and Wang, 2014) are related to crowdfunding project success. Additionally, some researchers have investigated how project owners' backgrounds, project owners' emotional and cultural factors (Burtch *et al.*, 2014; Lin and Viswanathan, 2016) and interactions between project owners and backers (Clauss *et al.*, 2018; Efrat and Gilboa, 2020) are associated with crowdfunding project success.

Finally, in another stream of the literature, scholars have examined project backers' role in crowdfunding project success. Some of these researchers have investigated backers' motivations for supporting crowdfunding projects (Baber and Fanea-Ivanovici, 2023; Bretschneider and Leimeister, 2017; Bürger and Kleinert, 2021; Lin and Boh, 2020). Meanwhile, some scholars have studied backers' crowdfunding-related behaviors, such as herding behavior (Liu *et al.*, 2015; Kim *et al.*, 2020; Saxton and Wang, 2014) and funding decisions (Gleasure and Feller, 2018; Kromidha and Robson, 2016; Lin and Viswanathan, 2016). Some scholars have also examined the association between project backers and crowdfunding project success by focusing on backers' affiliations (Herd *et al.*, 2021), trust (Rodriguez-Ricardo *et al.*, 2019; Shneor *et al.*, 2022), interactions with project owners (Clauss *et al.*, 2018; Efrat *et al.*, 2021), influence (Tan and Reddy, 2021) and social networks (Chung *et al.*, 2021).

The prior literature has shown that crowdfunding project success is associated with various factors related to the three different actors involved in crowdfunding (Efrat and Gilboa, 2020; Deng *et al.*, 2022; Baber and Fanea-Ivanovici, 2023; Coakley *et al.*, 2022). However, the authors of previous studies have mainly examined factors related to platforms, project owners, or project backers (Klöhn, 2018; Clauss *et al.*, 2018; Lin and Boh, 2020). Few researchers have yet examined crowdfunding project success through factors related to both project owners and backers, though such an approach could explain their different roles in depth. Therefore, such an investigation that incorporated both project owners and project backers was needed. This investigation will help crowdfunding project owners understand both their own and project backers' different roles in achieving their fundraising goals.

*2.2 Social ties in crowdfunding*

Granovetter (1973) introduced the concept of tie strength and different kinds of social ties in a seminal study titled "The Strength of Weak Ties." He defined tie strength as "a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services which characterize the tie" (p. 1361). Tie strength connects micro-level interactions with macro-level patterns in two individuals' dyadic relationships (Granovetter, 1973). In other words, tie strength explains the degree of closeness between two individuals. In the literature, many different measures and proxies have been developed and used to calculate tie strength, such as communication frequency, reciprocity, mutual friends, communication recentness, interaction frequency and network topology (Aral and Walker, 2014; Fogues *et al.*, 2018; Gilbert and Karahalios, 2009; Marsden and Campbell, 1984, 2012; Onnela *et al.*, 2007).

Moreover, Granovetter (1973) characterized two kinds of social ties, based on the tie strength concept: strong ties and weak ties. Generally, the term strong ties refers to trusted people whose social circles tightly overlap with one's own social circle. Family members and close friends are common examples of this type. Strong ties provide emotional support, and they are stable and more reliable than weak ties (Gilbert and Karahalios, 2009; Granovetter, 1973). On the other hand, the term weak ties refers to people with whom one is merely acquainted or with whom one distantly and infrequently interacts. In many cases, weak ties provide access to novel or non-redundant information, and they can help diffuse new ideas or new knowledge (Aral and Walker, 2014; Burt, 2004; Granovetter, 1973; Levin and Cross, 2004; Shi *et al.*, 2014).

Over the past decade, social media's rise and proliferation in individuals' daily lives have provided new ways to manage and establish social relationships or social ties (Ahn and Park, 2015). This development has provided a new data source for the development of methods that measure tie strength in the online environment and identify different kinds of ties from social media data. Various models have been developed to identify different types of ties using such data. Many of these studies' authors have extensively used explicit relationship data from social media (such as Facebook friends) to develop such methods (Fogues *et al.*, 2018; Gilbert and Karahalios, 2009; Huang *et al.*, 2015; Jones *et al.*, 2013).

Researchers have also examined how social media ties are associated with crowdfunding project success (Borst *et al.*, 2018; Kim and Zhang, 2017; Madrazo-Lemarroy *et al.*, 2019). Digital platforms (including social media platforms and crowdfunding platforms) allow participants to reinforce both weak and strong ties in crowdfunding. On the one hand, these platforms strengthen existing social ties. On the other hand, they help develop new social ties as a campaign evolves. Thus, crowdfunding projects can leverage digital platforms to reach crowdfunding goals (Granovetter, 1973; Madrazo-Lemarroy *et al.*, 2019). Additionally, researchers have found that project owners' ties on social media play important roles in shaping their crowdfunding projects' success (Borst *et al.*, 2018; Kim and Zhang, 2017; Madrazo-Lemarroy *et al.*, 2019). For instance, some scholars have examined how project owners' social ties such as the presence or number of social media contacts are positively associated with crowdfunding project success (Colombo *et al.*, 2015; Mollick, 2014). Researchers have also found that the background of project owners and the closeness of project owners' social ties are positively associated with achieving fundraising goals and the timely project funding (Agrawal *et al.*, 2015; English, 2014). Some scholars have examined how project owners' social ties are associated with early project backers and crowdfunding success (Ordanini *et al.*, 2011; Shneor and Vik, 2020). Based on data collected from Facebook and Kickstarter, Jin *et al.* (2020) examined the temporal association between project owners' Facebook activities and crowdfunding project success. These authors found a J-curved relationship between owners' Facebook activities and project success, and they also identified a herding effect during a project's closing period.

Researchers have also explored project backers' different motives for supporting crowdfunding projects, as well as these motives' associations with crowdfunding project success (Tan and Reddy, 2021; Chung *et al.*, 2021). However, scholars have published very little research examining how project backers' ties on social media are associated with crowdfunding project success. In a recent study, Tan and Reddy (2021) attempted to examine backers' associations with crowdfunding project success through their affiliation networks. These authors found that backers with central positions in these networks were positively associated with various crowdfunding project outcomes—including success rates, goal attainment speed and funds raised. However, Tan and Reddy focused on social ties based on backers' affiliations, rather than social media data. Meanwhile, Chung *et al.* (2021) investigated how backers' social media networks are associated with their backing decisions. However, these researchers did not consider the networks' associations with crowdfunding project success.

Additionally, although researchers have examined social ties' roles in crowdfunding project success, most have focused on explicit social ties (Kim and Zhang, 2017; Madrazo-Lemarroy *et al.*, 2019). To the best of our knowledge, no scholars have attempted to examine the relationships between project owners' and backers' implicit social ties and crowdfunding projects' degrees of success.

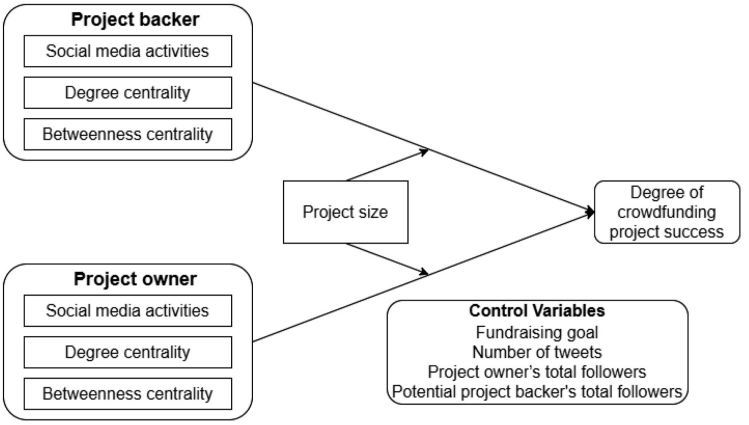
## 3. Research model and hypothesis development

### *3.1 Research model*

Based on the previous literature concerning social ties' roles in crowdfunding project success, as well as social ties theory, we developed a research model to examine the links between degrees of crowdfunding project success and the implicit social media ties of both project owners and potential project backers. Specifically, we assumed that owners' and potential backers' implicit ties on social media – represented by social media activities, degree centrality and betweenness centrality – would be associated with crowdfunding projects' degrees of success.

Degree centrality and betweenness centrality are two factors related to network structure. They can be calculated from a social network and used to identify different kinds of social ties in that network (Borgatti and Halgin, 2011; Marsden and Campbell, 2012). The authors of some network-related studies have used explicit relationship-related social media data (such as Facebook friends or Twitter followers) to directly create social networks (Mollick, 2014; Kim and Zhang, 2017). However, this approach cannot yet reflect implicit ties on social media. In the current study, we based project owners' and potential backers' degree centrality and betweenness centrality on their social media interactions concerning crowdfunding projects (Zhou *et al.*, 2014).

