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*Crowdfunding: Motivation
and a Measure of Social Energy
in International Context*

ABSTRACT

Social energy is an innovative perspective on the traditional understanding of energy – contained within the realm of physics and chemistry, and signifying here the human propensity and capacity for intensive action. The aim of the article is to determine the relationships and strength of interactions between two main attributes of the discussed funding source: the number of people supporting projects and the sum of donations contributed to projects, taking into account the attribute of the offered reward package serving as motivation for making contributions, as well as to formulate social energy metrics and verify reward packages.

The study covered selected countries with the highest crowdfunding popularity in the years 2020–2025: USA, Japan, Germany, and Canada. Four project features were considered across several dozen categories: the number of successfully completed projects, the sum of contributions to projects in a given category, the number of people supporting projects, and the types of rewards offered to them. A clustering method was applied, examining similar project categories, according to the above characteristics. An online diagnostic survey was conducted regarding motivation to participate in crowdfunding campaigns

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with reward offerings. Social energy metrics were proposed, taking into account selected project attributes.

KEYWORDS: reward crowdfunding; social energy metrics; clusterization; social energy; motivation

INTRODUCTION

Social energy as the human capacity for intensive action is one of the forms of energy occurring in the social living environment. It is always the result of enormous social mobilization, called by some authors “the power of the crowd” (Mayer, 2019; Kromidha & Robson, 2016; Khurana, 2021). However, the term “crowd” is usually used in psychology and psychiatry (e.g., crowd phobia). Meanwhile, the approach to energy in this article is situated in the area of social money power, that is, in so-called crowdfunding. Energy here therefore represents the strength of community funding both through a significant number of people supporting a given project, and through larger or smaller financial contributions. Most often it takes the form of numerous small contributions that accumulate and ensure the project’s success.

People contributing to a given project do so for various reasons. Authors (Mollick, 2014; Li & Wang, 2024) distinguish different types of motivation:

- egocentric motivation – characterized by a person’s tendency to focus attention on themselves, fulfilling their own needs, achieving benefits in the form of satisfaction. People using this motivation are guided by the principle of balancing losses and gains;
- empathic motivation – characterized by the innate human ability to empathize with other people. Currently, the view is accepted that empathic motivation is not the result of innate abilities, but is shaped as a result of certain experiences. There

is a hypothesis that the empathy mechanism functions on the condition that a given person perceives their partner as similar to themselves;

- normative motivation – characterized by an individual’s pursuit of implementing norms accepted by themselves, acquired in the course of socialization or learning processes.

These authors also emphasize that there are many theoretical concepts serving to explain why people help others. These include, among others, the so-called reciprocity theory, the so-called norm of social responsibility, social exchange theory, empathy-altruism theory, or the so-called altruistic personality.

The above theories draw attention to various factors important in the helping process, determining why people decide to act for the benefit of others. They also claim that humans in their behavior are usually guided by self-interest and these motives can be found in seemingly selfless actions. However, there are also forces of sympathy in humans toward people that are truly selfless.

In response to the needs of the first group of people, so-called reward crowdfunding was created. A person contributing a certain sum of money contributes to the project’s success and in return expects a reward. Practitioners operating on crowdfunding platforms believe that a reward can be anything that appeals to potential “donors,” for example:

- products – manufactured as a result of project implementation;
- services – provided as a result of project implementation;
- admission to events at promotional prices;
- discounts on product and service purchases;
- early access to products, pre-sales;
- free tickets;
- sponsored products – mugs, pens, clothing;
- symbolic rewards – public thanks on social media.

For many years, the global reward-based crowdfunding market has belonged to two platforms: Kickstarter and Indiegogo. For example, on Kickstarter every day over 30 campaigns obtain

at least 100% of the required funding. The total daily average of contributions exceeds 3 million dollars, and the daily number of supporters is over 2 thousand. Moreover, over 650 projects have already managed to raise more than 1 million dollars. Meanwhile, on Indiegogo, 19 thousand campaigns are launched every month, and the platform's website itself is visited by over 9 million people every 30 days.

In March 2022, an absolutely record-breaking campaign took place on Kickstarter for "Surprise! Four Secret Novels by Brandon Sanderson." Responsible for it is one of the most popular American fantasy authors who are still active writers. Sanderson proposed to the crowdfunding community that they fund his project to publish four novels written in secret during the coronavirus pandemic. In the campaign description, the writer revealed that three of them would be part of the Cosmere Universe, while the fourth would be something completely different. However, none of the books would be part of existing series, nor would the books open new cycles. For the novels to be published, Brandon Sanderson had to raise as much as one million dollars. To receive these books in ebook form, one had to contribute 40 dollars, in audiobook form – 60 dollars. Meanwhile, published in physical form, in hardcover, they were associated with a contribution of as much as 160 dollars. The author declared that if the campaign were successful, the first novel would be published in January 2023, the second – in April, the third – in July, and the fourth – in October. And so it happened, of course. The scale of the undertaking probably surprised even the author himself, because this goal was achieved after just 35 minutes. Ultimately, it was possible to raise over 41.7 million dollars, which is a new Kickstarter record and generally for reward-based crowdfunding. The campaign was supported by over 185 thousand contributors. Most of them decided on the expensive, physical edition.

Social energy caused a financial explosion! And it continues to do so. In 2025, on Kickstarter alone, over 1 billion dollars in contributions were obtained.

It should also be noted that it is forbidden on platforms of this type to offer as rewards:

- any investments, any financial instruments and virtual currency;
- pornographic materials, materials of a sexual or obscene nature;
- nicotine products, pharmaceuticals, drugs, narcotics, alcohol;
- weapons, weapon accessories and their replicas;
- products that do not meet safety guidelines.

