

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

“It’s fine to celebrate success, but it is more important to heed the lessons of failure.”

Bill Gates
Co-founder of Microsoft

Crowdfunding has emerged in recent years as an important alternative means for technology entrepreneurs to raise funds for their products and business ideas. While the success rate of crowdfunding projects is somewhat low, scholarly understanding of what distinguishes projects that reach their fundraising goals from those that fail remains incomplete. Further, studies on crowdfunding success often examine a number of variables that make predicting success a challenge for entrepreneurs willing to use crowdfunding. This study uses topic modelling on a data set of over 21,000 technology projects from Kickstarter to investigate if short-text project summaries can reveal predictors of fundraising success on crowdfunding platforms. The results indicate that compared to those that fail in fundraising, project summaries of successfully funded technology projects put forward more trendy topics, use wording that reflects novelty, and focus on solving a social problem. Our results contribute to theory and practice by suggesting the importance of summarizing project content for crowdfunding success.

Introduction

Crowdfunding has become an important channel for innovators, entrepreneurs, and incumbents to raise funds for developing new technology products and business ideas (Yuan et al., 2016; Kraus et al., 2016; Dushnitsky et al., 2016; Brem et al., 2019; Popescul et al., 2020; Rrustemi & Tuchschnid, 2020; Sahaym et al., 2021). Crowdfunding has been defined as “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” (Hörisch, 2015; Simons et al., 2019). Unlike traditional funding and investment options, crowdfunding is an alternative digital multisided marketplace that stays open to everyone (Kraus et al., 2016; Hoegen et al., 2018; Isabelle et al., 2019; Koch & Siering, 2019). It thereby aims to collect small amounts of money from many non-professional investors, rather than large amounts of money from a few professional investors (Simon et al., 2019).

The benefits of crowdfunding include online platforms that allow for efficient matching of fund-seekers and funders, aggregating small donations into large pools of capital, lowering geographic barriers to fundraising, funding projects that may otherwise be outside of traditional funding methods, and democratizing research and exploration in underexplored fields (Pomeroy et al., 2019; Popescul et al., 2020; Felipe et al., 2022). Crowdfunding platforms provide fund-seekers and funders with means for investment transactions to take place that create value (that is, via legal groundwork, pre-selection screening, and processing financial transactions), as well as allowing for the testing of new products, estimating demands, and running new marketing campaigns (Cordova et al., 2015; Lukkarinen et al., 2016; Borst et al., 2018; Wehnert et al., 2019; Popescul et al., 2020).

According to Koch and Siering (2019), a successful funding of crowdfunding campaigns can be important for founders, investors, platform operators, and other interest groups. However, success in raising capital through crowdfunding that involves non-professional

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

investors and happens online may not be easy and the determinants of investment decisions on crowdfunding platforms may be different than in traditional investing environments (Lukkarinen et al., 2016; Hoegen et al., 2018; Song et al., 2019; Popescu et al., 2020; Cappa et al., 2021). Rosetto and Regner (2018) found that most successful crowdfunding projects are not succeeding for 75 percent of their funding period. Further, Liang et al. (2019) noted that the success rate of projects that reach their crowdfunding goal is low (for example, 33 percent on Kickstarter), implying a need for research on what affects funders' intentions to sponsor or not sponsor a project.

Borst et al. (2018) argued that, for example, the online nature of crowdfunding may amplify a "bystander effect", which suggests that potential funders may withhold funding because they assume that others will provide funding. While research to understand and predict crowdfunding success has accelerated in recent years (for example, Majumdar & Bose, 2018; Song et al., 2019; Felipe et al., 2022), it has often focused on highly specific industrial domains, such as green energy (Hörisch, 2015; Kubo et al., 2021), restaurants (Lelo de Larrea et al., 2019), medical solutions (Ba et al., 2021), video games (Song et al., 2019), or space exploration (Pomeroy et al., 2019). Alternatively, research has also addressed multiple domains and numerous variables at once (for example, Parhankangas & Rernko, 2017; Zhou et al., 2018; Song et al., 2019; Ryoba et al., 2021).