Additionally, the authors of previous studies have found that crowdfunding project size (specifically, projects' fundraising goals) is associated with backers' decisions and projects' success (Jin *et al.*, 2020; Mollick, 2014). For example, projects with higher fundraising goals might need more backers than projects with lower fundraising goals. Accordingly, in this study, we assumed that project size (large or small, based on fundraising goals) would moderate the relationships between owners' and potential backers' implicit social ties (i.e. social media activity, degree centrality and betweenness centrality) and degrees of crowdfunding success. Fundraising goals, the number of tweets about a project, and the total followers of both project owners and potential project backers have been associated with crowdfunding project success in the literature (Hong *et al.*, 2018; Kim and Zhang, 2017; Jin *et al.*, 2020). Therefore, we used these factors as control variables in the current study. Figure 1 presents our research model.




**Source(s):** Author's own creation/work

**Figure 1.**
Research model

*3.2 Hypotheses*

Social media use has led to a new kind of user behavior: the ability to reiterate a friend's activity, that is, to replicate and redistribute content (e.g. text, videos, or pictures) that a friend has posted online (Geva *et al.*, 2019). This behavior has been shown to influence other social media users' behaviors by providing an effective way to share information with other users (Fischer and Reuber, 2011; Lynn *et al.*, 2020). Social media platforms offer various redistribution features. For example, Facebook and LinkedIn allow "sharing," while Twitter uses "retweets."

In previous studies, researchers have also investigated how social media activities are associated with effective personal branding strategies, social broadcasting and social commerce (Geva *et al.*, 2019; Lee *et al.*, 2015; Shi *et al.*, 2014). In the crowdfunding context, some scholars have also found that project owners' social media activities are positively associated with crowdfunding project success (Liu and Ding, 2020; Thies *et al.*, 2018). As Jin *et al.* (2020) explained, when project owners share a crowdfunding project on social media, their posts are publicly visible on their timelines to potential backers. Potential backers can also observe other social media users' activities in relation to a crowdfunding project, which encourages potential backers to fund the project. Potential backers can express approval for the project and share related posts publicly on social media, which may allow the project to attract more backers via information spillover effects (Tan and Reddy, 2021). Accordingly, based on findings in the literature, we hypothesized that project owners' and potential backers' social media activities are positively associated with crowdfunding projects' degrees of success.

*H1a.* Crowdfunding project owners' social media activities related to their projects are positively associated with their projects' degrees of success.

*H1b.* Potential backers' social media activities related to crowdfunding projects are positively associated with these projects' degrees of success.

The research on social networks has suggested that nodes' relational positions in such networks crucially shape social ties (Borgatti and Halgin, 2011). *Centrality* has been widely used as a metric to capture nodes' relational properties in a network, and it includes degree centrality and betweenness centrality (Chen *et al.*, 2012; Freeman, 1978). According to graph theory, degree centrality counts a node's neighbors in a network. This measure is useful for analyzing which individuals are likely to have the most information or be able to quickly

connect with a wider network (Hansen *et al.*, 2020). On the other hand, betweenness centrality measures centrality on a graph, based on the shortest paths between nodes. In other words, it measures the number of times a node lies on the shortest path between other nodes in a network. Betweenness centrality is useful for analyzing a network's communication dynamics, and it helps identify individuals who influence a network's information flow (Hansen *et al.*, 2020). On social media, for instance, a user with high degree centrality and betweenness centrality could access many disparate groups and influence their network's information flow. Studies have shown that users with high betweenness centrality have influential opinions and become thought leaders on social media, and they have been associated with information flow in contexts such as destination marketing (Bokunewicz and Shulman, 2017; Jin and Cheng, 2020), promoting niche products (Phang *et al.*, 2013) and political activism (Xu *et al.*, 2014). Researchers have also found that social media users with high degree centrality have positive relationships with some outcomes, such as the dissemination of health information (Meng *et al.*, 2018) and brands' purchasing decisions (Britt *et al.*, 2020).

Recent studies by Chung *et al.* (2021) found that the degree centrality and betweenness centrality of backers' social networks are positively related to backers' pledge decisions regarding crowdfunding projects. Tan and Reddy (2021) also found that the centrality of a backer's affiliation network is positively associated with crowdfunding project success. Therefore, in crowdfunding contexts, project owners' and potential backers' degree centrality and betweenness centrality on social media could be positively associated with a project's information flow and reach. Thus, their degree centrality and betweenness centrality would attract more potential backers and help reach fundraising goals. Accordingly, we proposed that both project owners' and potential backers' degree centrality and betweenness centrality are positively associated with crowdfunding projects' degrees of success.

*H2a.* Project owners' degree centrality is positively associated with their crowdfunding projects' degrees of success.

*H2b.* Potential backers' (average) degree centrality is positively associated with crowdfunding projects' degrees of success.

*H3a.* Project owners' betweenness centrality is positively associated with their crowdfunding projects' degrees of success.

*H3b.* Potential backers' (average) betweenness centrality is positively associated with crowdfunding projects' degrees of success.

Previous studies have also found that crowdfunding projects' fundraising goals (project size) can influence potential backers' expectations and funding decisions (Mollick, 2014; Tan and Reddy, 2021; Zheng *et al.*, 2014). To succeed, projects with higher fundraising goals (large projects) require funding from a much larger social network than small projects. Additionally, as Tan and Reddy (2021) argued, smaller crowdfunding projects' outcomes are more certain since their smaller fundraising goals are easier to achieve than large projects' goals. Therefore, we hypothesized that project owners' and potential backers' social media activities, degree centrality and betweenness centrality are more strongly associated with degrees of success for crowdfunding projects with lower fundraising goals than for projects with higher fundraising goals.

*H4a.* Project owners' activities, degree centrality and betweenness centrality on social media are more strongly associated with degrees of success for projects with lower fundraising goals than for projects with higher fundraising goals.

*H4b.* Potential project backers' activities, degree centrality and betweenness centrality on social media are more strongly associated with degrees of success for projects with lower fundraising goals than for projects with higher fundraising goals.

## 4. Research method

### *4.1 Data collection*

This study's data were collected from two sources: the social media platform Twitter and the all-or-nothing (AON), reward-based crowdfunding platform Kickstarter. In AON crowdfunding, project creators keep no pledged funding if their projects' total fundraising goals are not achieved (Cumming *et al.*, 2020). We selected Twitter and Kickstarter as our data sources because Kickstarter is one of the world's largest reward-based crowdfunding platforms, while Twitter is among the largest social media platforms. Both platforms' global user bases can reach much wider audiences than any local crowdfunding or social media platform.

Twitter data were collected using the Twitter Premium application programing interface (API) and a search query containing keywords related to Kickstarter, such as "#Kickstarter," "#kickstarter," and "@kickstarter." For each relevant tweet, we recorded the time stamp, author handle, any mentioned user handles, the text and any URLs included in the tweet's body or user's metadata. The collected Twitter data had been published between June 2016 and September 2018. Table 1 described this data set in detail.

Kickstarter is one of the largest online crowdfunding platforms in the world that enables organizations or teams to issue fundraising over the Internet and receive small investments from registered funders in return. The platform uses a reward-based AON model (Cumming *et al.*, 2020). Kickstarter projects fall into 15 categories. This study's Kickstarter data were collected via webrobots.io, which uses a scraper robot to crawl all Kickstarter project data and export them in.csv and.json formats. This crawl is conducted once monthly, and the entire data set is available on the webrobots.io website. The data set used in this study contains all Kickstarter project data from April 2009 to September 2018. Collecting all the corresponding data from Twitter for all crowdfunding projects from April 2009 to September 2018 would have required vast resources and an enormous workload. Therefore, from this data set, we selected only crowdfunding projects that had been conducted between June 2016 and September 2018. Of these selected projects, we filtered out projects for which related tweets were unavailable up to six months before a project's start date since crowdfunding project owners must normally use social media campaigns to market their projects before seeking funding. After this filtering, we identified 2,161 crowdfunding projects that satisfied all our inclusion criteria. The basic campaign information in our crowdfunding project data sample included campaign organizer IDs, web page URLs, shortened versions of these URLs, campaign fundraising goals, fundraising durations, funding amounts raised, campaign start dates, campaign end dates and projects' countries of origin.

For researchers, knowing all possible relevant search terms for every crowdfunding project is practically impossible. Therefore, to avoid a potential data collection problem, we

| Variables | Collected data set | Filtered data set |
|---|---|---|
| Total number of tweets | 4,206,408 | 172,892 |
| Total number of retweets | 1,856,063 | 26,350 |
| Total number of users | 4,406,408 | 255,419 |
| Total number of unique users | 1,128,397 | 21,491 |

**Source(s):** Authors' own creation/work

**Table 1.** Description of the study's collected and filtered Twitter data set

used broadly relevant search terms to collect the most relevant data from Twitter related to different crowdfunding projects during our initial data collection from Twitter. To prepare for our analysis, the data was cleaned and organized. Tweets related to the selected 2,161 Kickstarter projects were filtered, and only tweets posted during a crowdfunding project's campaign were included in our analysis. A code script based on Python was used in this data refinement process. Thus, we greatly reduced the initial data collected from Twitter for this study. Based on this Python script, in total, 172,892 tweets related to 2,161 Kickstarter projects were identified and used in this study.