As the above data show, crowdfunding has become one of the most popular ways for individuals to raise money for a specific goal, project, or event. This funding source is based on soliciting funds from an undefined group of people – a community, also called – as already mentioned – by some authors “the crowd” (Block et al., 2018; Guenther et al., 2018; Polzin et al., 2018; Ryoba et al., 2020). The participation of hundreds of thousands, and even millions of people in crowdfunding campaigns after just thirty years since the launch of the first campaign, shows the scale of this phenomenon. It already has its place in economic and financial theory, where it appears as an element of the so-called sharing economy (Menor-Campos et al., 2019; Rey-Martí et al., 2019; Van Montfort et al., 2021; Vismara, 2018) or behavioral finance (Antony, 2020; Chartier et al., 2021; Köseoğlu, 2019).

The popularity of this relatively new form of funding is, however, geographically differentiated. This is illustrated by Tables 1–4, covering so-called data snapshots, randomly selected from July 2025, originating from the leading crowdfunding platform – Kickstarter.

Table 1. Data on crowdfunding by geographic distribution

Country	No. of projects	No. of supporters	Donation amount in USD
United States	20,174	4,752,152	333,500,200
Japan	2,950	80,135	7,537,462
Germany	1,927	148,372	9,300,935
Canada	1,012	240,333	2,478,521
Australia	528	75,164	6,957,692
United Kingdom	520	12,774	12,750,250
Hong Kong	313	99,103	22,872,133
Italy	227	138,051	1,888,700
France	208	44,128	6,200,396
Sweden	195	4,930	3,555,238
Mexico	170	16,366	1,930,120
Spain	130	2,850	5,082,333
Poland	123	2,792	1,200,372
Denmark	121	16,927	1,875,238
Singapore	99	23,950	2,733,357
Netherlands	95	38,500	4,020,033
Ireland	66	8,251	627,100
Austria	65	5,288	550,021
New Zealand	65	7,820	868,830
Belgium	47	8,227	897,927
Switzerland	42	16,732	4,335,244
Norway	40	2,930	300,238
Greece	31	1,882	42,937
Luxembourg	12	1,492	293,405
Slovenia	11	2,499	233,700
Total	29,171	5,751,648	370,219,793

Note. Data from webrobots.io/kickstarter-datasets.

The presented data suggests that there are clearly leading countries both in terms of the number of submitted projects and obtained donations, as well as the number of people supporting them.

The reason for this territorial differentiation in crowdfunding intensity may be, among other things, the lack of information about this relatively young form of project financing. For example, the percentage of people aware of crowdfunding in the USA was 68% in 2022, but in Poland the figure was 45%, and only 18% in Germany.

In this work, only projects that ended successfully were considered, that is, those that achieved or even exceeded the planned sum of donations. Among the 25 analyzed countries, four of them turned out to be leading in the number of submitted projects: the United States, Japan, Germany, Canada. Data from these countries will be further processed.

The innovative use of the term “social energy” in economics and finance, and especially in the section concerning human behavior, that is, in the behavioral area, where many authors place crowdfunding (Allison et al., 2017; André et al., 2017; Block et al., 2018) can be an inspiration for interesting research. It should be emphasized that the authorial contribution is the method of studying crowdfunding attributes and measuring relationships between them, as well as proposals for social energy metrics “emitted” in crowdfunding.

The aim of the work is to determine the relationships and strength of interactions between two main attributes of the discussed funding source: the number of people supporting projects and the sum of donations contributed to projects, taking into account the attribute of the offered reward package serving as motivation for making contributions, as well as to formulate social energy metrics and verify reward packages.

The authorial research method applied for this purpose is based on the principle of attribute similarity – on clustering analyzed data about projects and creating clusters of similar attributes

in the arrangement of thematic categories of projects and the studied country. The developed clustering algorithm takes as its starting point a specific measure of proximity, that is, similarity of grouped elements.

The following research hypotheses were adopted:

- project categories cluster together according to adopted criteria - the measure of proximity and their weight;
- it is possible to determine the relationships and strength of social energy's impact on the desired sum of donations, that is, on the project's success;
- groups of people supporting the project and sums of donations show different strengths of mutual interactions depending on the studied country;
- packages of offered rewards affect social energy;
- the procedure for studying attributes enables the construction of social energy metrics.

The research results are intended to have practical significance for participants in crowdfunding campaigns.

Thus, the main idea and importance of the research included in the work comes down to the proper selection of community funding attributes, capturing their mutual dependencies, similarities and strengths of interactions, as well as measuring social energy, which enables new, comprehensive, multi-aspect navigation through the thicket of information about projects submitted for funding in the studied countries.

The proposed approach using the method of clustering categories and attributes, as well as research results, complement the current state of knowledge in the area of reward crowdfunding.

To justify the need for research on social energy in the above aspect, it is considered appropriate to present the works of selected authors on related topics.

Literature review

The phenomenon of crowdfunding is dealt with by both scientists and practitioners in many countries, because in recent years its role in funding various ventures has intensified. The accumulated subject literature allows us to notice that published works are general, review-oriented, showing crowdfunding from different perspectives, or concern particular cases of this phenomenon in the world of finance.

Below are examples of different aspects of addressing issues related to the specific funding source that is crowdfunding. A relatively universal perception of this phenomenon is given, for example, in publications (André et al., 2017; Gleasure & Feller, 2016; Groza et al., 2020; Kunz et al., 2017).

However, it can be noticed that crowdfunding is presented by many authors at different levels of detail. First, one can find publications discussing crowdfunding in relation to typical, classical areas of economics, such as its impact on investments, the financial condition of companies, or strengthening their role in the market. Interesting publications should be cited here: Rossi et al. (2019), who discuss investment-based crowdfunding in the aspect of cross-platform analysis, Dilger et al. (2017), who assess the potential of crowdfunding for business model innovation of energy cooperatives, Miglo et al. (2018), who analyse venture capital and crowdfunding of entrepreneurial ventures, Ter Wal et al. (2016) writing on capital retention and social network theory in equity crowdfunding, Chu et al. (2019) on open innovation in the context of crowdfunding, and Miglo (2020b) concerning some patterns of crowdfunding entrepreneurial firms in Canada. The financial approach to crowdfunding can also be found in Colistra and Duvall (2017), Mohamad (2021), Allison et al. (2017), Davidson and Poor (2016), Giudici et al. (2020), and Planells (2017).