More accurate prediction models may be provided by widening up a large number of variables into the research investigations, such as including project and funding level (Liang et al., 2019), the entrepreneur's gender (Johnson et al., 2018; Geiger & Moore, 2022), education (Allison et al., 2017), number of social network ties (Lukkarinen et al., 2016; Borst et al., 2018; Hoegen et al., 2018), number of comments and blog entries, and presence of a video appeal (see Kraus et al., 2016; Wang et al. 2018; Geiger & Moore, 2022; Kubo et al., 2021; Ryoba et al., 2021). However, applying such complex models into practice can be difficult. Fundraising has also been suggested as dependant upon how funding requests are placed (Majumdar & Bose, 2018), implying that crowdfunding decisions could depend on the content and persuasiveness of short-text descriptions that summarize a fund-seeking project's main idea (Parhankangas & Renko, 2017; Majumdar & Bose, 2018; Koch & Siering, 2019; Yeh et al., 2019). This possible avenue of exploration gives raise to our research question for this paper: can we identify what matters for

funders deciding whether or not to sponsor fund-seekers by investigating fund-seeking project summaries and using that information to predict project crowdfunding success?

Automated content analysis of texts can help to identify key topics in textual data (Yuan et al., 2016; Costello & Lee, 2022). One particular method of content analysis called "topic modelling" has emerged to explore hidden topics in text documents, which provides a means of analyzing large unclassified texts (Alghamdi & Amfalqi, 2015; Jeong et al., 2019). It creates clusters of words based on co-occurrences and similarity of meanings and distinguishes between uses of words with multiple meanings (Alghamdi & Amfalqi, 2015). Prior studies have applied topic modelling on crowdfunding project descriptions in specific technology domains such as green energy (Yuan et al., 2016) and software (Lee & Sohn, 2019), and suggested that results from topic modelling should be linked with project funding success (Jiang et al., 2020). Hence, in our research we used topic modelling, namely the Latent Dirichlet Allocation (LDA) method (Blei et al., 2003) applied to a data set of over 21,000 short-text summaries of diverse technology projects from Kickstarter. This was done to identify and compare topics in project summaries of successfully funded versus unsuccessfully funded fund-seeking projects. In this way, we aimed to contribute to the literature with various insights on what matters for fundraising success in crowdfunding.

Literature Review

Crowdfunding success

Crowdfunding opens an alternative financing channel for entrepreneurs to raise funds online for innovative projects (Xu et al., 2016). In crowdfunding, a high number of individuals, each contributing relatively small amounts of capital, can collectively aggregate funds for the purpose of financing potentially large projects (Hörisch, 2015). Crowdfunding is facilitated by online platforms where people can register a project and try to raise funds from a crowd of platform users (Brem et al., 2019; Song et al., 2019). Projects on crowdfunding platforms are often called "campaigns" (Popescu et al., 2020). A project "creator" (also known as "initiator", "founder" or "fundraiser") sets an appeal to potential funders (also known as "investors", "backers" or "lenders") in the crowd of users through a dedicated crowdfunding platform for capital. This takes place in the form of loans, donations, equity purchases, or pre-ordering a product (Kraus et al., 2016; Koch & Siering,

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

2019; Pomeroy et al., 2019). Online platforms such as Kickstarter or Indiegogo serve as intermediaries that charge fees to creator fundraisers, while funders are not required to pay fees to the platform (Kraus et al., 2016; Zhang et al., 2022). Crowdfunding platforms not only allow creators to raise money, but also enable them to gain public attention, connect with others, run marketing campaigns, test and validate new products and services, and obtain feedback from a platform crowd (Cordova et al., 2015; Bi et al., 2017; Wehnert et al., 2019).

Crowdfunding can be applied to raise money for various purposes, based on the specific type of platform; for example, organizing an event, realizing an art project, accomplishing a social initiative, creating a product, or launching a start-up (Petitjean, 2018; Brem et al., 2019). Crowdfunding platforms offer several different models of crowdfunding: 1) donation-based crowdfunding, where funders do not receive any reward but donate for the pleasure that they get from supporting an initiative, 2) passive investment crowdfunding (also known as the “reward-based model”) where funders receive a monetary or non-monetary reward for their support, ranging from honorary recognition to receiving the final product or service for free or at a discounted price, or even profit sharing, 3) the lending-based model, where investors provide small loans and can earn a contractually-agreed interest payment, and 4) active investment crowdfunding (also known as the “equity-based model”), where funders, similar to traditional investors, receive shares or similar rights in return for their financial contribution (Hörisch, 2015; Kraus et al., 2016; Yeh et al., 2019; Ralcheva & Roosenbloom, 2021; Felipe et al., 2022). According to several scholars (Cordova et al., 2015; Xie et al., 2019; Ralcheva & Roosenbloom, 2021; Cappa et al., 2021), reward-based platforms such as Kickstarter have been the most popular due to their widespread usage by entrepreneurs for raising funds for startup businesses or pre-selling products and services. However, platforms that have started using the equity-based model are rapidly growing in importance. Further, Petitjean (2018) argued that reward-based and equity-based crowdfunding campaigns are driven by similar success factors.

