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# *Social Energy as a Potential Source of Funding for Energy Projects in North American States: Data Analysis and Statistical Inference*

ABSTRACT

This article presents an innovative financing model for renewable energy projects, specifically for small and medium-sized local communities, leveraging crowdfunding, also known as social energy. This concept, studied for over two decades across various fields like sustainable development and finance, is explored as a way to strengthen investment in these communities.

The study investigates the relationship between social energy and regional economic conditions, with a particular focus on North American states. Its findings aim to guide project developers and co-funders in making optimal decisions regarding the location and scale of projects. The analysis accounts for economic diversity and demographic trends, illustrating how regional variations influence the success of crowdfunding initiatives.

The methodology is rooted in data analysis and statistical inference, including correlation and regression, to identify key economic variables. We used spatial analysis to pinpoint factors that either stimulate or inhibit investment. The results highlight significant correlations between social energy and economic conditions in different states. This information offers valuable insights for

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promoting small and medium-sized renewable energy projects in economically suitable areas. The article suggests that lessons from the U.S. context can be applied to other regions that foster social energy to cater to regional economic needs.

*KEYWORDS: energy projects; social energy; data analysis; crowdfunding; spatial analysis; clustering*

## INTRODUCTION

Businesses, at various stages of their operations, must acquire capital to fund new or ongoing activities, and corporate growth. The method of obtaining these funds largely depends on the company's stage of development, size, and growth prospects. Sources of financing, i.e., monetary resources, can take the form of equity, debt, or hybrid capital, and can be accessed through either internal or external sources (Fisher, 2015; Chowdhury et al., 2019). For many years, established funding sources in the financial market have included bank loans, bonds, other loans, and short- or long-term liabilities.

Entrepreneurs, however, are continually seeking new forms of funding, particularly for starting businesses, known as startups. Individual innovators who are not necessarily tied to business, and whose projects may relate to hobbies, passions, or local market needs, face similar financial challenges. On the other hand, potential lenders are exploring areas underserved by traditional banks. The emergence of the global fintech market is one response to this problem. Haddad and Hornuf (2019) demonstrated that the harder it is for companies to access credit, the greater the number of fintech startups in a given country. Jagtiani and Lemieux (2018) reached similar conclusions and further found that fintech loan shares increased in regions where the local economy was underperforming. Researchers continue to probe whether the use of one funding instrument affects the likelihood of later obtaining another; for example, whether venture capital (VC) financing can follow crowdfunding, or vice versa. It is also examined whether new players and their financial instruments reduce the early-stage funding gap for startups or merely replace or displace existing instruments at later stages, and whether they help fill the financial gap for new technologies that have not yet proven their commercial applications or usefulness (Block et al., 2018). This research team explored how intermediaries operate to identify providers of IT services and funding sources for innovative ventures. Among these, crowdfunding is particularly noteworthy.

Crowdfunding has become one of the most popular methods of raising funds by collecting typically small amounts from numerous contributors. It is important to note that, unlike loans, credits, and similar sources of financing, in crowdfunding, the project initiator does not repay the received funds. Instead, various rewards are often offered to contributors as a form of gratitude (Wei Shi, 2018; Martínez-Climent et al., 2021). The pool of rewards may include material gifts, early access to the product, discounts on purchases, various gadgets, or symbolic acknowledgments such as mentions on social media or a handshake in a photo with the project creator.

However, contributors generally support selected projects not because of expected rewards but because they care about the realization of the idea, which is often an innovative solution. A key aspect is that the so-called success of a project, meaning the achievement (or exceeding) of the desired funding amount, is the result of significant social mobilization, which we refer to as social energy or crowd energy (Szewczyk et al., 2021; Szewczyk, 2022, 2023).

It should be emphasized that the United States has been the pioneer and largest user of this form of fundraising for many years. The number of active projects seeking funding there is at least an order of magnitude higher than in other countries. For example, in a randomly selected month – September 2023 – there were 223,285 active projects in the U.S. In comparison, the next leading countries had 71,640 projects (United Kingdom) and 2,490 projects (Canada).