An equally interesting work was published by Giglio (2022). He proved that crowdfunding is an alternative investment method, that is, a parallel financing channel to that represented by banks

or other financial intermediaries. The actual funding of a project in reality does not depend on an assessment made by a single intermediary based on their own funding strategies, but on the ability of applicants to convince a sufficient number of investors to risk their funds to directly support the initiative.

Scientific research on crowdfunding in the aspect of description and correlates of financial success was conducted by Sauermann et al. (2019), as well as Hörisch (2015), who analyzed crowdfunding of environmental ventures from this angle. Similar research – on the success of campaigns concerning distribution networks – can be found in the collective work by Ter Wal et al. (2016). Meanwhile, Usman et al. (2019) try to answer in their article the question of whether the role of media and the founder's previous success mitigates the information asymmetry problem? On the other hand, the problem – what determines success on Kickstarter, with a suggestion of the role of anonymity and team – is considered by Ullah and Zhou (2020), and empirical research distinguishing key success factors of crowdfunding projects was published by Fernandez-Blanco et al. (2020). More specialized in nature are the works of Chen (2021), concerning the study of the impact of competition and incentive design on the performance of crowdfunding projects using the example of independent films, and von Selasinsky and Lutz (2021) on the impact of pro-social and pro-environmental orientation on crowdfunding outcomes.

Among the diverse literature on crowdfunding, one can find interesting works in which it has been placed in the area of behavioral economics and finance, as well as psychology or sociology. Authors addressing the topic of behavioral finance very rightly recognize the need to study behaviors, and especially the motivation of both investors and people co-funding various projects. The so-called crowd syndrome, that is, the large number of people supporting projects, is particularly important here, because the ultimate success of campaigns for given projects depends on its

size, reaction, attitude, and reasons for joining the crowdfunding “machine.” Many works from this area deserve special attention.

Bretschneider and Leimeister (2017) write interestingly about discovering motivations for funding within motivational crowdfunding. Pérez et al. (2019) conducted an exploratory study on donation intentions for rural area development, Li et al. (2019) consider consumer purchase intentions regarding crowdfunding products or services from a cost-benefit perspective, Kim and Hall (2019) examine whether types of co-creation and crowdfunding can predict funder behavior and build an extended goal-directed behavior model, Miglo (2020a) investigates crowdfunding in a competitive environment, Seo and Park (2020) analyze the impact of others’ participation in investments on psychological ownership of crowdfunding projects. Meanwhile, Song and Tian (2020) cite managers’ statements and evaluate customer engagement in crowdfunding, Rodriguez-Ricardo et al. (2019) emphasize that trust, altruism, and internal locus of control influence the intention to participate in crowdfunding. The role of trust and investor intentions is also addressed in the work of Alharbey and Van Hemmen (2021). Reciprocal altruism and legitimacy in donation-based crowdfunding is also highlighted by Khurana (2021), citing evidence from India.

In the area of behavioral economics and finance, publications concerning broadly understood rewards for supporters can also be situated. Practically every project, goal, or event for which funds are raised offers a great many of them. They are meant to encourage contributions and promote the given initiative. The topic of rewards, addressed by relatively few authors, is most often associated with research on the success of a given campaign; for example, Dikaputra et al. (2019) analyze success factors of reward-based campaigns using a so-called multi-theory approach, while Comeig et al. (2020) emphasize the importance of rational “herding” in reward-based crowdfunding. Meanwhile, a comparative study of China and the United Kingdom conducted

by Usman et al. (2020) was developed in terms of the impact of signals on investment decisions.

The problem of signal analysis in reward-based crowdfunding was also considered by Li and Wang (2024). In a study of data from the Indiegogo platform, these authors examined the joint effects of various signals: creator engagement (updates, comments), community support (endorsement in the form of supportive comments, Facebook shares), and project preparation (e.g., presence of video, images, polished description). The application of fsQCA and regression methods revealed that none of these factors alone guarantees high effectiveness, but specific combinations of factors lead to success. Two equivalent configurations leading to high funding results were identified: (1) a pattern based on strong creator engagement, and (2) a pattern based on strong community support. Importantly, solid project preparation alone (e.g., good materials) proved insufficient – it must be combined with other signals to bring maximum effect. The study thus emphasizes the importance of simultaneously managing different aspects of a campaign.

Mollick (2014), on the other hand, analyzes nearly 47,000 projects on Kickstarter, which constitutes one of the first large studies of reward-based crowdfunding. He identified key factors associated with campaign success: the creator's personal networks and project quality (e.g., polished description, absence of errors), and found that they significantly increase the chances of success. He also demonstrated that geography matters – although crowdfunding takes place online, local support and the origin of projects influenced the type of initiatives and their success. An interesting conclusion is also that most creators try to deliver promised rewards, but over 75% of projects deliver them with significant delays. Moreover, the more funds a project raised, the greater the delays in reward fulfillment. This article established the foundations for scientific understanding of reward-based crowdfunding mechanisms.

Another article (Belleflamme et al., 2014) presents a microeconomic model of choice between different crowdfunding models. The authors compared reward pre-selling (reward model) with equity financing (profit sharing) as alternative ways of obtaining capital from the crowd. Analyses showed that with smaller capital needs, the reward model (product pre-sale) is more profitable because the community derives so-called “community benefits” from being part of the project. However, when the required amount is relatively large in relation to the market, the equity model (sharing future profits) becomes more advantageous. The entrepreneur therefore prefers pre-sale when the market is sufficiently capacious and the needed capital is small; above a certain threshold, it becomes more profitable to share profits with investors. These conclusions have practical significance when planning startup financing strategy at an early stage, and the work also points to the role of “community benefits” (e.g., sense of belonging), product quality, and information asymmetry in choosing a crowdfunding model.