Previous research has investigated crowdfunding success from multiple perspectives. Xu et al. (2016) argued that crowdfunding consists of two major phases: 1) raising capital, and 2) project implementation. Thus, crowdfunding success or failure addresses two key dimensions: whether the crowdfunding project reaches its capital raising goal, and whether the entrepreneur

implements the project successfully (Xu et al., 2016). Scholars such as Xu et al. (2016) and Pomeroy et al. (2019) have focused on understanding the antecedents and consequences of success in the second dimension, that is, project implementation. Xu et al. (2016) investigated the role of project implementation performance (delivery timeliness and product quality), project novelty, sponsor participation, entrepreneur activeness, and sponsor demographics. Of note, sponsor participation was found to be highly important for successful crowdfunding as it helps entrepreneurs improve their projects (Xu et al., 2016). Further, Mollick (2014) found that the geographical proximity of founders to their project’s supporters tends to result in more successful projects. Stanko and Henard (2017) noticed that the amount of funding raised does not significantly impact implementation performance, while the number of backers does. Finally, Pomeroy et al. (2019) found that crowdfunding implementation can lead to democratizing exploration in emerging and under-researched fields.

That said, most research on crowdfunding success has aimed at identifying the antecedents of successfully raising capital, rather than on project implementation. Hence, similar to Yan et al. (2016), Sahaym et al. (2021) and Zhang et al. (2022), “crowdfunding success” in our study refers to the fundraising success of a project, addressing specifically whether or not the project’s initial funding goal is met. Naturally, the higher a project’s funding goal is, the less likely it will be reached (Koch & Siering, 2019). Nonetheless, prediction models that aim to understand crowdfunding success from the fundraising perspective typically include a large number of various antecedents, ranging from the creator’s age and gender (Johnson et al., 2018; Ba et al., 2021), education (Allison et al., 2017), and social capital (Ba et al., 2021; Zhang et al., 2022), to web presence and social network ties (Hoegen et al., 2018), replies, updates, comments and blog entry counts on the project (Kraus et al., 2016; Wang et al., 2018; Yeh et al., 2019), word count of the project’s introduction, video count (Bi et al., 2017), and project type and funding level (Liang et al., 2019). Cordova et al. (2015) investigated the roles of funding goal, project duration, and daily amount of money contributions in predicting fundraising success. They found that backers tend to evaluate project potential in terms of a project’s anticipated economic value, in addition to the presence of a guaranteed tangible output. Likewise important were the degree to which the functional benefits of the project outcome serve a functional need of the individual funder

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

(Cordova et al., 2015), as well as the project's general trustworthiness (Liang et al., 2019; Song et al., 2019; Yeh et al., 2019).

Nonetheless, it may not be quantity, but rather quality that matters most for crowdfunding success. In other words, important factors include what is said and how (that is, the tone) the project is being introduced (Chen et al., 2013; Costello & Lee, 2022; Geiger & Moore, 2022). For example, the presence of various persuasive appeals, such as videos (Wheat et al., 2013) and various rational and emotional appeals, use of images, length of project title and description (Koch & Siering, 2019; Yeh et al., 2019), as well as references to authenticity in a funding request increase the likelihood of a project's funding success (Majumdar & Bose, 2018). Davis et al. (2017) found that the affective reactions of funders toward a new product pitch, particularly in terms of how the funders perceive entrepreneurial passion in the crowdfunding pitch, be that written or spoken in a video, are strongly associated with crowdfunding success. Further, the linguistic style and persuasiveness of entrepreneurial communication and the project description have been identified as being essential for fundraising performance (Parhankangas & Renko, 2017). In particular, the content of the project description, via either a short summary of the project or a longer elaboration, has surfaced as a potential indicator of a project's funding success (Majumdar & Bose, 2018; Zhou et al., 2018; Yeh et al., 2019; Costello & Lee, 2022). Zhang and colleagues (2022) found that longer descriptions about campaigns can improve crowdfunding performance. However, while many crowdfunding platforms, such as Kickstarter, only provide short-text project summaries, limited to tens of characters (Koch & Siering, 2019), a question remains: can content analysis of short-text project summaries help to predict crowdfunding success?