### *4.2 Variables*

In this subsection, we present the different data measures we used to test our hypotheses. *Crowdfunding project success* can be defined in multiple ways. For instance, it can be understood as a binary value that is, whether a project was successful or unsuccessful (Madrazo-Lemarroy *et al.*, 2019; Mollick, 2014) or as a ratio between a project's fundraising goal and actual funding received (Shneor and Vik, 2020). In this study, we defined crowdfunding project success as the ratio of a project's actual funding to its goal. This definition has been suggested to provide more comprehensive insights into project success than a binary value (Yin *et al.*, 2019).

We operationalized social media activities using Twitter's retweet function. We calculated degree centrality and betweenness centrality in an implicit social network using Twitter interactions between potential backers and project owners concerning a crowdfunding project. Specifically, we identified a network of potential backers and project owners based on their mentioning each other in tweets. The network's nodes were project owners and potential backers. Meanwhile, the network's edges were defined by the number of interactions between these different nodes. This kind of network construction has been used in many previous studies to analyze various phenomena (Aramo-Immonen *et al.*, 2015, 2016). We created such networks for each crowdfunding project analyzed in this study.

We used three measures of project owners' and potential backers' implicit social ties as independent variables associated with a crowdfunding project's success. For example, a project that reached 100% of its fundraising goal would have a degree of success equal to 1. Meanwhile, a project that reached 50% of its goal would have a degree of success equal to 0.5. We used project size based on the median value of all crowdfunding projects' fundraising goals as a moderator. As control variables, we used project owners' and potential backers' total Twitter followers, fundraising goals and tweets about each crowdfunding project. Fixed effects for project categories were added to our models to capture the unobserved, constant heterogeneity within each crowdfunding project category. Table 2 describes all these variables.

### *4.3 Data analysis*

Table 3 presents descriptive statistics for all measures used in this study except the project category and project size variables. The latter two variables were excluded because project category is a categorical variable and project size is a dummy variable. This table depicts the data measures' maximums, minimums, means and standard deviations.

A correlation matrix was calculated for the different measures used in this study's hypothesis testing. This matrix is depicted in Table 4.

Our data's skewness and kurtosis exceeded the respective recommended thresholds of 3 and 7 for normal distribution (Kline, 2015). Therefore, log transformation was performed for all independent, dependent and control variables except for project category and project size before our ordinary least squares (OLS) regression models were created. We used the following formula for our data analysis:

| Measure | Definition |
|---|---|
| Potential backers' total followers (PBTF) | The average number of all potential crowdfunding project backers' followers in a project |
| Project owners' total followers (POTF) | A crowdfunding project owner's number of followers |
| Fundraising goal | A project's actual crowdfunding project goal (in US dollars) |
| Number of tweets | The total number of tweets related to a crowdfunding project |
| Potential backers' social media activities (PBSM) | The average number of a potential project backer's retweets about a crowdfunding project |
| Potential backers' degree centrality (PBDC) | A potential project backer's average degree centrality (calculated from the implicit social network created for each project using project-related tweets) |
| Potential backers' betweenness centrality (PBBC) | A potential project backer's average betweenness centrality (calculated from the implicit social network created for each project using project-related tweets) |
| Project owners' social media activities (POSM) | A project owner's number of retweets about a crowdfunding project |
| Project owners' degree centrality (PODC) | A project owner's degree centrality (calculated from the implicit social network created for each project using project-related tweets) |
| Project owners' betweenness centrality (POBC) | A project owner's betweenness centrality (calculated from the implicit social network created for each project using project-related tweets) |
| Project size (PS) | A project's size value (*small = 0*; *large = 1*), based on the median value of all crowdfunding projects' fundraising goals (projects with goals below the median value were considered *small*, while the remaining projects were considered *large*) |
| Project category | The specific category label for each project on Kickstarter (Kickstarter defines 15 different project categories: art, comics, crafts, dance, design, fashion, film and video, food, games, journalism, music, photography, publishing, technology and theater) |
| Degree of crowdfunding project success (DCPS) | The ratio of the project funding received to a project's fundraising goal (in US dollars) |

**Source(s):** Authors' own creation/work

**Table 2.** Research model variables

| Variable | Minimum | Maximum | Mean | Standard deviation |
|---|---|---|---|---|
| PBTF | 0 | 2,786,937 | 15,548.650 | 94,917.720 |
| POTF | 0 | 960,041 | 2,613.979 | 24,343.563 |
| Fundraising goal | 0.779 | 50,000,000 | 43,0001.160 | 1,104,818 |
| Number of tweets | 1 | 5,049 | 80.006 | 310.613 |
| PBSM | 0 | 1,403 | 4.195 | 35.544 |
| PBDC | 0 | 4 | 0.394 | 0.622 |
| PBBC | 0 | 0.250 | 0.012 | 0.041 |
| POSM | 0 | 66.250 | 0.990 | 2.841 |
| PODC | 0 | 4 | 0.661 | 0.833 |
| POBC | 0 | 1 | 0.065 | 0.165 |
| DCPS | 0 | 438.140 | 2.049 | 11.155 |

**Source(s):** Authors' own creation/work

**Table 3.** Descriptive statistics

$$\begin{aligned}\text{LogDCPS} = &\beta_0 + \text{Project category effect} + \beta_1(\text{LogPBSM}) + \beta_2(\text{LogPBDC}) \\ &+ \beta_3(\text{LogPBBC}) + \beta_4(\text{LogPOSM}) + \beta_5(\text{LogPODC}) + \beta_6(\text{LogPOBC}) \\ &+ \beta_7(\text{LogPBTF}) + \beta_8(\text{LogPOTF}) + \beta_9(\text{LogFundraisingGoal}) + \beta_{10}(\text{PS}) \\ &+ \beta_{11}(\text{LogNoofTweets}) + \beta_{12}(\text{LogPBSM} * \text{PS}) + \beta_{13}(\text{LogPBDC} * \text{PS}) \\ &+ \beta_{14}(\text{LogPBBC} * \text{PS}) + \beta_{15}(\text{LogPOSM} * \text{PS}) + \beta_{16}(\text{LogPODC} * \text{PS}) \\ &+ \beta_{17}(\text{LogPOBC} * \text{PS})\end{aligned}$$

To test our research instrument's multicollinearity, we calculated maximum variance inflation factors (VIFs). All VIFs were below the cutoff value of 10 for regression models (the maximum VIF value was 8.99). This finding indicates that multicollinearity is not a concern for this study (James *et al.*, 2013).

*4.4 Results*

We estimated a series of OLS regressions to test our hypotheses (see Table 5). First, we tested the relationships between potential project backers' social media activities, degree centrality and betweenness centrality and crowdfunding projects' success (see Model 1 in Table 5). The results of this test showed that potential backers' social media activities are negatively associated with projects' success, while degree centrality and betweenness centrality are not significantly associated with projects' degrees of success. Therefore, H1b, H2b and H3b were not supported.

Model 3 tested the associations between project owners' social media activities, degree centrality and betweenness centrality and projects' crowdfunding success. This model showed that project owners' social media activities ($\beta = 0.101$; $p < 0.001$), degree centrality ($\beta = 0.106$; $p < 0.01$) and betweenness centrality ($\beta = 0.262$; $p < 0.05$) are significantly positively associated with crowdfunding projects' success. Hence, H1a, H2a and H3a were supported.

Model 5 included all the independent variables related to both project owners and project backers. This model's test results supported H1a and H2a but did not support H1b, H2b, H3a, or H3b.