Therefore, it is believed that studying crowdfunding in the U.S. would be particularly interesting, as the results of such research could help in analyzing and forecasting the development of this form of financing in other countries. To enable this transfer, it is necessary to examine crowdfunding at the state level, where significant economic differences exist. For example, states vary in population size, per capita income, and gross domestic product (GDP). It would be valuable to investigate whether each state also exhibits different levels of interest among its residents in supporting crowdfunding projects.

The aim of this paper is to identify potential relationships between independent (economic) variables in a given state and dependent variables characterizing crowdfunding. Specifically, it seeks to demonstrate the impact of a state's economic conditions on social energy, with the assumption that this energy could also contribute to the development of traditional energy systems.

A systematic review of publications on crowdfunding reveals that authors present both broader, general overviews of this financing model and more specific, sectoral or geographical approaches. In the first group, especially in the field of economics, the work of Strausz and Roland (2017) stands out. It emphasizes the innovative nature of crowdfunding, which allows entrepreneurs to enter into agreements with consumers before making investments. In situations of uncertain aggregate demand, this improves the identification of valuable projects. Popular crowdfunding platforms offer programs that enable consumers to make conditional commitments. Efficiency is sustained only when expected profits exceed the agency costs associated with incentive problems in entrepreneurship. By reducing demand uncertainty, crowdfunding promotes welfare and complements traditional entrepreneurial financing, which focuses on controlling moral hazard.

Moon et al. (2018) highlight the role of crowdfunding in promoting sustainable and appropriate technologies, as projects in this domain particularly require stable financial support. According to these authors, the inflow of funds depends on identifying factors that influence potential sponsors and analyzing the connections between these factors, thereby determining the viability of crowdfunding as a realistic new alternative financing source. Their findings suggest that key factors influencing users' intentions to support appropriate technology projects through crowdfunding include social influence, expected effort, and perceived trust. Compared to crowdfunding in other fields, we argue that crowdfunding for appropriate technologies is more akin to donations. Consequently, for these projects to succeed, aggressive online exposure through sponsors' social networks should be sought from the earliest funding stages.

A similar issue was addressed in the work of Flórez-Parra et al. (2020), who analyzed 101 projects on the crowdfunding platform Colectual. They examined factors such as sustainability, the company's financial characteristics-liquidity, financial leverage, and solvency-and the characteristics of loans related to crowdfunding, such as loan amounts, repayment terms, and interest rates. The study found that investors consider not only financial risk but also factors related to sustainability and the growth of the company's equity, which improves shareholder profitability.

Another significant contribution is from Motylska-Kuzma (2018), who negatively verifies the hypothesis that crowdfunding campaigns with a sustainability focus have a significantly higher chance of convincing investors and successfully raising funds. Her research included 50 successful reward-based and equity crowdfunding projects on Polish platforms, analyzing the campaign context.

Links between crowdfunding and business models are explored in the works of Belleflamme et al. (2015) and Chang (2020), who demonstrate connections between crowdfunding and broader economic research, which is essential for understanding crowdfunding platforms (CFPs). The authors assert that a two-sided market perspective is necessary to understand CFP business models.

Figueroa-Armijos and Berns (2022) drew interesting conclusions by examining the role vulnerability plays in successful fundraising within the prosocial context of crowdfunding, using complex frameworks of social responsibility and framing theory.

Attention should also be given to Brent and Lorah (2019) and Mayer (2019), who analyzed the economic geography of crowdfunding. They studied the average distance between donors and projects, concluding that neighborhood characteristics, including median household income, do not impact the ability to raise capital. This addresses concerns that crowdfunding could exacerbate inequalities in local amenities. The average distance between a donor and a project exceeds 300 miles, with a median distance of 8 miles, indicating that while projects attract donations from outside the community, local donations are crucial. The income levels of donors' neighborhoods do not affect whether they contribute to projects in either low- or high-income areas.

Meanwhile, Lewis et al. (2020) observed that crowdfunding is less popular in conservative regions of the U.S. Additionally, the legitimacy of crowdfunding is more significant in these regions, and after reaching a threshold of legal acceptability, crowdfunding adoption in conservative regions surpasses that in liberal regions.