Topic modelling

The accumulation of user-generated content (UGC), including a wealth of information about people's tastes, opinions, thoughts, and actions is raising an increasing interest from entrepreneurs (Gallinucci et al., 2015). Topic modelling offers a means to extract meaningful information from documents through attempts to identify models, trends, patterns, or rules in unstructured textual data (He et al., 2017). Topic modelling is based on the idea that every document in a text corpus addresses various topics that are not necessarily known a priori (Bittermann et al., 2018). Thus, it helps to uncover hidden shared topics in

multiple text documents. This is because text documents are composed of words, and a topic mentioned in multiple documents can be expressed in a combination of correlated words (Jeong et al., 2019). As a result, topic modelling can discover underlying patterns called "topics" that unite the documents in the corpus (Alghamdi & Amfalqi, 2015).

Among the alternative topic modelling algorithms, Latent Dirichlet Allocation (LDA) has become the most widely used (Guen & Juyoung, 2018). It is considered to offer the highest performance value when dealing with a large-scale of documents and interpreting topics (Jeong et al., 2019). LDA is a generative probabilistic model (Blei et al., 2003) that enables determining the probability of a text document that belongs to each topic and which thereafter groups overlapping topics in documents. It also helps to identify which topics are capturing more attention (Calheiros et al., 2017). According to Huang et al. (2018), the benefits of LDA include that, 1) it can process a massive collection of documents that would be too costly to code manually, 2) it provides a reliable and replicable classification of topics, and 3) it does not require researchers to pre-specify rules or keywords for the underlying taxonomy of categories. Lee and Sohn (2019) applied LDA to investigate the crowdfunding of software projects and suggested that the results from topic modelling should be linked with projects' funding success. Jiang et al. (2020) did not interpret their topics but found that the topics in project descriptions were statistically associated with crowdfunding success. We thus focussed on the Kickstarter platform, analyzing a large data set of projects across various technology subcategories, with the aim of identifying and interpreting key topics in the corpus, associating these topics with crowdfunding success and failure, and explaining the potential associations.

Methodology

Our empirical research draws on a topic modelling analysis of short-text project summaries that were extracted from Kickstarter in 2018. Kickstarter is a reward-based crowdfunding platform that enables entrepreneurs to garner funds in support of a specific purpose, which often centers on the development or distribution of a new, unfinished, or unproven product (Davis et al., 2017; Liang et al., 2019). Our initial data comprised of almost 23,000 project summaries with information on their funding success, covering a total of 15 technology subcategories. Xu et al. (2016) argued that the success of crowdfunding can be measured by

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

whether the crowdfunding project reaches its capital raising goal or whether the entrepreneur implements the project successfully. Similar to Cordova et al. (2015), we studied the crowdfunding success of technology projects, and refer to success or failure in simple terms of overfunding and underfunding. While an overfunded project successfully reaches or exceeds the initial funding goal, an underfunded project fails to reach the goal, and is thus deemed “unsuccessful” in terms of fundraising. This is in line with Kickstarter that uses the All-or-Nothing model as compared to the Keep-it-All model, in which a project’s owner can keep the raised funds even if their project failed to reach its crowdfunding goal (Koch & Siering, 2019; Kubo et al., 2021).

First, we split the data into three groups, namely: successful, unsuccessful, and cancelled projects. Given that we did not know the reasons for cancellations, we could not treat cancelled projects as unsuccessful because the fundraising cancellations took place before the project funding deadline. Thus, similar to Ryoba et al. (2021), we removed cancelled projects from the data, leaving a final data set of over 21,000 summaries with which to compare successful (~7,300) and unsuccessful (~13,900) technology projects. Of note, the ratio of approximately 34 percent successful versus 66 percent unsuccessful technology projects in our data extracted from Kickstarter is nearly equivalent to that of Cordova et al. (2015), whose data of technology projects extracted from the Indiegogo and Eppela platforms included 30 percent successful projects. Further, Liang et al. (2019) reported a 33 percent success rate on Kickstarter, while

Costello and Lee (2022) extracted a 37 percent success rate on Kickstarter.