Next, we tested the interaction effect between project size and potential backers' and project owners' social media activities, degree centrality and betweenness centrality on projects' success (see Model 2 and Model 4). The results of this test showed no significant interaction effect between project size and potential backers' social media activities, degree centrality, or betweenness centrality. Therefore, H4b was not supported (see Model 2). Moreover, the results of Model 4 showed no significant interaction effect between project size and project owners' degree centrality or betweenness centrality; however, the interaction

| | PBSM | PBDC | PBBC | POSM | PODC | POBC | DCPS |
|---|---|---|---|---|---|---|---|
| PBSM | 1 | | | | | | |
| PBDC | 0.027 | 1 | | | | | |
| PBBC | −0.009 | 0.148 | 1 | | | | |
| POSM | −0.028 | 0.013 | −0.016 | 1 | | | |
| PODC | −0.017 | 0.717 | 0.07 | 0.093 | 1 | | |
| POBC | −0.022 | 0.056 | 0.004 | 0.102 | 0.456 | 1 | |
| DCPS | −0.003 | 0.042 | −0.006 | 0.011 | 0.070 | −0.008 | 1 |

**Table 4.**
Correlation matrix

**Source(s):** Authors' own creation/work

**Table 5.**
OLS regression with fixed-effect models

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ |
| Intercept | 1.385 (0.074) | 0.000 | 1.738 (0.094) | 0.000 | 1.442 (0.074) | 0.000 | 1.755 (0.092) | 0.000 | 1.483 (0.075) | 0.000 | 1.797 (0.093) | 0.000 |
| PBTF | 0.016 (0.005) | 0.001 | 0.015 (0.005) | 0.002 | 0.001 (0.004) | 0.733 | 0.001 (0.004) | 0.811 | 0.0107 (0.005) | 0.044 | 0.010 (0.005) | 0.057 |
| POTF | 0.079 (0.006) | 0.000 | 0.077 (0.007) | 0.000 | 0.063 (0.007) | 0.000 | 0.063 (0.007) | 0.000 | 0.063 (0.007) | 0.000 | 0.062 (0.007) | 0.000 |
| Fundraising goal | −0.121 (0.007) | 0.000 | −0.175 (0.011) | 0.000 | −0.126 (0.007) | 0.000 | −0.179 (0.011) | 0.000 | −0.128 (0.007) | 0.000 | −0.180 (0.011) | 0.000 |
| No. of tweets | −0.004 (0.010) | 0.694 | −0.002 (0.011) | 0.822 | −0.004 (0.010) | 0.653 | −0.006 (0.010) | 0.586 | −0.006 (0.011) | 0.522 | −0.006 (0.010) | 0.605 |
| PBSM | *−0.073 (0.015)* | *0.000* | *−0.079 (0.019)* | *0.000* | | | | | *−0.042 (0.016)* | *0.010* | *−0.040 (0.019)* | *0.045* |
| PBDC | 0.022 (0.039) | 0.572 | 0.062 (0.051) | 0.228 | | | | | *−0.181 (0.066)* | *0.007* | *−0.162 (0.091)* | *0.006* |
| PBBC | 0.204 (0.322) | 0.527 | −0.246 (0.432) | 0.568 | | | | | 0.483 (0.323) | 0.135 | −0.027 (0.434) | 0.949 |
| POSM | | | | | *0.101 (0.021)* | *0.000* | *0.162 (0.029)* | *0.000* | *0.093 (0.021)* | *0.000* | *0.155 (0.030)* | *0.000* |
| PODC | | | | | *0.106 (0.033)* | *0.001* | *0.126 (0.044)* | *0.004* | *0.215 (0.058)* | *0.000* | *0.228 (0.080)* | *0.005* |
| POBC | | | | | *0.262 (0.105)* | *0.013* | 0.327 (0.174) | 0.061 | 0.078 (0.121) | 0.520 | 0.148 (0.192) | 0.439 |
| Project size (PS) | | | *0.231 (0.043)* | *0.000* | | | *0.299 (0.046)* | *0.000* | | | *0.292 (0.049)* | *0.000* |
| PBSM*PS | | | 0.014 (0.024) | 0.556 | | | | | | | −0.003 (0.024) | 0.899 |
| PBDC*PS | | | −0.082 (0.069) | 0.243 | | | | | | | −0.040 (0.127) | 0.752 |
| PBBC*PS | | | 1.041 (0.630) | 0.099 | | | | | | | 0.994 (0.626) | 0.113 |
| POSM*PS | | | | | | | *−0.116 (0.019)* | *0.003* | | | *−0.116 (0.040)* | *0.004* |
| PODC*PS | | | | | | | −0.054 (0.031) | 0.375 | | | −0.037 (0.112) | 0.742 |
| POBC*PS | | | | | | | −0.092 (0.108) | 0.669 | | | −0.102 (0.243) | 0.675 |
| Fixed effects | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | |
| Max VIF | 3.60 | | 3.75 | | 3.99 | | 4.50 | | 4.88 | | 8.99 | |
| R-squared | 0.232 | | 0.248 | | 0.245 | | 0.261 | | 0.251 | | 0.268 | |
| Adj. $R^2$ | 0.225 | | 0.239 | | 0.237 | | 0.252 | | 0.242 | | 0.257 | |
| $F$ | 30.89 | 0.000 | 28.21 | 0.000 | 33.06 | 0.000 | 30.20 | 0.000 | 29.81 | 0.000 | 25.14 | 0.000 |
| $N$ | 2,161 | | 2,161 | | 2,161 | | 2,161 | | 2,161 | | 2,161 | |

**Note(s):** Crowdfunding projects were divided into size values based on the median value of all projects' fundraising goals
**Source(s):** Authors' own creation/work

between project size and project owners' social media activities has a significant negative effect on projects' success. This finding demonstrates that, for crowdfunding projects with lower fundraising goals, project owners' social media activities are more strongly associated with project success than they are for larger projects. Thus, H4a was partially supported.

Model 6 included the interaction between project size and both project owners and potential backers, based on Model 5. The results of Model 6 showed that project owners' social media activities and degree centrality are significantly associated with crowdfunding projects' success, which further supported H1a and H2a. Significant negative relationships were observed between potential backers' social media activities, degree centrality and project success, while no significant relationship was observed between potential backers' betweenness centrality and project success. These findings provided further evidence that does not support H1b, H2b, or H3b. The results of Model 6 show that project size significantly and negatively moderates the relationships between project owners' social media activities and project success, but project size does not significantly moderate the other relationships we examined. Thus, H4a was partially supported, while H4b was not supported. The proposed research model explains 25.7% of crowdfunding project success.

### *4.5 Robustness check*

We also ran a robustness check on our research model. We used binary values for the dependent variable via logit regression models, defining a crowdfunding project as either a success or a failure. Table 6 depicts these robustness checks' results. Projects that achieved their fundraising goals were defined as successes, whereas projects that did not achieve their fundraising goals were defined as failures. Our fixed-effect logit regression model's results concerning the relationships between potential backers' and project owners' social media activities, degree centrality, betweenness centrality and crowdfunding project success were consistent with the results of our OLS regression model. However, we observed no significant interaction effects of the independent variables and project size on the dependent variable crowdfunding project success.

## 5. Discussion

In this study, we explored how project owners' and potential backers' implicit social ties are associated with crowdfunding projects' degrees of success. Our findings show that project owners' degree centrality is significantly associated with crowdfunding project success. Degree centrality is a simple count of a node's total number of linked connections in a network. This count helps determine which highly connected individuals are likely to have the most information or the ability to quickly connect with a wider network (Borgatti *et al.*, 2013). In the Twitter context, degree centrality captures users' engagement with other users and their content. Users with high degree centrality act as conversational hubs on the platform (Hansen *et al.*, 2020). A project owner's high degree centrality can enable crowdfunding project information to spread across a wider network, which could help attract more backers and funding.

Our results also show that project owners' betweenness centrality is significantly associated with crowdfunding project success. Betweenness centrality measures how often a given node falls along the shortest path between two other nodes (Borgatti *et al.*, 2013), and it highlights the potential to control flows through a network – i.e. to play a gatekeeping or toll-taking role. Network nodes with high betweenness centrality can filter, color, or distort information when passing it along. At the same time, the ability to exploit a position with high betweenness centrality varies inversely with nodes' ability to create new social ties (Borgatti *et al.*, 2013). On Twitter, a user's high betweenness centrality could indicate the ability to