Breznitz and Noonan (2020) analyzed the geographic concentration of crowdfunding activities in selected countries and discovered that digital media projects tend to concentrate more frequently than local projects, which exhibit significant geographic dispersion. A decade ago, Mollick (2014) also noted that crowdfunding geography is linked to both the type of proposed projects and successful fundraising. Cha (2017) suggested that geography influences crowdfunding success for video games, while Chan et al. (2018) examined the impact of location on crowdfunding success, finding it to be significant.

Several publications also present the legal and economic aspects of crowdfunding in the U.S. It is evident that legislators recognize the importance of this issue, as it is regulated through legal frameworks, which are relatively scarce in other countries.

It is, however, easy to observe a significant discrepancy between the number of publications on crowdfunding and its popularity in the U.S. As indicated by the systematic review of the literature on this subject, the issue of social energy in financial terms is addressed by researchers in a broad context. Nevertheless, only a very limited number of studies are directly related to the use of crowdfunding for financing energy-generating projects. These include publications such as "A Decision Support Tool for Social Engagement, Alternative Financing and Risk Mitigation of Geothermal Energy Projects" (Ioannou et al., 2023), "Social License to Operate in Geothermal Energy" (Barich et al., 2022), "Community-Based Business on Small Hydropower (SHP) in Rural Japan: A Case Study on a Community-Owned SHP Model of Ohito Agricultural Cooperative" (Alam et al., 2021), and "Microgeneration of Electricity Using a Solar Photovoltaic System in Ireland" (Virupaksha et al., 2019).

Additionally, no publications have been found that examine the relationship between social energy and economic conditions.

For these reasons, the objective of this research – to identify the relationship between social energy and economic conditions, and to demonstrate the intensity and effectiveness of this form of financing, thereby encouraging the development of small and medium-sized energy-generating projects – appears to be an important and progressive task. Accordingly, the following research hypotheses have been formulated:

H1. There are significant relationships between data on the intensity and effectiveness of social energy (crowdfunding) and parameters reflecting the economic situation of a given area.

H2. Spatial analysis allows for the identification of potential relationships between the location and neighborhood of studied areas and the intensity of social energy.

H3. The processes of so-called clustering, which graphically illustrate the relationships under study, will help determine optimal locations for new projects, with social energy serving as a potential source of funding.

H4. The proposed hypotheses will be tested through a custom-designed research methodology.

**Research methodology**

Our original methodology for researching the relationship between crowdfunding phenomena and the economic situation in various U.S. states was conducted using primary data sourced from a crowdfunding platform via web robots provided by webrobots.io. This website offers indexing and scraping services, delivering the data in ready-to-use CSV files at regular intervals. The study was based on data from the leading platform, Kickstarter, as of September 2023. First, the names of detailed categories were established by extracting them from the general fields in projects' source data. Only successful projects – those that reached or exceeded their fundraising goals and originated from various U.S. states – were selected according to the established research scope. From this curated project database, the following pieces of data were chosen to align with the research objectives:

- average number of residents per project, relative to the total population of the state,
- number of projects authored by state residents,
- number of residents supporting all projects,

Table 1. Data on projects in U.S. states.