Second, to understand the distributional properties of the data as suggested by Schmiedel et al. (2019), we calculated the total length of the text corpus, which was approximately 399,000 words. Further, we calculated the average length of a project summary, which was 19 words in both successful and unsuccessful project groups. This eliminated the possibility that crowdfunding success would be associated with the length of a project’s summary. Of note, Koch and Siering (2019) pointed out that Kickstarter provides a rather fixed framework for filling out project information fields, including a strict short-text limitation for project summaries. Thus, we anticipated that project owners tend to put a lot of effort to maximize the informational value of their project description field.

Third, we applied the topic modelling widget of the Orange 3.18 software package to identify a set of topics in two separate corpora (successful and unsuccessful projects). Orange is an open-source data visualization, machine learning, and data mining toolkit (Wikipedia, 2019) that offers the option of applying the LDA algorithm for text analyses. LDA requires researchers to choose the number of topics to be generated (Maier et al., 2018). Given the purpose of providing managerially useful information, we followed the notion of Westerlund et al. (2018) and chose a relatively small number of topics based on trial, avoiding overlaps, and ensuring the interpretability of topics. We ran the analyses systematically from 5 to 15 topics and

Table 1. Topics and their keywords regarding successful projects

<i>Topic</i>	<i>Keywords</i>
Platform	community, free, platform, phone, app, digital, real, technology, project, video
Advanced	first, world, new, online, music, make, wearable, space, get, people
Mobility	design, social, allows, service, book, unique, charging, comfort, anywhere, training
Stress management	help, time, find, sleep, future, take, information, glasses, activity, smartphone
Learning	learning, mobile, students, built, support, home, access, work, needs, school
Smart	smart, better, without, users, power, play, perfect, tool, smartwatch, program
Ambient	learn, bluetooth, audio, control, battery, simple, businesses, performance, local, join

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

concluded that 7 topics provided the best solution in both groups. We also drilled into the text documents to understand each topic using the “concordance” option, which allowed us to spot keywords and their use contexts. That is, we read the high-probability words in topics and their respective use in sentences, to provide a short and intuitive label for each topic (Huang et al., 2018). Finally, we compared topics and their keywords between the two groups (successful and unsuccessful projects) to understand the differences in topics and keywords that might explain the behaviour of funders.

Results

Successful technology projects

Our topic modelling analysis on successfully funded projects revealed several interesting and trendy topics (in 2018). We assigned the topics with descriptive labels based on keywords and their occurrences in the documents. The topics, which reflect uniform patterns across various types of technology, included: 1) Platform, 2) Advanced, 3) Mobility, 4) Stress management, 5) Learning, 6) Smart, and 7) Ambient. In the following, we will elaborate on these topics. Table 1 lists the topics and their keywords derived from the successful projects data set.

The first topic in the data set is 1) Platform, which refers to digital platforms and the related communities around those platforms, addressing how platforms provide digital content such as video, apps, and tools, as well as relevant data and services, and how they bring various stakeholders or sides together. The second topic is 2) Advanced, which refers to advancements in various interesting and newsworthy areas, such as music production, wearable technology, wireless technology, open source, experience creation, and final frontiers such as space exploration. This topic includes many kinds of novel technologies.

The third topic, 3) Mobility, refers to technologies that enable comfort anywhere by providing accessibility to services, media, and content “anywhere, anytime, anyone”. Such technologies may include, for example, smartphone apps that enable access to social networking services or photo libraries, mobile solutions such as portable speakers, social activities, emails, and various types of information portals. The fourth topic, 4) Stress management refers to technologies that help users to relax, for example, by providing them with relaxing time, improving their sleep, monitoring their activity, or offering amusing and enjoyable virtual reality

content.

The fifth topic, 5) Learning, refers to various technologies aimed to support students and learning in general, in the context of schools, home and work, by providing remote access to solutions and research databases that help with learning. The sixth topic, 6) Smart, refers to smart devices, such as smartwatches, and how intelligent technology can augment traditional products and services, such as musical instruments or home and car keys to become smart products and services that provide more value to users.