**Table 6.**
Fixed-effects logit regression models

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ | $\beta$ (se) | $p$ |
| Intercept | 2.544 (0.391) | 0.000 | 3.666 (0.517) | 0.000 | 2.963 (0.399) | 0.000 | 3.948 (0.519) | 0.000 | 3.111 (0.404) | 0.000 | 4.073 (0.529) | 0.000 |
| PBTF | 0.077 (0.024) | 0.002 | 0.071 (0.025) | 0.004 | 0.033 (0.021) | 0.109 | −0.035 (0.021) | 0.085 | 0.019 (0.026) | 0.468 | 0.014 (0.026) | 0.577 |
| POTF | 0.321 (0.034) | 0.000 | 0.320 (0.034) | 0.000 | 0.221 (0.035) | 0.000 | 0.222 (0.035) | 0.000 | −0.232 (0.036) | 0.000 | 0.233 (0.036) | 0.000 |
| Fundraising goal | −0.338 (0.038) | 0.000 | −0.505 (0.062) | 0.000 | −0.375 (0.039) | 0.000 | −0.533 (0.063) | 0.000 | −0.385 (0.039) | 0.000 | −0.542 (0.064) | 0.000 |
| No. of tweets | 0.078 (0.054) | 0.144 | 0.086 (0.054) | 0.110 | 0.129 (0.051) | 0.011 | 0.131 (0.051) | 0.010 | 0.084 (0.054) | 0.122 | 0.087 (0.054) | 0.109 |
| PBSM | *−0.485 (0.075)* | *0.000* | *−0.491 (0.091)* | *0.000* | | | | | *−0.261 (0.077)* | *0.001* | *−0.238 (0.092)* | *0.010* |
| PBDC | 0.414 (0.194) | 0.053 | 0.446 (0.274) | 0.103 | | | | | −0.622 (0.346) | 0.073 | −0.511 (0.514) | 0.320 |
| PBBC | 0.985 (1.704) | 0.563 | −0.107 (2.367) | 0.964 | | | | | 2.651 (1.707) | 0.120 | 1.581 (2.373) | 0.505 |
| POSM | | | | | *0.678 (0.126)* | *0.000* | *0.857 (0.201)* | *0.000* | *0.615 (0.126)* | *0.000* | *0.814 (0.202)* | *0.000* |
| PODC | | | | | *0.790 (0.167)* | *0.000* | *0.762 (0.241)* | *0.002* | *1.116 (0.305)* | *0.000* | *1.011 (0.461)* | *0.028* |
| POBC | | | | | *3.793 (0.810)* | *0.000* | *8.206 (2.514)* | *0.001* | *2.776 (0.877)* | *0.002* | *6.848 (2.536)* | *0.007* |
| Project size (PS) | | | *0.613 (0.209)* | *0.003* | | | *0.754 (0.223)* | *0.001* | | | *0.760 (0.234)* | *0.001* |
| PBSM*PS | | | 0.025 (0.112) | 0.821 | | | | | | | −0.032 (0.114) | 0.774 |
| PBDC*PS | | | 0.035 (0.354) | 0.920 | | | | | | | −0.182 (0.678) | 0.788 |
| PBBC*PS | | | 2.343 (3.343) | 0.483 | | | | | | | 2.227 (3.331) | 0.504 |
| POSM*PS | | | | | | | −0.328 (0.251) | 0.193 | | | −0.358 (0.254) | 0.159 |
| PODC*PS | | | | | | | 0.023 (0.309) | 0.941 | | | 0.157 (0.609) | 0.796 |
| POBC*PS | | | | | | | −5.287 (2.642) | 0.054 | | | −4.881 (2.694) | 0.070 |
| Fixed effects (project category) | Yes | | Yes | | Yes | | Yes | | Yes | | Yes | |
| Pseudo $R^2$ | 0.173 | | 0.179 | | 0.204 | | 0.211 | | 0.212 | | 0.219 | |
| Log likelihood | −1045.42 | | −1037.37 | | −1006.31 | | −997.43 | | −996.74 | | −987.94 | |
| LR $\chi^2$ | 438.96 | 0.000 | 1038.83 | 0.000 | 517.19 | 0.000 | 534.93 | 0.000 | 536.33 | 0.000 | 553.92 | 0.000 |
| $N$ | 2,161 | | 2,161 | | 2,161 | | 2,161 | | 2,161 | | 2,161 | |

**Source(s):** Authors' own creation/work

access users from other disparate network clusters or just the user's presence at both clusters' peripheries (Hansen *et al.*, 2020). Hence, project owners' high betweenness centrality might enable them to control information flows and spread information across different groups. This ability could result in an overall information flow to more disparate networks, potentially increasing owners' chances of attracting more backers and receiving more funding.

This study also found that project owners' retweet counts are significantly associated with crowdfunding project success. Retweets redistribute content across an individual's social network. A higher retweet count indicates that a project owner has distributed more messages related to their crowdfunding project to many Twitter users. Thus, a high count can help attract more potential backers. This finding is consistent with previous studies' findings that crowdfunding project owners' retweets can cause messages to cascade to larger audiences; in many cases, this effect increases interest and trust in a project, thus increasing funding (Liu and Ding, 2020; Liu *et al.*, 2021).

Contrary to our expectations, this study's results show that potential backers' retweet counts and degree centrality are significantly but negatively associated with crowdfunding project success. Our results align with the findings of Polzin *et al.* (2018). They observed that, when potential backers make funding decisions for crowdfunding projects, they likely rely on project owners' information, rather than information provided by other potential backers, due to such projects' potential risks and uncertainties. Additionally, when potential backers with high degree centrality act as conversational hubs by tweeting about a crowdfunding project and garnering more retweets, other Twitter users may suspect these potential backers to work as marketers for the project. This suspicion may lead to lower trust in these potential project backers and fewer contributions to the project. At the same time, potential backers with high betweenness centrality have no significant effect on crowdfunding project success. High betweenness centrality can offer access to disparate user groups. However, this access may not necessarily lead to new information about a crowdfunding project campaign since project owners are the primary source of project-related information. Therefore, other potential backers on Twitter might receive the same information about a project from different users with high betweenness centrality and pay little attention to this information. Therefore, their crowdfunding decisions would not be associated with crowdfunding project success.

We also found that project size negatively moderates the relationship between project owners' social media activities and project success. Owners' social media activities such as retweets are much more strongly associated with crowdfunding success for projects with lower fundraising goals than for projects with higher fundraising goals. The reason for this finding might be that projects with higher fundraising goals experience much more struggle to achieve these goals than projects with lower goals. Project owners' social media activities greatly help small projects achieve their lower fundraising goals, but these activities cannot help large projects in the same way. Project size's insignificant moderating effect on our other hypotheses might indicate that project information is the most important variable for potential backers' funding decisions, rather than project size.

## 6. Contributions and limitations

### *6.1 Theoretical contributions*

This study contributes to the literature in the following ways. First, it enriches the literature on implicit social ties' roles in determining crowdfunding project success by assessing both project owners' and potential backers' implicit social ties, based on social media data. This study's results show that project owners' implicit social ties (social media activities, degree centrality and betweenness centrality) are positively associated with crowdfunding project

success, whereas potential backers' implicit social ties are mainly negatively associated with such success. Specifically, potential backers' social media activities are negatively associated with crowdfunding project success, while potential backers' degree centrality and betweenness centrality are not significantly associated with this success. Previous studies have mainly investigated explicit social ties' associations with crowdfunding project success (Colombo *et al.*, 2015; Mollick, 2014; Shneor and Vik, 2020; Kim and Koh, 2023; Tosatto *et al.*, 2022). However, our findings extend the research on social ties' roles in determining crowdfunding project success by investigating the implicit social ties of both project owners and project backers.

Second, in this study, we used network-related measures (degree centrality and betweenness centrality) that were calculated based on social media interactions (i.e. tweets) about crowdfunding projects. These measures enabled us to deeply explain how implicit social ties are associated with crowdfunding project success through individuals' (i.e. project owners' and backers') network positions on social media. Both centrality measures (degree centrality and betweenness centrality) were based on nodes' positions in a network (Borgatti *et al.*, 2013). By using these centrality measures to explain implicit social ties' roles in determining crowdfunding project success, we answered a call to understand the roles of individuals' network positions in crowdfunding research (Hong *et al.*, 2018). Thus, in this study, we have partially addressed a research gap and provided evidence that the network positions of both project owners and potential backers importantly affect crowdfunding outcomes. While project owners' positions positively affect crowdfunding project success, potential backers' positions negatively affect such success.

Finally, to analyze crowdfunding project success, we constructed implicit social networks using social media interactions between project owners and potential backers as this study's data. Researchers have previously examined the link between social ties and crowdfunding project success using mainly explicit social media ties, such as the presence or number of contacts and likes (Colombo *et al.*, 2015; Jin *et al.*, 2020; Mollick, 2014). The current study contributes to the literature on project owners and potential backers by using social media interaction data to measure implicit social ties on social media to explain crowdfunding project success.

### *6.2 Practical implications*

Our study's results have some important practical implications. First, our findings show that project owners' degree centrality and betweenness centrality are positively associated with crowdfunding project success. This association indicates that project owners should engage with other users on social media as much as possible to promote their crowdfunding projects, especially by directly interacting with other users. Additionally, project owners should strive to engage with different user groups (for example, networks based on different locations or interests). These direct interactions with other social media users will likely increase project funding.

Second, our findings show that project owners' social media activities are positively associated with projects' success. Practically, this finding indicates that project owners should strive to use social media platforms' information-sharing functionality (such as shares on Facebook and retweets on Twitter) as much as possible since their social media activity effectively attracts funding during crowdfunding campaigns. However, we found that project size has a negative moderating effect on the relationship between project owners' social media activities and project success. This finding indicates that project owners should consider their fundraising goals when using social media for a crowdfunding campaign.