| State | Average number of inhabitants per project to the total state population | Number of projects authored by state residents | Number of residents supporting all projects | Total planned fundraising amount for projects | Total actual amount of fundraising for projects | Average number of residents paying for a given project | Average planned fundraising amount for a given project | Average actual amount of collection for a given project |
|---|---|---|---|---|---|---|---|---|
| Alabama | 0.003 | 1,158 | 163,165 | 6,963,042 | 14,546,619 | 141 | 6,013 | 12,562 |
| Alaska | 0.017 | 659 | 79,924 | 3,939,460 | 6,331,887 | 121 | 5,978 | 9,608 |
| Arizona | 0.003 | 3,274 | 745,395 | 22,464,571 | 71,800,939 | 228 | 6,862 | 21,931 |
| Arkansas | 0.007 | 753 | 166,663 | 5,277,654 | 13,238,309 | 221 | 7,009 | 17,581 |
| California | 0.001 | 44,096 | 15,599,276 | 543,778,302 | 1,714,682,574 | 354 | 12,332 | 38,885 |
| Colorado | 0.005 | 5,616 | 1,704,217 | 46,972,649 | 184,648,659 | 303 | 8,364 | 32,879 |
| Connecticut | 0.004 | 2,005 | 273,754 | 15,343,743 | 26,246,690 | 137 | 7,653 | 13,091 |
| Delaware | 0.099 | 684 | 691,020 | 9,784,964 | 122,484,359 | 1,010 | 14,306 | 179,071 |
| District of Columbia | 0.031 | 2,268 | 468,300 | 23,267,725 | 35,375,901 | 206 | 10,259 | 15,598 |
| Florida | 0.001 | 8,444 | 1,842,624 | 63,587,644 | 173,769,523 | 218 | 7,531 | 20,579 |
| Georgia | 0.002 | 4,732 | 1,016,030 | 40,126,378 | 118,463,339 | 215 | 8,480 | 25,035 |
| Hawaii | 0.009 | 846 | 108,729 | 7,335,555 | 10,399,357 | 129 | 8,671 | 12,292 |
| Idaho | 0.008 | 1,072 | 168,660 | 7,200,092 | 14,932,399 | 157 | 6,717 | 13,929 |
| Illinois | 0.002 | 8,658 | 1,983,161 | 66,203,678 | 149,725,976 | 229 | 7,647 | 17,293 |
| Indiana | 0.002 | 2,400 | 380,056 | 14,893,162 | 28,702,270 | 158 | 6,205 | 11,959 |
| Iowa | 0.005 | 1,174 | 171,834 | 10,104,990 | 17,200,301 | 146 | 8,607 | 14,651 |