The seventh topic, 7) Ambient, refers to embedded technologies, for example, technologies within technologies such as Bluetooth, sensors, inbuilt security, voice control, or novel audio or battery technologies that improve the performance, usability, and personal controllability of products and services.

In sum, topics and their keywords in the successful projects group include references to novelty and innovativeness (for example, world’s first, new, unique, innovative, better, revolutionize), needs of communities rather than only individuals (for example, training, learning, service, platform), and a focus on socially relevant problems (for example, social, needs, information, sleep, time, access, future). Overall, the focus seems to be on providing value to communities and solving bigger and more complex problems.

Unsuccessful technology projects

The analysis of technology projects that failed to reach their initial funding goal revealed seven topics labelled as follows: 1) Power, 2) Connected, 3) Handy, 4) Usability, 5) Personal, 6) Mobility, and 7) Easy. Table 2 lists these seven topics and their keywords.

The first topic in the data set of unsuccessful crowdfunding projects is 1) Power, which includes a variety of aspects related to power management, especially in the small device context. These include, for example, charging of devices using the USB plug, power solutions, monitoring power, power-related safety, and the lack of need for charging. The second topic, 2) Connected, refers to being able to connect with social and digital networks, either through cables or wirelessly, with various support tools.

The third topic, 3) Handy, describes technologies and products that are aimed to be available and handy when needed, for example, items and gadgets for hobby,

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

Table 2. Topics and their keywords regarding unsuccessful projects

<i>Topic</i>	<i>Keywords</i>
Power	new, usb, without, charging, ever, power, safety, see, solution, media
Connected	social, portable, tool, provides, makes, energy, network, fast, umbrella, cables
Handy Usability	air, real, golf, let, cold, stick, long, style, protects, website control, used, button, phones, ultimate, enabled, wallet, easily, bottle, left
Personal Mobility	app, phone, light, new, led, keep, stand, small, hand, best device, first, world, people, home, smartphone, car, free, mobile, technology
Easy	time, help, use, designed, life, make, way, easy, water, need

school, or home such as reachable sticks and tools, various time management applications, alert and messaging solutions, liquids that help to do something better than the current options, various items and clothes that provide protection from cold, and so forth. The fourth topic, 4) Usability, refers to features that aid and enable the use of various products or services in an easier manner, for example, a coffee maker equipped with only one button that allows operation through easy control.

The fifth topic, 5) Personal, refers to various types of personal products and services, such as small devices or phone applications that allow users to adjust and customize products and services to their personal liking and needs, which are convenient and lightweight to carry, and provide personal protection or other utility, for example, small but luminous led lights and other items that can be always available. The sixth topic, 6) Mobility describes mobile technologies such as smartphones and other mobile devices, hands-free gadgets, and so forth. Interestingly, the topic is like the Mobility topic identified in successful projects, the main difference being that unsuccessful projects use less novel and more product-oriented terms and argumentation compared with successful projects.

Finally, the seventh topic is 7) Easy, which refers to solutions designed to make an individual's everyday life simple, easy, and convenient. Such solutions include technologies that help a person find something that is lost, save time, money, and effort, for example, with solar and cleaning technologies. The solutions make it simple for people to use specific products and services (for example, remote operability), are fun, and resonate with personal interests and values of users, for example,

cameras and green technologies.

In unsuccessful crowdfunding projects, the topic of Mobility was considered similar to that in successfully funded projects, although the keywords were different and reflected less novelty. The keywords connected to other topics also seemed to address incremental advancements, such as usability improvements (for example, easily, control, enabled, easy, aid), a focus on personal gadgets and aiding tools (for example, tool, device, led, bottle) for easier daily life, and a focus on product features (for example, button, long, stick, portable, design) rather than its value. Overall, the focus tends to be on helping individuals and suggesting that small technological devices can enable more conveniences in their lives.

Discussion and Conclusion

This study used topic modelling on a data set of over 21,000 project summaries from Kickstarter to examine whether short-text project summaries can be used for identifying what appeals to funders or puts them off when assessing technology projects on crowdfunding platforms. According to our results, the topics differ in project summaries of projects that succeed in raising funds versus those that fail to meet their funding goals. Whereas project descriptions of successful technology projects focus on novelty, innovativeness, and big problems shared by larger communities, those of unsuccessful projects focus on providing minor improvements that mainly help individuals to make their daily lives more convenient.