Finally, our findings show that potential backers' social media activity and degree centrality are negatively associated with crowdfunding project success. Practically, these findings

indicate that project owners should not rely on their social media followers or influencers to attract potential backers since followers' and influencers' excessive sharing of project information could lead to fewer contributions by other social media users. Accordingly, project owners should focus on actively sharing project information with social media users by serving as information hubs, which will help attract more potential backers.

### *6.3 Limitations and future research*

This study faced some limitations. First, we used data from June 2016 to September 2018, which may have limited our findings' generalizability somewhat. In future studies, researchers could use data from different periods and examine whether similar results can be obtained. Second, in this study, we used data from a single crowdfunding platform and a single social media platform. This decision may have limited our findings' generalizability to different platforms. In future studies, researchers should consider replicating the current study using data from various crowdfunding and social media platforms. Third, to test our hypotheses, we used only three measures that we derived from social media data to assess implicit social ties. In future studies, researchers could use other measures of social ties derived from social media data, such as hashtags, text sentiment and topic clouds. Finally, we did not consider factors such as previous crowdfunding experience (for example, whether project owners had participated in multiple crowdfunding projects or whether backers had previously supported projects). In future studies, researchers could consider such factors while analyzing how project owners' and backers' social ties determine crowdfunding project success.

## References

Agrawal, A., Catalini, C. and Goldfarb, A. (2015), "Crowdfunding: geography, social networks, and the timing of investment decisions", *Journal of Economics and Management Strategy*, Vol. 24 No. 2, pp. 253-274, doi: 10.1111/jems.12093.

Ahmadian, S., Joorabloo, N., Jalili, M., Ren, Y., Meghdadi, M. and Afsharchi, M. (2020), "A social recommender system based on reliable implicit relationships", *Knowledge-Based Systems*, Vol. 192, 105371, doi: 10.1016/j.knosys.2019.105371.

Ahn, H. and Park, J.H. (2015), "The structural effects of sharing function on Twitter networks: focusing on the retweet function", *Journal of Information Science*, Vol. 41 No. 3, pp. 354-365, doi: 10.1177/0165551515574974.

Aral, S. and Walker, D. (2014), "Tie strength, embeddedness, and social influence: a large-scale networked experiment", *Management Science*, Vol. 60 No. 6, pp. 1352-1370, doi: 10.1287/mnsc.2014.1936.

Aramo-Immonen, H., Jussila, J. and Huhtamäki, J. (2015), "Exploring co-learning behavior of conference participants with visual network analysis of Twitter data", *Computers in Human Behavior*, Vol. 51, pp. 1154-1162, doi: 10.1016/j.chb.2015.02.033.

Aramo-Immonen, H., Kärkkäinen, H., Jussila, J.J., Joel-Edgar, S. and Huhtamäki, J. (2016), "Visualizing informal learning behavior from conference participants' Twitter data with the Ostinato Model", *Computers in Human Behavior*, Vol. 55, pp. 584-595, doi: 10.1016/j.chb.2015.09.043.

Baber, H. and Fanea-Ivanovici, M. (2023), "Motivations behind backers' contributions in reward-based crowdfunding for movies and web series", *International Journal of Emerging Markets*, Vol. 18 No. 3, pp. 666-684, doi: 10.1108/IJOEM-01-2021-0073.

Belleflamme, P., Lambert, T. and Schwienbacher, A. (2014), "Crowdfunding: tapping the right crowd", *Journal of Business Venturing*, Vol. 29 No. 5, pp. 585-609, doi: 10.1016/j.jbusvent.2013.07.003.

Bokunewicz, J.F. and Shulman, J. (2017), "Influencer identification in Twitter networks of destination marketing organizations", *Journal of Hospitality and Tourism Technology*, Vol. 8 No. 2, pp. 205-219, doi: 10.1108/JHTT-09-2016-0057.

Borgatti, S.P. and Halgin, D.S. (2011), "On network theory", *Organization Science*, Vol. 22 No. 5, pp. 1168-1181, doi: 10.1287/orsc.1100.0641.

Borgatti, S.P., Everett, M.G. and Johnson, J.C. (2013), *Analyzing Social Networks*, 1st ed., Sage Publications, London.

Borst, I., Moser, C. and Ferguson, J. (2018), "From friendfunding to crowdfunding: relevance of relationships, social media, and platform activities to crowdfunding performance", *New Media and Society*, Vol. 20 No. 4, pp. 1396-1414, doi: 10.1177/1461444817694599.

Bretschneider, U. and Leimeister, J.M. (2017), "Not just an ego-trip: exploring backers' motivation for funding in incentive-based crowdfunding", *The Journal of Strategic Information Systems*, Vol. 26 No. 4, pp. 246-260, doi: 10.1016/j.jsis.2017.02.002.

Britt, R.K., Hayes, J.L., Britt, B.C. and Park, H. (2020), "Too big to bell? A computational analysis of network and content characteristics among mega and micro beauty and fashion social media influencers", *Journal of Interactive Advertising*, Vol. 20 No. 2, pp. 111-118, doi: 10.1080/15252019.2020.1763873.

Bürger, T. and Kleinert, S. (2021), "Crowdfunding cultural and commercial entrepreneurs: an empirical study on motivation in distinct backer communities", *Small Business Economics*, Vol. 57 No. 2, pp. 667-683, doi: 10.1007/s11187-020-00419-8.

Burt, R.S. (2004), "Structural holes and good ideas", *American Journal of Sociology*, Vol. 110 No. 2, pp. 349-399, doi: 10.1086/421787.

Burtch, G., Ghose, A. and Wattal, S. (2014), "Cultural differences and geography as determinants of online prosocial lending", *MIS Quarterly*, Vol. 38 No. 3, pp. 773-794, doi: 10.25300/MISQ/2014/38.3.07.

Cai, W., Polzin, F. and Stam, E. (2021), "Crowdfunding and social capital: a systematic review using a dynamic perspective", *Technology Forecasting and Social Change*, Vol. 162, 120412, doi: 10.1016/j.techfore.2020.120412.

Chen, D., Lü, L., Shang, M.S., Zhang, Y.C. and Zhou, T. (2012), "Identifying influential nodes in complex networks", *Physica A: Statistical Mechanics and Its Applications*, Vol. 391 No. 4, pp. 1777-1787, doi: 10.1016/j.physa.2011.09.017.

Chung, Y., Li, Y. and Jia, J. (2021), "Exploring embeddedness, centrality, and social influence on backer behavior: the role of backer networks in crowdfunding", *Journal of the Academy of Marketing Science*, Vol. 49 No. 5, pp. 925-946, doi: 10.1007/s11747-021-00779-x.

Clauss, T., Breitenecker, R.J., Kraus, S., Brem, A. and Richter, C. (2018), "Directing the wisdom of the crowd: the importance of social interaction among founders and the crowd during crowdfunding campaigns", *Economics of Innovation and New Technology*, Vol. 27 No. 8, pp. 709-729, doi: 10.1080/10438599.2018.1396660.

Coakley, J., Lazos, A. and Liñares-Zegarra, J. (2022), "Strategic entrepreneurial choice between competing crowdfunding platforms", *Journal of Technology Transfer*, Vol. 47 No. 6, pp. 1794-1824, doi: 10.1007/s10961-021-09891-0.

Colombo, M.G., Franzoni, C. and Rossi-Lamastra, C. (2015), "Internal social capital and the attraction of early contributions in crowdfunding", *Entrepreneurship: Theory and Practice*, Vol. 39 No. 1, pp. 75-100, doi: 10.1111/etap.12118.

Cumming, D.J., Leboeuf, G. and Schwienbacher, A. (2020), "Crowdfunding models: keep-it-all vs all-or-nothing", *Financial Management*, Vol. 49 No. 2, pp. 331-360, doi: 10.1111/fima.12262.

Deng, L., Ye, Q., Xu, D., Sun, W. and Jiang, G. (2022), "A literature review and integrated framework for the determinants of crowdfunding success", *Financial Innovation*, Vol. 8 No. 1, p. 41, doi: 10.1186/s40854-022-00345-6.

Efrat, K. and Gilboa, S. (2020), "Relationship approach to crowdfunding: how creators and supporters interaction enhances projects' success", *Electronic Markets*, Vol. 30 No. 4, pp. 899-911, doi: 10.1007/s12525-019-00391-6.

Efrat, K., Gilboa, S. and Wald, A. (2021), "The emergence of well-being in crowdfunding: a study of entrepreneurs and backers of reward and donation campaigns", *International Journal of*

*Entrepreneurial Behavior and Research*, Vol. 27 No. 2, pp. 397-415, doi: 10.1108/IJEBR-12-2019-0685.

English, R. (2014), "Rent-a-crowd? Crowdfunding academic research", *First Monday*, Vol. 19 No. 1, doi: 10.5210/fm.v19i1.4818.

Fischer, E. and Reuber, A.R. (2011), "Social interaction via new social media: (how) can interactions on Twitter affect effectual thinking and behavior?", *Journal of Business Venturing*, Vol. 26 No. 1, pp. 1-18, doi: 10.1016/j.jbusvent.2010.09.002.