| State | Average number of inhabitants per project to the total state population | Number of projects authored by state residents | Number of residents supporting all projects | Total planned fundraising amount for projects | Total actual amount of fundraising for projects | Average number of residents paying for a given project | Average planned fundraising amount for a given project | Average actual amount of collection for a given project |
|---|---|---|---|---|---|---|---|---|
| Kansas | 0.006 | 793 | 150,055 | 5,093,423 | 13,983,977 | 189 | 6,423 | 17,634 |
| Kentucky | 0.004 | 1,464 | 236,975 | 9,954,513 | 16,546,893 | 162 | 6,800 | 11,303 |
| Louisiana | 0.003 | 1,679 | 209,546 | 12,342,001 | 17,615,318 | 125 | 7,351 | 10,492 |
| Maine | 0.009 | 1,192 | 144,201 | 8,134,099 | 12,758,681 | 121 | 6,824 | 10,704 |
| Maryland | 0.003 | 2,918 | 509,581 | 16,299,912 | 37,758,939 | 175 | 5,586 | 12,940 |
| Massachusetts | 0.004 | 7,495 | 2,253,849 | 67,623,025 | 194,822,538 | 301 | 9,022 | 25,994 |
| Michigan | 0.002 | 4,999 | 819,585 | 30,400,629 | 62,880,439 | 164 | 6,081 | 12,579 |
| Minnesota | 0.005 | 4,729 | 1,240,900 | 54,614,680 | 139,843,387 | 262 | 11,549 | 29,571 |
| Mississippi | 0.003 | 386 | 30,695 | 1,612,933 | 2,314,624 | 80 | 4,179 | 5,996 |
| Missouri | 0.003 | 3,012 | 496,656 | 19,121,682 | 40,453,694 | 165 | 6,349 | 13,431 |
| Montana | 0.027 | 881 | 262,635 | 7,583,847 | 35,467,761 | 298 | 8,608 | 40,259 |
| Nebraska | 0.006 | 616 | 69,212 | 3,527,734 | 6,536,924 | 112 | 5,727 | 10,612 |
| Nevada | 0.006 | 2,699 | 507,979 | 17,480,514 | 69,780,920 | 188 | 6,477 | 25,854 |
| New Hampshire | 0.009 | 911 | 109,843 | 4,438,577 | 6,831,864 | 121 | 4,872 | 7,499 |
| New Jersey | 0.002 | 3,325 | 575,065 | 22,041,929 | 49,432,175 | 173 | 6,629 | 14,867 |
| New Mexico | 0.008 | 1,309 | 210,741 | 9,722,514 | 16,636,611 | 161 | 7,427 | 12,709 |
| New York | 0.001 | 30,474 | 6,818,178 | 319,992,152 | 660,113,710 | 224 | 10,500 | 21,662 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| North Carolina | 0.001 | 4,794 | 767,733 | 35,537,879 | 61,694,922 | 160 | 7,413 | 12,869 |
| North Dakota | 0.013 | 269 | 27,976 | 2,150,400 | 2,600,324 | 104 | 7,994 | 9,667 |
| Ohio | 0.002 | 5,370 | 1,121,569 | 36,814,567 | 97,673,515 | 209 | 6,856 | 18,189 |
| Oklahoma | 0.003 | 1,157 | 131,774 | 6,438,647 | 10,073,388 | 114 | 5,565 | 8,706 |
| Oregon | 0.006 | 6,798 | 1,726,743 | 59,353,108 | 131,761,045 | 254 | 8,731 | 19,382 |
| Pennsylvania | 0.002 | 7,472 | 1,516,207 | 47,825,847 | 117,292,682 | 203 | 6,401 | 15,698 |
| Rhode Island | 0.015 | 833 | 136,800 | 5,698,291 | 14,166,661 | 164 | 6,841 | 17,007 |
| South Carolina | 0.002 | 1,598 | 183,672 | 10,439,164 | 18,452,080 | 115 | 6,533 | 11,547 |
| South Dakota | 0.013 | 208 | 25,164 | 1,645,054 | 3,497,849 | 121 | 7,909 | 16,817 |
| Tennessee | 0.003 | 4,907 | 1,052,270 | 43,776,963 | 101,848,028 | 214 | 8,921 | 20,756 |
| Texas | 0.001 | 11,939 | 2,770,815 | 92,487,439 | 239,562,379 | 232 | 7,747 | 20,066 |
| Utah | 0.017 | 3,673 | 2,123,798 | 37,766,720 | 320,578,207 | 578 | 10,282 | 87,280 |
| Vermont | 0.017 | 1,030 | 114,897 | 7,595,744 | 9,907,740 | 112 | 7,375 | 9,619 |
| Virginia | 0.002 | 4,296 | 808,473 | 28,489,546 | 70,468,107 | 188 | 6,632 | 16,403 |
| Washington | 0.004 | 8,665 | 2,777,691 | 90,318,531 | 282,435,595 | 321 | 10,423 | 32,595 |
| West Virginia | 0.007 | 478 | 62,137 | 2,361,446 | 3,755,433 | 130 | 4,940 | 7,857 |
| Wisconsin | 0.002 | 2,716 | 342,381 | 17,006,967 | 32,572,601 | 126 | 6,262 | 11,993 |
| Wyoming | 0.052 | 361 | 109,000 | 3,790,751 | 8,316,087 | 302 | 10,501 | 23,036 |

*Note*. Own elaboration based on raw data collected at http://webrobots.io/kickstarter-datasets.

– total planned fundraising amount for projects,
– total actual fundraising amount for projects,
– average number of residents contributing to a given project,
– average planned fundraising amount for a given project,
– average actual fundraising amount for a given project.

The data from the various states of North America are summarized in Table 1. The database was transformed by recalculating the data per capita for each state to achieve comparability between states.

In line with the research objectives, the following data were selected:
– GDP per capita,
– income per capita,
– consumption per capita,
– poverty rate,
– unemployment rate,
– labor force participation rate.

The data from the various U.S. states are summarized in Table 2.

Table 2. Data on the economic situation in U.S. states.