Meanwhile, the review work of Alhammad et al. (2022) contains a systematic literature review from 2012–2019 on factors influencing supporter behavior in reward-based crowdfunding. From hundreds of publications, 33 key works were selected and a broad set of factors was identified, which were grouped into nine main categories. These categories include, among others: characteristics of the project team, characteristics of the project itself, social influences (e.g., recommendations, social media), user-generated content (comments, updates), perceived risk and lack of trust, early marketing activities, environmental readiness (e.g., payment infrastructure), as well as the motivations of the supporters themselves. This review indicates that supporters’ decisions are the result of complex interaction of many elements – from project quality and credibility to psychological (e.g., expecting rewards) and contextual factors – and emphasizes the need for further research on crowd behavior in the reward model.

In turn, Pinkow (2022) in the article addresses the less frequently studied topic of “overfunding,” that is, campaigns that not only achieved but significantly exceeded their assumed financial goal. Using data from 338 Kickstarter projects, the author first confirmed known success factors (number of updates, number of reward packages, presence of the project page on social media, etc.) – according to the literature, they increase the probability of achieving the goal. Next, he examined whether these same factors explain the scale of surplus funds raised above the goal. It turned out that existing success factors do not explain the overfunding phenomenon. In other words, what helps achieve 100% of the goal does not guarantee obtaining, for example, 200%. The author interprets this through an analogy to two-factor theory: basic factors (so-called “hygiene” factors) are necessary for a campaign to succeed at all, but do not “motivate” the crowd to continue funding after exceeding the goal. He indicates that understanding the overfunding phenomenon requires further research on other, more subjective factors (e.g., individual perception of the project by supporters) that encourage people to continue contributing despite the goal being achieved.

Interesting conclusions were reached by Ishida et al. (2021), publishing them in an article concerning success factors of crowdfunding campaigns in Japan, in the context of differences between theory and practice. These authors collected data from 336 projects from a large Japanese platform and tested hypotheses based on the signaling theory. The results found that campaign description length (word count) and the use of animated GIFs in the presentation positively influence achieving the financial goal. The funding model also proved to be a significant factor – campaigns in the flexible “all-in” model (keeping collected funds even when the full goal is not achieved) more often ended in success than those in the “all-or-nothing” model. Moreover, certain creator actions translated into higher amounts of collected funds: frequent project status updates, adding a promotional video, and offering

limited “early bird” rewards for the earliest supporters increased the total collected sum. This study emphasizes the importance of both campaign content quality and project management strategy (funding model, reward structure) in the context of success, especially in the specific Japanese market.

A comprehensive literature review published in the *Baltic Journal of Management* (Shneor & Vik, 2020) summarizes the state of research on crowdfunding campaign success (all types, with particular emphasis on the reward model) in the years 2010–2017. The authors analyzed 88 scientific works from 65 journals, identifying applied theories, methods, examined factors, and research gaps. From the conclusions: existing research on success focuses mainly on reward-based crowdfunding, is based on public platform data, and often uses theories such as signaling theory, social capital, or the ELM model¹ (information processing). A need was noted for a broader view of the success measure – not only in financial terms, but also, for example, product realization or participant satisfaction, e.g., through receiving rewards. The review enabled the construction of success models aggregating the most frequently studied factors (the authors analyzed a total of 1,718 relationships between variables and campaign outcomes) and identifying areas requiring further research.

Meanwhile, the authors of an article in *Business Horizons* (Zhao et al., 2021) studied the phenomenon in which campaign creators themselves financially support their own projects on a reward platform. The authors started from the assumption that such “putting one’s own skin in the game” can serve as a signal to other supporters, similar to traditional bootstrapping. Analysis of 1,583 campaigns from China’s largest platform (Zhongchou) showed that direct co-financing of one’s own project by the entrepreneur

¹ The Elaboration Likelihood Model (ELM) is a psychological theory of attitude change developed by Petty and Cacioppo that explains how persuasive messages influence audiences.

strongly correlates with campaign success. In other words, projects whose creators made contributions to their own fundraisers more often achieved or exceeded the goal. Additionally, this effect was partially mediated by campaign content quality - the authors suggest that people willing to invest their own money usually better prepare the project page (better materials, description), which in turn increases community trust. The results imply that moderate “self-funding” can build campaign credibility in the crowd’s eyes, signaling the creator’s belief in their product.

Literature in the area of crowdfunding was also analyzed particularly in terms of including the human factor in this process. People supporting a project, and even more broadly – people associated with a given project, for example the owner or future producer of a given product, significantly influence campaign success, if only through marketing, disseminating information about the project, obtaining sponsors, and the like. These relationships were presented by various authors. Particularly noteworthy are the works by Sahelices-Pinto et al. (2018), as well as Fernandez (2021), who analyze the role of trust and social engagement in startup financing, and Rodríguez-Fernández et al. (2020), who present diversified social responsibility through stakeholder engagement. More detailed considerations from this area can be found in the works of Kang and Na (2018), Tajpour et al. (2021), and Whittingham (2021).

An area similar to the above is crowdfunding indicating clear social mobilization and leading to organizational changes and innovation at various levels. Research in this area was conducted, among others, by Vrontis et al. (2021), Blanco-Ariza et al. (2019), Bansal et al. (2019), Seggewiss et al. (2019), Höllinger (2017), Witt (2016), Dreyer et al. (2017), Kim and Lee (2018).

In the context of this article, it deserves emphasis that in the considerable publication resources on crowdfunding, studies highlighting this phenomenon in specific geographical areas – continents or countries – appeared sporadically. These are

publications by Jelinčić and Šveb (2021), Rossi and Vismara (2018), Passeri (2020), and all concerning research in Europe. Meanwhile, research in specific countries (Canada, India, China, the United Kingdom, the United States, and South Korea) was discussed in the works of Miglo (2020b), Khurana (2021), Usman et al. (2020), Cho and Kim (2017). However, they did not take into account the impact of social energy on the sum of campaign donations and its relationship with the type of rewards offered.

From the above systematic review of the subject literature, it can be concluded that scientists' interest in the topic of crowdfunding discussed in various aspects is still considerable, which can certainly be justified by the vigorously developing financing of this type. Therefore, the issue of continuing research remains current and worthy of attention.