Fogues, R.L., Such, J.M., Espinosa, A. and Garcia-Fornes, A. (2018), "Tie and tag: a study of tie strength and tags for photo sharing", *PLoS ONE*, Vol. 13 No. 8, p. e0202540, doi: 10.1371/journal.pone.0202540.

Freeman, L.C. (1978), "Centrality in social networks conceptual clarification", *Social Networks*, Vol. 1 No. 3, pp. 215-239, doi: 10.1016/0378-8733(78)90021-7.

Geva, H., Oestreicher-Singer, G. and Saar-Tsechansky, M. (2019), "Using retweets when shaping our online persona: topic modeling approach", *MIS Quarterly*, Vol. 43 No. 2, pp. 501-524, doi: 10.25300/MISQ/2019/14346.

Gilbert, E. and Karahalios, K. (2009), "Predicting tie strength with social media", *Conference on Human Factors in Computing Systems Proceedings*, ACM, pp. 211-220, doi: 10.1145/1518701.1518736.

Gleasure, R. and Feller, J. (2018), "What kind of cause unites a crowd? Understanding crowdfunding as collective action", *Journal of Electronic Commerce Research*, Vol. 19 No. 3, pp. 223-236.

Granovetter, M.S. (1973), "The strength of weak ties", *American Journal of Sociology*, Vol. 78 No. 6, pp. 1360-1380, doi: 10.1086/225469, available at: http://www.jstor.org/stable/2776392

Greiner, M.E. and Wang, H. (2010), "Building consumer-to-consumer trust in e-finance marketplaces: an empirical analysis", *International Journal of Electronic Commerce*, Vol. 15 No. 2, pp. 105-136, doi: 10.2753/JEC1086-4415150204.

Hansen, D.L., Shneiderman, B., Smith, M.A. and Himelboim, I. (2020), "Twitter: information flows, influencers, and organic communities", in Hansen, D.L., Shneiderman, B., Smith, M.A. and Himelboim, I. (Eds), *Analyzing Social Media Networks with NodeXL*, 2nd ed., Morgan Kaufmann, pp. 161-178, doi: 10.1016/B978-0-12-817756-3.00011-X.

Herd, K.B., Mallapragada, G. and Narayan, V. (2021), "Do backer affiliations help or hurt crowdfunding success?", *Journal of Marketing*, Vol. 86 No. 5, pp. 117-134, doi: 10.1177/00222429211031814.

Hong, Y., Hu, Y. and Burtch, G. (2018), "Embeddedness, prosociality, and social influence: evidence from online crowdfunding", *MIS Quarterly*, Vol. 42 No. 4, pp. 1211-1224, doi: 10.25300/MISQ/2018/14105.

Hornuf, L. and Schwienbacher, A. (2017), "Should securities regulation promote equity crowdfunding?", *Small Business Economics*, Vol. 49 No. 3, pp. 579-593, doi: 10.1007/s11187-017-9839-9.

Huang, H., Tang, J., Liu, L., Luo, J. and Fu, X. (2015), "Triadic closure pattern analysis and prediction in social networks", *IEEE Transactions on Knowledge and Data Engineering*, Vol. 27 No. 12, pp. 3374-3389, doi: 10.1109/TKDE.2015.2453956.

James, G., Witten, D., Hastie, T. and Tibishirani, R. (2013), *An Introduction to Statistical Learning with Applications in R*, Springer Publishing, New York.

Jin, X. and Cheng, M. (2020), "Communicating mega events on Twitter: implications for destination marketing", *Journal of Travel and Tourism Marketing*, Vol. 37 No. 6, pp. 739-755, doi: 10.1080/10548408.2020.1812466.

Jin, Y., Ding, C., Duan, Y. and Cheng, H.K. (2020), "Click to success? The temporal effects of Facebook likes on crowdfunding", *Journal of the Association for Information Systems*, Vol. 21 No. 5, pp. 1191-1213, doi: 10.17705/1jais.00634.

Jones, J.J., Settle, J.E., Bond, R.M., Fariss, C.J., Marlow, C. and Fowler, J.H. (2013), "Inferring tie strength from online directed behavior", *PLoS ONE*, Vol. 8 No. 1, p. e52168, doi: 10.1371/journal.pone.0052168.

Josefy, M., Dean, T.J., Albert, L.S. and Fitza, M.A. (2017), "The role of community in crowdfunding success: evidence on cultural attributes in funding campaigns to 'save the local theater'", *Entrepreneurship Theory and Practice*, Vol. 41 No. 2, pp. 161-182, doi: 10.1111/etap.12263.

Kaartemo, V. (2017), "The elements of a successful crowdfunding campaign: a systematic literature review of crowdfunding performance", *International Review of Entrepreneurship*, Vol. 15 No. 3, pp. 291-318.

Kickstarter.com (2023), "Kickstarter stats — kickstarter", available at: https://www.kickstarter.com/help/stats (accessed 11 February 2023).

Kim, Y. and Koh, T.K. (2023), "Crowdfunding from friends: tie strength and embeddedness", *Decision Support Systems*, Vol. 168, 113931, doi: 10.1016/j.dss.2023.113931.

Kim, Y. and Zhang, Z. (2017), "Mobilizing online social capital: the relational view of crowdfunding", *International Conference on Information Systems, 2017 Proceedings: Transforming Society with Digital Innovation*, AIS.

Kim, C., Kannan, P.K., Trusov, M. and Ordanini, A. (2020), "Modeling dynamics in crowdfunding", *Marketing Science*, Vol. 39 No. 2, pp. 339-365, doi: 10.1287/mksc.2019.1209.

Kline, R.B. (2015), *Principles and Practice of Structural Equation Modeling*, 4th ed., Guilford Publications, New York.

Klöhn, L. (2018), "The regulation of crowdfunding in Europe", in Cumming, D. and Hornuf, L. (Eds), *The Economics of Crowdfunding: Startups, Portals and Investor Behavior*, Springer International Publishing, pp. 219-253, doi: 10.1007/978-3-319-66119-3_10.

Koch, J.A. and Cheng, Q. (2016), "The role of qualitative success factors in the analysis of crowdfunding success: evidence from Kickstarter", *Pacific Asia Conference on Information Systems, 2016 Proceedings*, AIS.

Konhäusner, P., Shang, B. and Dabija, D.-C. (2021), "Application of the 4Es in online crowdfunding platforms: a comparative perspective of Germany and China", *Journal of Risk and Financial Management*, Vol. 14 No. 2, p. 49, doi: 10.3390/jrfm14020049.

Kromidha, E. and Robson, P. (2016), "Social identity and signaling success factors in online crowdfunding", *Entrepreneurship and Regional Development*, Vol. 28 Nos 9-10, pp. 605-629, doi: 10.1080/08985626.2016.1198425.

Lee, K., Lee, B. and Oh, W. (2015), "Thumbs up, sales up? The contingent effect of Facebook likes on sales performance in social commerce", *Journal of Management Information Systems*, Vol. 32 No. 4, pp. 109-143, doi: 10.1080/07421222.2015.1138372.

Levin, D.Z. and Cross, R. (2004), "The strength of weak ties you can trust: the mediating role of trust in effective knowledge transfer", *Management Science*, Vol. 50 No. 11, pp. 1477-1490, doi: 10.1287/mnsc.1030.0136.

Li, G., Chen, Y., Zhang, Z., Zhong, J. and Chen, Q. (2018), "Social personalized ranking with both the explicit and implicit influence of user trust and of item ratings", *Engineering Applications of Artificial Intelligence*, Vol. 67, pp. 283-295, doi: 10.1016/j.engappai.2017.10.006.

Lin, Y. and Boh, W.F. (2020), "How different are crowdfunders? Examining archetypes of crowdfunders", *Journal of the Association for Information Science and Technology*, Vol. 71 No. 11, pp. 1357-1370, doi: 10.1002/asi.24332.

Lin, M. and Viswanathan, S. (2016), "Home bias in online investments: an empirical study of an online crowdfunding market", *Management Science*, Vol. 62 No. 5, pp. 1393-1414, doi: 10.1287/mnsc.2015.2206.

Liu, J. and Ding, J. (2020), "Requesting for retweeting or donating? A research on how the fundraiser seeks help in the social charitable crowdfunding", *Physica A: Statistical Mechanics and Its Applications*, Vol. 557, 124812, doi: 10.1016/j.physa.2020.124812.

Liu, D., Brass, D.J., Lu, Y. and Chen, D. (2015), "Friendships in online peer-to-peer lending: pipes, prisms, and relational herding", *MIS Quarterly*, Vol. 39 No. 3, pp. 729-742, doi: 10.25300/misq/2015/39.3.11.