Contributions to theory and practice

The findings provide implications to theory and practice.

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

First, our results contribute to the extant body of literature on crowdfunding project success by suggesting that although studies on crowdfunding success tend to examine many variables at once to create better prediction models (see for example, Zhou et al., 2018; Yeh et al., 2019; Jiang et al., 2020; Ryoba et al., 2021; Sahaym et al., 2021), a simple content analysis of project summaries may be sufficient to estimate success or failure. Specifically, our results show that a content analysis of short-text project summaries can be used for assessing funding success likelihood on crowdfunding platforms. In other words, the project summary alone can be enough to predict whether a project is likely to reach or fail the funding goal.

Further, topic modelling seems to be a good tool for automated content analysis because it can handle large unstructured texts and does not require pre-set rules. However, results from a topic model analysis need to be enriched to proceed from mere clustering of related words into providing managerially meaningful topics. These topics and their keywords can then be converted into concrete results and suggestions that can inform decision-makers. Hence, our results contribute to the literature by addressing the notions by Lee and Sohn (2019) and Jiang et al. (2020) who call for more research that links topic modelling with crowdfunding success. Our study provides entrepreneurs, managers, and innovators with an example of how data mining and content analysis can help them find means to better promote their projects and improve the chances of meeting funding goals.

Second, our results confirm the notion by Yuan et al. (2016) who argued that researchers should look at topical features behind topics. That was apparent to us with Mobility, which surfaced as a topic in both successful and unsuccessful projects, differing between them only in terms of keywords. However, Mobility in unsuccessful projects used clearly less novel and more product-oriented terminology compared to successful projects. The potential of a project may thus be assessed at two levels, namely whether the topic falls under an ongoing technology trend and what the topic's features are, that is, keywords used in the project's fund-seeking summary. Overall, while successfully funded projects represent more trendy topics, they also use terminology that reflects novelty and focus on solving a social problem. While previous research has argued that non-profit projects that emphasize social problems are more likely to succeed in crowdfunding (Mollick, 2014; Hörisch, 2015; Xu et al., 2016), our results suggest that

even for profit-oriented projects, focussing on social problems may be crucial.

Third, our findings are interesting in light of previous research, which found that, in general, online funding success is associated with the language describing a project's targeted focus on social problems, while the role of innovativeness has been less addressed (Parhankangas & Renko, 2017). Song et al. (2019) suggested that topic novelty could play a role in the online funding of non-profit campaigns. Based on our results, novelty plays an especially relevant role in for-profit campaigns. Our findings are in line with previous research, according to which online fundraisers can benefit more from the use of exclusive language if the messages are framed with possible gains for donating (Yilmaz & Blackburn, 2022). Therefore, our results suggest that technology entrepreneurs using crowdfunding should pay attention to wording and concepts in their project summary and emphasize novel project outcomes along with the problem's broader social character. This can be done even after launching a campaign, as Crosetto and Regner (2018) argued that crowdfunding projects can be boosted to eventual success at virtually any point of time.

Limitations and future research

As a limitation of this study, the data set was extracted from a single crowdfunding platform (Kickstarter), covering only a specific period in 2018 and focusing on diverse technology projects as selection criteria. However, Dushnitsky and Fitza (2018) argued that factors associated with success on a given platform may not replicate to other platforms. Lacan and Desmet (2017) noted that funders' attitudes and trust toward a crowdfunding platform itself may affect their funding willingness, thus underscoring the generalizability challenge and calling for further explorations of the results of similar projects across multiple crowdfunding platforms. Future research should therefore cross-validate the results using comparable data from another platform or several platforms.

Future research should also investigate the relationship between topics and their success or failure using a more fine-grained investigation. We only categorized the technology projects studied as "successful" or "unsuccessful", but future research should consider how much a project exceeds or falls short of its initial funding goal and investigate whether topics correlate with the degree of overfunding or underfunding. Finally, future research could examine the words used in project

Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

summaries from the perspective of marketing communication and technology adoption models as suggested by Djimesah et al. (2022). They argue that crowdfunding success and failure may differ in terms of usability, ease of use, and other dimensions of the technology and user acceptance models as presented in the project descriptions.

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Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

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Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

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Technology Project Summaries as a Predictor of Crowdfunding Success

Mika Westerlund, Ishdeep Singh, Mervi Rajahonka & Seppo Leminen

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