| State | GDP per capita | Income per capita | Consumption per capita | Poverty rate | Unemployment rate | Professional activity rate |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Alabama | 54,276 | 48,429 | 34,781 | 19.2 | 2.6 | 2,227 |
| Alaska | 87,544 | 66,796 | 48,550 | 11.4 | 4.0 | 342 |
| Arizona | 61,639 | 51,381 | 39,012 | 18.2 | 3.8 | 3,477 |
| Arkansas | 53,769 | 49,862 | 34,304 | 18.7 | 3.3 | 1,324 |
| California | 91,176 | 75,588 | 47,041 | 16.4 | 4.2 | 18,441 |
| Colorado | 82,334 | 68,106 | 46,384 | 12.1 | 3.0 | 3,104 |
| Connecticut | 87,674 | 82,759 | 49,478 | 10.8 | 4.2 | 1,852 |
| Delaware | 85,977 | 58,702 | 44,042 | 13.0 | 4.5 | 474 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| District of Columbia | 239,179 | 90,691 | 69,127 | 18.4 | 4.7 | 370 |
| Florida | 61,653 | 59,146 | 42,612 | 16.6 | 2.9 | 10,449 |
| Georgia | 68,499 | 54,294 | 37,456 | 18.4 | 3.0 | 5,075 |
| Hawaii | 67,347 | 61,549 | 44,047 | 11.5 | 3.5 | 653 |
| Idaho | 55,925 | 51,204 | 33,409 | 14.8 | 2.7 | 925 |
| Illinois | 81,388 | 67,655 | 44,000 | 14.3 | 4.6 | 6,177 |
| Indiana | 66,211 | 55,551 | 37,662 | 15.2 | 3.0 | 3,303 |
| Iowa | 71,885 | 56,785 | 37,146 | 12.3 | 2.7 | 1,670 |
| Kansas | 71,254 | 59,043 | 38,538 | 13.5 | 2.7 | 1,465 |
| Kentucky | 57,246 | 50,155 | 36,292 | 19.0 | 3.9 | 1,968 |
| Louisiana | 61,230 | 53,726 | 37,804 | 19.9 | 3.7 | 2,012 |
| Maine | 61,008 | 56,650 | 44,133 | 14.0 | 3.0 | 655 |
| Maryland | 76,279 | 69,611 | 43,545 | 10.4 | 3.2 | 3,069 |
| Massachu-setts | 97,268 | 83,105 | 51,342 | 11.7 | 3.8 | 3,603 |
| Michigan | 61,332 | 55,249 | 40,997 | 16.2 | 4.2 | 4,633 |
| Minnesota | 77,406 | 65,544 | 43,940 | 11.4 | 2.7 | 2,995 |
| Mississippi | 47,190 | 43,926 | 32,652 | 21.9 | 3.9 | 1,202 |
| Missouri | 62,544 | 54,083 | 39,827 | 15.5 | 2.5 | 2,984 |
| Montana | 57,664 | 56,748 | 40,712 | 15.2 | 2.6 | 553 |
| Nebraska | 81,941 | 62,432 | 40,505 | 12.3 | 2.3 | 1,034 |
| Nevada | 67,152 | 56,242 | 38,720 | 15.4 | 5.4 | 1,466 |
| New Hampshire | 75,565 | 71,488 | 50,695 | 9.2 | 2.5 | 747 |
| New Jersey | 80,490 | 77,740 | 48,162 | 11.1 | 3.7 | 4,564 |
| New Mexico | 57,908 | 48,460 | 35,152 | 20.6 | 4.0 | 909 |
| New York | 103,416 | 78,252 | 48,875 | 15.9 | 4.3 | 9,206 |
| North Carolina | 68,243 | 53,327 | 37,943 | 17.2 | 3.7 | 4,971 |
| North Dakota | 95,950 | 65,594 | 43,172 | 11.1 | 2.1 | 406 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Ohio | 69,550 | 55,842 | 39,653 | 15.8 | 4.0 | 5,510 |
| Oklahoma | 60,274 | 51,861 | 34,196 | 16.6 | 3.0 | 1,830 |
| Oregon | 69,416 | 59,473 | 42,070 | 16.4 | 4.2 | 2,086 |
| Pennsylvania | 70,569 | 64,514 | 44,000 | 13.6 | 4.4 | 6,196 |
| Rhode Island | 64,679 | 64,005 | 41,496 | 14.8 | 3.2 | 551 |
| South Carolina | 55,448 | 49,949 | 37,092 | 17.9 | 3.2 | 2,298 |
| South Dakota | 74,164 | 63,887 | 41,031 | 14.1 | 2.1 | 465 |
| Tennessee | 66,648 | 53,954 | 36,626 | 18.2 | 3.4 | 3,239 |
| Texas | 78,403 | 58,347 | 38,777 | 17.2 | 3.9 | 14,093 |
| Utah | 72,710 | 55,229 | 35,920 | 11.8 | 2.3 | 1,703 |
| Vermont | 62,209 | 60,319 | 45,664 | 12.2 | 2.6 | 333 |
| Virginia | 74,789 | 64,669 | 42,296 | 11.8 | 2.9 | 4,309 |
| Washington | 92,132 | 71,115 | 45,494 | 13.2 | 4.2 | 3,822 |
| West Virginia | 53,852 | 46,989 | 37,411 | 18.3 | 3.9 | 754 |
| Wisconsin | 67,682 | 58,080 | 40,544 | 13.2 | 2.9 | 2,992 |
| Wyoming | 82,692 | 64,032 | 42,112 | 10.6 | 3.6 | 281 |