MATERIALS AND METHODS

The research data were obtained from the webrobots.io platform, which provides website indexing and scraping services. A robot placed on this service collects data from selected crowdfunding platforms and publishes it in ready-made CSV file format. This indexing is performed once a month, and the study was based on data collected for the Kickstarter platform from 2025.

The choice of Kickstarter as a data source can be justified by its leading position and wide popularity, as it appears among the five hundred most frequently searched websites in the world, and since its inception has brought success to over 357 thousand projects.

The data contained on webrobots.io is a public raw dataset, which is also used by other authors, for example (Fernandez-Blanco et al., 2020). The examined dataset contains over 50 thousand projects, of which over 38 thousand were successfully completed.

In the dataset on projects obtained in this way, the following project attributes were selected for detailed research, taking into account data availability:

- country submitting the project on Kickstarter;
- category – the thematic group to which the project belongs;
- reward package(s) offered in given categories;
- number of people supporting the project;
- sum of project donations – as the total amount of collected contributions.

The available attribute of campaign duration was excluded from the study, as previous research has shown that it essentially has no relationship with the number of people supporting the project (Szewczyk & Stempnakowski, 2021).

It should be emphasized here that thematic categories are more stable than projects within a given crowdfunding platform, hence their classification and attribute analyses provide the possibility of greater generalizations when formulating conclusions.

Data concerning attributes for processing in subsequent stages of their analysis and classification were specially prepared for the purposes of the methodology presented below:

- Based on projects submitted in the past two years to the Kickstarter platform, four reward packages were developed, which occurred with varying frequency across the 43 examined project categories:
 - **P1:** a) early access to products or services - in the form of pre-sale, b) discounts on the purchase of products and services, c) personalized products;
 - **P2:** c) personalized products, d) symbolic rewards, e) admission to events at promotional prices, f) products created as a result of project implementation, g) services provided as a result of project implementation;
 - **P3:** b) discounts on the purchase of products and services, d) symbolic rewards;

– **P4:** a) early access to products and services - in the form of pre-sale, c) personalized products, d) symbolic rewards.

The reward packages, in addition to being subjected to a clustering procedure, were verified through an online diagnostic survey conducted among crowdfunding campaign participants in selected countries.

- The names of main and detailed thematic categories were established by extracting these names from general fields of source data concerning projects (Table 2).
- Value ranges for attributes were specified – number of supporters and sum of donations – by repeatedly analyzing different distributions of their values; for the number of supporters attribute, ranges were established from 1 to 41, in increments of 50 supporters, with the last range above 2000 people; for the campaign donation sum attribute, ranges were established from 1 to 41, in increments of \$1000, with the last range above \$40,000, the dollar amount was taken directly from source databases.
- Four leading countries were selected: United States, Japan, Germany, Canada from among 25, taking into account the number of projects submitted by them; this criterion was adopted to include the maximum occurring number of thematic categories in the study; the selection was made to demonstrate the procedure of the developed research method on a pilot basis (Table 3).
- Four most popular categories in these leading countries were selected and data in this cross-section is contained in (Table 4).

Table 2. Summary of detailed categories and their corresponding attributes including reward packages

Main category	Detailed category	No. of projects	No. of supporters	Sum of donations in USD	Reward packages
comics	graphic novels	2,163	633,639	32,791,216	P2, P4
	webcomics	726	294,435	16,053,811	P3
crafts	candles	132	6,971	366,145	P1, P4
design	product design	1,484	931,260	116,520,662	P3
	graphic design	1,154	261,768	16,024,797	P3, P4
	design	206	62,622	7,464,262	P1, P2, P3
	toys	128	46,732	5,995,995	P2, P4
	architecture	39	3,618	678,054	P4
	interactive design	32	3,610	263,643	P1
	typography	32	1,089	92,388	P1
	civic design	26	234	18,663	P2, P4
film & video	comedy	1,248	204,047	16,061,252	P4
food	food	483	183,318	25,266,529	P1
	drinks	434	74,547	6,609,851	P2, P4
	cookbooks	386	111,283	6,687,180	P3, P4
	small batch	320	41,317	3,224,502	P3, P4
	restaurants	294	57,937	8,070,393	P4
	vegan	196	38,574	2,944,986	P2
	events	189	12,328	1,406,705	P1, P2
	farms	140	13,989	1,685,303	P1
	community gardens	118	7,200	584,383	P4
	food trucks	113	9,229	1,153,316	P3
	spaces	94	16,050	1,661,943	P2, P4
	bacon	71	6,590	414,540	P4
farmer's markets	46	2,334	225,532	P1	

journalism	journalism	567	93,349	6,879,179	P2
	audio	423	75,072	4,757,628	P2
	print	294	44,057	2,827,233	P4
	photo	107	9,216	725,477	P2
	web	285	55,091	3,996,613	P1
	video	96	8,558	701,309	P3, P4
music	pop	1,926	199,553	14,649,889	P1
	punk	248	20,428	1,069,452	P2
	R&B	194	16,092	1,211,604	P2
publishing	fiction	2,171	273,438	19,212,251	P4
	poetry	746	47,152	2,420,427	P4
	literary journals	227	36,400	1,861,344	P2, P4
	literary spaces	114	19,556	1,538,960	P3, P4
	letterpress	81	9,851	1,220,567	P3, P4
technology	software	529	206,749	11,209,863	P4
	sound	508	324,703	54,887,025	P1
theater	plays	1,092	60,310	5,117,936	P1, P2, P3
	places	142	19,764	2,183,808	P2, P3
Total		20,004	4,544,060	237,444,138	

Note. Data from webrobots.io/kickstarter-datasets.