Liu, Y., Chen, Y. and Fan, Z.P. (2021), "Do social network crowds help fundraising campaigns? Effects of social influence on crowdfunding performance", *Journal of Business Research*, Vol. 122, pp. 97-108, doi: 10.1016/j.jbusres.2020.08.052.

Lu, C.T., Xie, S., Kong, X. and Yu, P.S. (2014), "Inferring the impacts of social media on crowdfunding", *WSDM 2014 - Proceedings of the 7th ACM International Conference on Web Search and Data Mining*, ACM, pp. 573-582, doi: 10.1145/2556195.2556251.

Lynn, T., Rosati, P., Nair, B. and Bhaird, C.M. (2020), "An exploratory data analysis of the #crowdfunding network on Twitter", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 6 No. 3, 80, doi: 10.3390/JOITMC6030080.

Madrazo-Lemarroy, P., Barajas-Portas, K. and Labastida Tovar, M.E. (2019), "Analyzing campaign's outcome in reward-based crowdfunding: social capital as a determinant factor", *Internet Research*, Vol. 29 No. 5, pp. 1171-1189, doi: 10.1108/INTR-03-2018-0115.

Marsden, P.V. and Campbell, K.E. (1984), "Measuring tie strength", *Social Forces*, Vol. 63 No. 2, pp. 482-501, doi: 10.1093/sf/63.2.482.

Marsden, P.V. and Campbell, K.E. (2012), "Reflections on conceptualizing and measuring tie strength", *Social Forces*, Vol. 91 No. 1, pp. 17-23, doi: 10.1093/sf/sos112.

Meng, J., Peng, W., Tan, P.N., Liu, W., Cheng, Y. and Bae, A. (2018), "Diffusion size and structural virality: the effects of message and network features on spreading health information on Twitter", *Computers in Human Behavior*, Vol. 89, pp. 111-120, doi: 10.1016/j.chb.2018.07.039.

Mollick, E.R. (2014), "The dynamics of crowdfunding: an exploratory study", *Journal of Business Venturing*, Vol. 29 No. 1, pp. 1-16, doi: 10.1016/j.jbusvent.2013.06.005.

Moritz, A. and Block, J.H. (2016), "Crowdfunding: a literature review and research directions", in Brüntje, D. and Gajda, O. (Eds), *Crowdfunding in Europe: State of the Art in Theory and Practice*, Springer, pp. 25-53, doi: 10.1007/978-3-319-18017-5_3.

Onnela, J.P., Saramäki, J., Hyvönen, J., Szabó, G., Lazer, D., Kaski, K., Kertész, J. and Barabási, A.-L. (2007), "Structure and tie strengths in mobile communication networks", *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 104 No. 18, pp. 7332-7336, doi: 10.1073/pnas.0610245104.

Ordanini, A., Miceli, L., Pizzetti, M. and Parasuraman, A. (2011), "Crowdfunding: transforming customers into investors through innovative service platforms", *Journal of Service Management*, Vol. 22 No. 4, pp. 443-470, doi: 10.1108/09564231111155079.

Paschen, J. (2017), "Choose wisely: crowdfunding through the stages of the startup life cycle", *Business Horizons*, Vol. 60 No. 2, pp. 179-188, doi: 10.1016/j.bushor.2016.11.003.

Phang, C.W., Zhang, C. and Sutanto, J. (2013), "The influence of user interaction and participation in social media on the consumption intention of niche products", *Information and Management*, Vol. 50 No. 8, pp. 661-672, doi: 10.1016/j.im.2013.07.001.

Polzin, F., Toxopeus, H. and Stam, E. (2018), "The wisdom of the crowd in funding: information heterogeneity and social networks of crowdfunders", *Small Business Economics*, Vol. 50 No. 2, pp. 251-273, doi: 10.1007/s11187-016-9829-3.

Reafee, W., Salim, N. and Khan, A. (2016), "The power of implicit social relation in rating prediction of social recommender systems of social recommender", *PLoS ONE*, Vol. 11 No. 5, e0154848, doi: 10.1371/journal.pone.0154848.

Rodriguez-Ricardo, Y., Sicilia, M. and López, M. (2019), "Altruism and internal locus of control as determinants of the intention to participate in crowdfunding: the mediating role of trust", *Journal of Theoretical and Applied Electronic Commerce Research*, Vol. 14 No. 3, pp. 1-16, doi: 10.4067/S0718-18762019000300102.

Saxton, G.D. and Wang, L. (2014), "The social network effect: the determinants of giving through social media", *Nonprofit and Voluntary Sector Quarterly*, Vol. 43 No. 5, pp. 850-868, doi: 10.1177/0899764013485159.

Schwienbacher, A. (2018), "Entrepreneurial risk-taking in crowdfunding campaigns", *Small Business Economics*, Vol. 51 No. 4, pp. 843-859, doi: 10.1007/s11187-017-9965-4.

Shi, Z., Rui, H. and Whinston, A.B. (2014), "Content sharing in a social broadcasting environment: evidence from Twitter", *MIS Quarterly*, Vol. 38 No. 1, pp. 123-142, doi: 10.25300/MISQ/2014/38.1.06.

Shneor, R. and Vik, A.A. (2020), "Crowdfunding success: a systematic literature review 2010-2017", *Baltic Journal of Management*, Vol. 15 No. 2, pp. 149-182, doi: 10.1108/BJM-04-2019-0148.

Shneor, R., Mrzygłód, U., Adamska-Mieruszewska, J. and Fornalska-Skurczyńska, A. (2022), "The role of social trust in reward crowdfunding campaigns' design and success", *Electronic Markets*, Vol. 32 No. 3, pp. 1103-1118, doi: 10.1007/s12525-021-00456-5.

Tan, Y.H. and Reddy, S.K. (2021), "Crowdfunding digital platforms: backer networks and their impact on project outcomes", *Social Networks*, Vol. 64, pp. 158-172, doi: 10.1016/j.socnet.2020.09.005.

Thies, F., Wessel, M. and Benlian, A. (2016), "Effects of social interaction dynamics on platforms", *Journal of Management Information Systems*, Vol. 33 No. 3, pp. 843-873, doi: 10.1080/07421222.2016.1243967.

Thies, F., Wessel, M. and Benlian, A. (2018), "Network effects on crowdfunding platforms: exploring the implications of relaxing input control", *Information Systems Journal*, Vol. 28 No. 6, pp. 1239-1262, doi: 10.1111/isj.12194.

Tosatto, J., Cox, J. and Nguyen, T. (2022), "With a little help from my friends: the role of online creator-fan communication channels in the success of creative crowdfunding campaigns", *Computers in Human Behavior*, Vol. 127, 107005, doi: 10.1016/j.chb.2021.107005.

Vulkan, N., Åstebro, T. and Sierra, M.F. (2016), "Equity crowdfunding: a new phenomena", *Journal of Business Venturing Insights*, Vol. 5, pp. 37-49, doi: 10.1016/j.jbvi.2016.02.001.

Wang, N., Li, Q., Liang, H., Ye, T. and Ge, S. (2018), "Understanding the importance of interaction between creators and backers in crowdfunding success", *Electronic Commerce Research and Applications*, Vol. 27, pp. 106-117, doi: 10.1016/j.elerap.2017.12.004.

Wang, N., Liang, H., Xue, Y. and Ge, S. (2021), "Mitigating information asymmetry to achieve crowdfunding success: signaling and online communication", *Journal of the Association for Information Systems*, Vol. 22 No. 3, pp. 773-796, doi: 10.17705/1jais.00679.

Weng, L., Zhang, Q., Lin, Z. and Wu, L. (2021), "Harnessing heterogeneous social networks for better recommendations: a grey relational analysis approach", *Expert Systems with Applications*, Vol. 174, 114771, doi: 10.1016/j.eswa.2021.114771.

Xu, W.W., Sang, Y., Blasiola, S. and Park, H.W. (2014), "Predicting opinion leaders in Twitter activism networks: the case of the Wisconsin recall election", *American Behavioral Scientist*, Vol. 58 No. 10, pp. 1278-1293, doi: 10.1177/0002764214527091.

Yin, C., Liu, L. and Mirkovski, K. (2019), "Does more crowd participation bring more value to crowdfunding projects? The perspective of crowd capital", *Internet Research*, Vol. 29 No. 5, pp. 1149-1170, doi: 10.1108/INTR-03-2018-0103.

Zheng, H., Li, D., Wu, J. and Xu, Y. (2014), "The role of multidimensional social capital in crowdfunding: a comparative study in China and US", *Information and Management*, Vol. 51 No. 4, pp. 488-496, doi: 10.1016/j.im.2014.03.003.

Zhou, W., Duan, W. and Piramuthu, S. (2014), "A social network matrix for implicit and explicit social network plates", *Decision Support Systems*, Vol. 68, pp. 89-97, doi: 10.1016/j.dss.2014.09.006.

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