*Note*. The values of GDP, income and consumption are stated in USD. Data from https://www.bea.gov.

After preparing the above data, it was possible to proceed to the next stage, which involved calculating correlation indices and rolling linear regression with an initial proposal of all six independent variables. These indices were calculated to examine which economic data variables were significant and to what extent (moderately or substantially), and which were insignificant, with no impact on the crowdfunding data. It was also determined which economic data were stimulants and which were destimulants for the project data. For this purpose, Excel and Statistica 13.3 software packages were used. The third stage involved spatial analysis, which examined potential relationships between the location and proximity of various states and the project data. To this end, a binary (zero-one) neighborhood matrix (known as a weight matrix) for the states of North America was prepared, as presented in Table 3.

Moran's global I was computed to investigate the aforementioned relationships. Additionally, data were clustered in terms of individual crowdfunding variables with the use of the K-Means algorithm. This algorithm, also known as the Centroid Algorithm, is part of the so-called unsupervised learning in machine learning. It is used to divide input data into a predetermined number of clusters, where a centroid, also referred to as the center of the group, represents the cluster.

The K-Means algorithm was chosen because of its high efficiency, particularly with large datasets, where it is significantly faster than other algorithms of its class. Moreover, the clusters formed are generally well-defined, making the intensity of variables more apparent. Five iterations of the clustering procedure are going to be performed. The first iteration will be conducted without any restrictions on the K-Means algorithm. In the second iteration, the procedure will be limited to a smaller number of clusters (the target number is four clusters). The next procedure will consider all available economic data but without specifying a dependent variable. A similar analysis will be performed based on synthetic indicators for economic and crowdfunding data. The final iteration will be conducted without dimension reduction, directly using all available columns with economic and crowdfunding data.

These steps are crucial to comprehensively understand the relationships between crowdfunding and economic indicators across different states, enhancing the reliability and depth of the analysis.

Table 3. Zero-one neighborhood matrix of U.S. states.

| | WA | MT | ME | ND | SD | WY | WI | ID | VT | MN | OR | NH | IA | MA | NE | NY | PA | CT | RI | NJ | IN | NV | UT | CA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WA | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MT | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ME | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ND | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SD | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WY | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| WI | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ID | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| VT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MN | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OR | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| NH | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IA | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| PA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| CT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| RI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| NJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| IN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| NV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| UT | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| CA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| OH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| IL | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| DC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| WV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| KY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| KS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| VA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| OK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TX | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| AL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| LA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MI | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| HI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| OH | IL | DC | DE | WV | MD | CO | KY | KS | VA | MO | AZ | OK | NC | TN | TX | NM | AL | MS | GA | SC | AR | LA | FL | MI | HI | AK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

*Note*. Own elaboration.

## RESEARCH RESULTS AND CONCLUSIONS

The results of the correlation calculations between economic situation data in U.S. states and crowdfunding data are presented in Tables 4 and 5.

Tables 4 and 5 illustrate the relationships between economic data and crowdfunding data. The chart indicates how specific economic indicators correlate with crowdfunding metrics. The colors on the heat map represent the strength and direction of the correlations: deep red colors indicate a strong positive correlation, deep blue colors indicate a strong negative correlation, and shades close to white indicate weak or no correlation.