Table 3. Summary of attributes for the selected 4 countries

Main Category	Detailed Category	USA			Japan			Germany			Canada		
		A	B	C	A	B	C	A	B	C	A	B	C
comics	graphic novels	1590	511876	27686307	99	11528	437914	295	56003	2012472	170	27802	1245295
	webcomics	560	239426	13315946	47	1709	52851	78	14308	638221	112	29129	1602362
design	architecture	42	2249	464108				35	52	2327	35	101	4550
	graphic design	688	197624	12128973	66	2778	141691	279	36125	2200673	74	5871	275848
food	community gardens	119	5132	467336				37	291	25299			
journalism	video	81	5483	443744	37	343	30433	43	913	125068	36	1018	38616
technology	software	372	147853	7452433	46	1518	112392	68	21595	1736136	78	13262	555332
	sound	314	265147	43866155	45	2676	507882	83	19748	3075774	45	3193	816448
theater	places	124	16759	1976248				46	1855	128601	36	259	20549
	plays	643	39638	3558600	49	617	51527	397	16777	1261450	62	1078	63213
Total		4533	1431187	111359850	389	21169	1334690	1361	167667	11206021	648	81713	4622213

Note. Data from webrbots.io/kickstarter-datasets. A = number of projects (weight), B = number of supporters, C = sum of donations in USD.

Table 4. Summary of data according to the 4 most popular categories for selected countries including Reward Packages

Country	fiction P4			graphic novels P2, P4			pop P1			product design P3		
	A	B	C	A	B	C	A	B	C	A	B	C
USA	2180	273406	19219901	2172	633607	32798900	1935	199521	14657573	1492	931230	116618346
Canada	135	9335	44986	170	27802	1246295	75	3675	251518	117	37170	5214352
Germany	44	574	29880	50	6856	412558	51	1679	94979	92	30734	4036957
Japan	35	120	3967	37	133	2642	39	1108	88480	94	12806	1468532
Sum	2394	283435	19298734	2429	668398	34460395	2100	205983	15092550	1795	1011940	127338187

Note. Data from webrobots.io/kickstarter-datasets. A = number of projects (weight), B = number of supporters, C = sum of donations in USD.

It should be noted here that when selecting a single platform for research, there is no need to systematize terminology, which would be necessary when studying multiple platforms, as practically each of them uses different (though often similar) naming conventions for categories or their internal structure. As previously mentioned, the study analyzed only those projects that ended successfully. Projects canceled by the platform or creator, still ongoing, and those that ended in failure were eliminated. The number of thematically corresponding projects was adopted as the weight of a given category. As a result, a dataset with 21,835 records highly representative for this study was obtained.

The numerical values necessary for implementing the developed methodology were obtained by processing source data according to established attribute value ranges. They were developed in eight working tables (two tables for each country) which were then used to build appropriate matrices. The table rows contained detailed project categories arranged according to decreasing weights, which were taken as the number of projects in a given category. The table headers contained attribute value ranges. If a given category contains projects whose attribute takes values from specific ranges, then the number of these projects was placed at the intersection of the column and row.

After the preliminary stage, that is, after analyzing crowdfunding attributes and preparing data, the actual research procedure can begin. First, it is necessary to determine which element clustering method is appropriate, that is, best takes into account various constraints or specific conditions of the datasets.

The measure of proximity (similarity) of elements is usually adopted as the basis for building clusters. The proximity measure is successfully used by many authors. Some of them require establishing a priori the target number of clusters, for example the factor analysis method (Carroll & Roeloffs, 1969). In other classical methods, for example Rocchio (1966) or Hill (1968), it is possible to regulate the number of clusters. The method developed by

Vaswani (1969) uses indirect connections between elements of future clusters, while in the method elaborated by Dattola (1968, 1969) it is assumed that the set is divided a priori into so-called initial clusters. Some methods are based on a single-aspect principle, while others use multiple criteria, for example the method by Gitman and Lewine (1970).

Analysis of cluster building methods leads to the conclusion that the method closest to the assumptions adopted in this work will be the binding method derived from the design-giving and two-aspect approach. The design-giving approach creates the possibility of binding elements while omitting constraints resulting from the actual state of the studied system. The two-aspect nature allows for considering two fundamental criteria for binding elements, that is, proximity and importance (weights).

Taking into account the above considerations, the following stages are adopted in the presented methodology:

1. Clustering of project categories sequentially according to adopted attributes – sum of donations, number of supporters, reward packages:
 - a. construction of a category-attribute matrix,
 - b. selection of similarity function (category proximity),
 - c. comparison of category pairs and determination of logical product and sum = 1 (without converting this structure to a binary matrix).
2. Creation of category sequences ordered by weights and category sequences ordered by decreasing values of the proximity parameter.
3. Comparison of both sequences and construction of successive category clusters according to the principle: pairs of previously equal categories initially form - the first cluster.
4. Cyclical repetition of the above procedure and testing whether a category can be adjacent to more than one cluster; if so, it is attached to the one in which a similar category with a higher

weight has already been placed. However, if the category has not been attached anywhere, it forms a new cluster.

5. Clusters created for each of the attributes are checked sequentially on a cross basis: each with each, and then the degree of their dependency is determined (from 1 to 0), adopting values of this strength, defined as very strong dependency (0.9), fairly strong dependency, moderate dependency, weak dependency, and no dependency (< 0.2).
6. Implementation of stages A-E for selected countries – United States, Japan, Germany, Canada.

The obtained category clusters and the strength of influence of the examined attributes provide the possibility of greater generalizations when formulating conclusions than when analyzing individual projects.

RESEARCH RESULTS

By conducting the adopted clustering procedure and determining the strength of influence for the four selected countries, the following results were obtained:

- for the US: 5 clusters of similar project categories according to the sum of donations criterion, 4 clusters according to the number of supporters criterion, and 3 clusters according to the reward packages criterion;
- for Japan: 6, 7, 3 clusters, respectively;
- for Germany: 3, 4, 5 clusters, respectively;
- for Canada: 4, 5, 4 clusters, respectively.

Below are presented sample detailed results for the US:

According to the sum of donations criterion:

- Cluster 1: 24, 25, 26, 27, 29, 30, 39, 40, 41;
- Cluster 2: 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 18, 19;
- Cluster 3: 12, 16, 20, 21, 35, 38;
- Cluster 4: 22, 23, 28, 31, 32, 36, 37;

– Cluster 5: 1, 2, 3, 4, 33, 34.

According to the number of supporters criterion:

– Cluster 1: 17, 24, 30, 35, 37, 38, 39, 41;

– Cluster 2: 18, 20, 21, 23, 28, 31, 32, 34, 36, 40;

– Cluster 3: 6, 8, 10, 12, 13, 14, 15, 16, 19, 22, 25, 26, 27, 29, 33;

– Cluster 4: 1, 2, 3, 4, 5, 7, 9, 11.

According to the reward packages criterion:

– Cluster 1: P1a, P4a, P1b, P3b;

– Cluster 2: P2f, P2g;

– Cluster 3: P1c, P4c, P2d, P3d, P2e.

In the United States during the examined period, 41 categories were active in which projects ended successfully. Clusters have different numbers of similar categories, from 2 to 17. The thematic scope of clusters is very diverse, for example the largest cluster– number 3 gathers categories that were popular because they were supported by many people (graphic design, poetry, traditional journalism, sound technologies, food, beverages, audio journalism, cookbooks, traditional newspapers, literary magazines, R&B music, culinary events, theatrical arts, candle making, food trucks).

The smallest cluster built from two elements was defined in the reward packages criterion. It contains two rewards – products created as a result of project implementation and services provided as a result of project implementation.

The strength of dependency was determined for all ranges. The strongest relationship (> 0.9) occurred twice between clusters built according to the sum of donations and number of supporters, as well as between cluster 1 and 3 reward packages. The weakest, that is < 0.2 – in 6 cases.

Numerical and percentage analysis of the first two crowdfunding attributes: sum of donations and number of people supporting projects in a given category in connection with clusters containing reward packages, provides a clear picture of reality with the adopted source data.

This separate analysis of social energy attributes can be enriched with aggregate indicators.

Achieving success by a project, as mentioned earlier, can occur when a relatively small number of people contribute significant sums and therefore the planned (desired) sum of donations for the project is collected quickly, often before the designated deadline and is even sometimes exceeded. But more often the situation occurs that obtaining the final collection sum takes place when many people make small contributions and in this case the social energy is greater. As calculations show, social energy increases proportionally to the strength of dependency with clusters built according to the reward packages criterion.

It is therefore worth examining various cases of this energy. In the first – financial social energy can be demonstrated by comparing the percentage of donation contributions to a given category (percentage of sum of donations) to the percentage of people supporting projects in a given category. If the value of this indicator is > 1 , it means a larger sum of contributions, that is, greater financial social energy directed toward projects in a given category. Value < 1 means relatively lower social energy. For example, the highest indicator in the examined period was 2.15 and concerned the architecture category (in Japan), and the lowest, 0.62, was received by two categories: topography and vegan (in Germany).

In turn, with crowd strength, numerical social energy can be calculated by comparing the percentage of the number of people supporting projects in a given category with the percentage of the sum of donations to a given category. The second social energy indicator is also contained within the range $>1 < 1$. For example, the highest indicator in the examined period was 1.73 and concerned the literary magazines category (in the United States), and the lowest, 0.28, was marked for the pop category (in Japan).

The simplest social energy indicator, which does not however provide information about the method of achieving success by a project, can be expressed as the ratio of the sum of donations

to a given project (or project category) to the number of people supporting the project (or project category).

It should be noted here that the clear majority of projects are local in nature, meaning that contributors come from the same country in which the project is to be implemented, therefore calculations of social energy indicators fall within acceptable error margins.

Alongside the already presented and analyzed results of social energy related to the number of projects submitted from specific categories, the number of people supporting them and the sum of donations, it is worth determining how offered reward packages in individual project categories influenced the decisions of people participating in crowdfunding campaigns.

As a result of processing the “reward types” parameter, three clusters were obtained containing various detailed rewards, not corresponding to packages used in practice by project creators.

Comparing the number of people supporting projects and the sum of donations to a given project with the offered reward package, it was found that offered rewards, and even their expansion during the crowdfunding campaign, do not always influence greater interest in the project and larger contributions.

Therefore, in addition to the adopted methodology of attribute clustering, an online diagnostic survey was conducted among people supporting projects of various categories on the Kickstarter platform in the analyzed four countries. The question was: “Are rewards a motive for your involvement in the crowdfunding campaign of a given project. If so, mark those from the ones listed below that would encourage you to participate in the campaign and to increase your declared contribution.” 37 thousand complete responses were received, including 15 thousand from the United States, 10 thousand from Japan, 7 thousand from Canada, 5 thousand from Germany. Table 5 presents a percentage summary of desired rewards which, according to campaign participants, would influence their decisions regarding project financing.

Table 5. Summary of desired rewards in crowdfunding campaigns in selected countries (percentage breakdown)

Country	USA	Japan	Canada	Germany
Reward type				
a	80	78	95	70
b	75	80	82	93
c	90	88	53	73
d	95	90	50	70
e	89	88	49	70
f	69	70	68	81
g	62	81	65	82

Note. a = early access to products or services, in the form of pre-sale; b = discounts on the purchase of products and services; c = personalized products; d = symbolic rewards; e = admission to events at promotional prices; f = products created as a result of project implementation; g = services provided as a result of project implementation.

However, in terms of resulting clusters, modified reward packages are desired:

- **PZ1:** early access to products or services – in the form of pre-sale (a), discounts on the purchase of products and services (b);
- **PZ2:** products created as a result of project implementation (f), services provided as a result of project implementation (g);
- **PZ3:** personalized products (c), symbolic rewards (d), admission to events at promotional prices (e).

DISCUSSION

It should be emphasized here that a systematic review of the subject literature conducted in terms of the methodology applied here and the scope of the research carried out showed that although some crowdfunding attributes were analyzed in a few works, they

were analyzed separately, for example Ullah and Zhou (2020) or Ter Wal (2016). However, no clear solution was found for studying attribute relationships in terms of similarity or clustering of their groups, created taking into account different criteria. There is also a lack of discussion of crowdfunding across multiple countries. Only studies concerning individual countries are encountered, for example India (Burtch et al., 2016), China (Gleasure & Feller, 2016) or Canada (Miglo, 2020b). No studies were found containing proposals for formulating metrics from the crowdfunding area or the term adopted in this work – social energy.

A lack of analyses and knowledge exploration helpful for crowdfunding process participants was also identified. And as already emphasized, the results of this work have, in addition to a scientific aspect, also practical application. This is important because the information made available by platform owners is in many cases insufficient for crowdfunding participants, that is, both for the platform owners themselves, as well as for the owners of projects posted on them, and also for people supporting projects or considering such a possibility, including potential investors.

The basic, general and often “raw,” unprocessed information that crowdfunding platforms make available, for example Kickstarter, does not fully meet the requirements of recipients. It is too detailed, provided at the level of individual projects, of which there are on average several tens of thousands daily on each platform.

There is a lack of “fairly” accessible information, in various cross-sections and at different levels of detail and aggregation, which often causes the so-called information gap that negatively affects the validity of decisions made in crowdfunding (Fernandez-Blanco et al., 2020).

As authors emphasize (Kang & Kim, 2020; Flórez-Parra et al., 2020; Bretschneider & Leimeister, 2017; Pérez et al., 2019), platform owners themselves, despite using robots that search project

databases, would be interested in processed and provided information, in various arrangements, adequate to their needs, which would encourage both project creators and people supporting the project, as well as investors, to choose this particular platform, which of course entails financial success.

The information gaps identified here in the area of reward-based crowdfunding have been significantly mitigated through the results of this research. This was possible through the preparation and processing of source data, and then their transformation – in accordance with the adopted research methodology – into information useful for crowdfunding campaign participants.

CONCLUSIONS

The aim of the article was to determine the relationships and strength of interactions between two main attributes of the discussed financing source: the number of people supporting projects and the sum of donations transferred to projects, taking into account the attribute of the offered set of rewards that motivate contributions, as well as to formulate social energy metrics and verify reward packages.

The application of the author's research methodology for this purpose, based on the principles of clustering similar elements and an online diagnostic survey, enabled the following conclusions to be drawn.

It should be stated that the conducted analysis of crowdfunding attributes and the clustering procedure runs allowed for the confirmation of the first research hypothesis in relation to all four selected attributes: the number of people supporting the project, sum of donations, types of rewards, and countries submitting projects – after establishing appropriate weights, project categories formed similar clusters in accordance with the adopted criteria and similarity function.

The second research hypothesis was also positively verified through conducting subsequent clustering procedures, so-called cross-clustering – they allowed for demonstrating the strength of mutual interactions between attributes.

The third research hypothesis, stating that the relationship between the number of people supporting a project and its sum of donations shows different strength depending on the studied country – was also confirmed after in-depth analysis of cross-classification results, covering four selected countries on a pilot basis.

The fourth research hypothesis was positively confirmed, as reward packages were verified and shown to influence social energy.

The fifth research hypothesis was also positively confirmed, as three social energy metrics were proposed as a result of the applied procedure.

Thus, the objectives of the article were achieved, and the presented approach using the clustering method, as well as the crowdfunding research results, complement the current state of knowledge in the field of reward-based crowdfunding. They can also serve as a guide for future research.

Based on the results presented in tables and sequences of project category clusters and their cross-comparisons, and after data were examined in quantitative terms (according to thematic project categories), it can be concluded that:

- Project categories according to selected attributes combine into clusters of varying sizes, which means they belong to different attribute value ranges, with the number of clusters within attributes being similar (here: 5 and 4), in all clustering runs taking into account data from the four selected countries.
- After most passes through the clustering procedure, the weights assigned to categories cease to be significant, because they end up in different clusters in which the thematic scope is essentially loose.

- The strength of interaction between the studied attributes was greatest, i.e., > 0.9 in Canada and the United States, meaning that the sum of project donations in some categories very clearly depended on the strength of social energy (people supporting projects), while the strength of interaction in the range of $0.7\text{--}0.9$ also occurred in the above countries, as well as in the United Kingdom.
- In all four studied countries there were also clusters of categories whose sum of donations and number of supporters remained in low dependency (range < 0.2); nevertheless, social energy, both financial and numerical, ensured that projects in these category clusters achieved success status.
- Social energy, i.e., the average contribution in \$ made by a person to one of the projects in a category, ranged from \$195 to \$5.4 and was clearly differentiated across the studied countries.
- Financial social energy and numerical social energy are also differentiated across the studied countries. This is confirmed by the fact that the sum of project donations guaranteeing its success, in some cases has its source in contributions of significant amounts, and in others in relatively small contributions from many people.
- There is a need to verify reward packages so that they better fulfill their functions. Comparing data obtained from the survey with data on rewards that were determined as a result of processing and grouping into three clusters, it can be observed that the survey confirmed them. The content of individual clusters is similar to the percentage responses of crowdfunding campaign participants. This data suggests to people submitting projects what rewards or their packages are an incentive for people supporting projects in given thematic categories.
- Research results, and especially the methodology itself for obtaining them, for example, daily or weekly information about which thematic category or which country is the leader in fundraising for project implementation, where significant

contributions can be expected, and where numerical social energy is needed – can significantly support the information offering of a given crowdfunding platform.

A certain research limitation may be basing the analysis and clustering of crowdfunding attributes on only one platform. Kickstarter is indeed a leading platform due to the number of projects posted there, as well as the number of successfully completed projects, but each platform has its own specificity, differing in the number, subject matter, and naming of categories. This may necessitate modification of input data before launching clustering procedures according to the presented algorithm.

Forecasts for the popularity of crowdfunding are very promising, therefore it is worth proposing future research directions for this phenomenon of social energy. These may concern, among others:

- research on possibilities of promoting crowdfunding, because as mentioned in Introduction chapter, in many countries the percentage of people aware of such a possibility of raising funds or supporting projects is too low;
- comparisons and specifics of small and large crowdfunding platforms;
- analyses of crowdfunding models according to different attributes;
- changes and trends in the formation of project categories;
- research on the relationship between the economic situation of a given country (for example, GDP per capita, % urbanization, unemployment rate, and the like) with social energy parameters and project attribute values.

It is therefore worth remaining in the interesting topic of reward-based crowdfunding and researching various aspects of social energy.

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