The analysis of the correlation between economic data and crowdfunding data across the examined areas reveals several interesting relationships.

There is a strong correlation between GDP and the number of projects initiated by residents of a state, with a correlation coefficient of 0.79. This suggests that states with higher GDPs have more projects submitted. Additionally, the planned total amount for project funding shows a strong correlation with GDP, reaching a value of 0.82. This indicates that in wealthier states, project authors plan for larger funding amounts.

On the other hand, the correlation of crowdfunding-related variables with the unemployment rate and the labor force participation rate shows weaker relationships with crowdfunding data (0.3 and 0.4, respectively). This may imply that these factors have a lesser impact on crowdfunding activity at the state level.

Considering the number of residents supporting all projects and the average number of residents per project relative to the total population, there is a significant relationship (0.61) with GDP. This means that in wealthier states, more residents support crowdfunding projects. Meanwhile, the total actual amount raised for projects has a correlation of 0.37 with GDP, suggesting that

Table 4. Results of the correlation calculations between economic situation data in U.S. states and crowdfunding data.

| Crowdfunding data / Economic data | Average number of residents per project to the total population | Number of projects initiated by state residents | Number of residents supporting all projects | Total planned fundraising amount for projects | Total actual fundraising amount for projects | Average number of residents contributing to a given project | Average planned fundraising amount for a given project | Average actual fundraising amount for a given project |
|---|---|---|---|---|---|---|---|---|
| GDP per capita | 0.607 | 0.791 | 0.607 | 0.822 | 0.372 | NS | 0.433 | NS |
| income per capita | 0.439 | 0.587 | 0.439 | 0.595 | NS | NS | NS | NS |
| Consumption per capita | 0.519 | 0.750 | 0.519 | 0.729 | 0.297 | NS | 0.381 | NS |
| Poverty rate | NS | NS | NS | NS | NS | NS | NS | NS |
| Unemployment rate | 0.320 | 0.332 | 0.320 | 0.342 | NS | NS | NS | NS |
| Labor force participation rate | 0.319 | 0.434 | 0.319 | 0.401 | NS | NS | 0.278 | NS |

*Note*. NS – nonsignificant. Own elaboration.

Table 5. Visualization of the correlation between economic data in U.S. states and crowdfunding data.

| Crowdfunding data / Economic data | Average number of residents per project to the total population | Number of projects initiated by state residents | Number of residents supporting all projects | Total planned fundraising amount for projects | Total actual fundraising amount for projects | Average number of residents contributing to a given project | Average planned fundraising amount for a given project | Average actual fundraising amount for a given project |
|---|---|---|---|---|---|---|---|---|
| GDP per capita | 0.607 | 0.791 | 0.607 | 0.822 | 0.372 | 0.26 | 0.433 | 0.15 |
| Income per capita | 0.439 | 0.587 | 0.439 | 0.595 | 0.25 | 0.08 | 0.2 | 0.02 |
| Consumption per capita | 0.519 | 0.75 | 0.519 | 0.729 | 0.297 | 0.21 | 0.381 | 0.12 |
| Poverty rate | −0.120 | −0.06 | −0.12 | −0.03 | −0.15 | −0.21 | −0.25 | −0.17 |
| Unemployment rate | 0.320 | 0.332 | 0.32 | 0.342 | 0.22 | 0.11 | 0.04 | 0.12 |
| Labor force participation rate | 0.319 | 0.434 | 0.319 | 0.401 | 0.2 | 0.1 | 0.278 | 0.04 |

*Note.* Correlation strength: -1.0 -0.5 0.0 0.5 1.0

the financial support provided by residents increases along with greater prosperity.

It is also worth noting that the correlations of approximately 0.43 for the average planned fundraising amounts per project with GDP and 0.28 with the labor force participation rate are similar to the previously discussed variables. This may indicate that while wealthier states generate more projects and greater support, this does not necessarily translate to significantly higher support amounts per individual project. Furthermore, the crowdfunding variables that correlated with GDP exhibit a similar level of interdependence with consumption. These correlations are about 0.1 lower than those for GDP.

An interesting conclusion can be drawn from the analysis of the correlations between crowdfunding variables and the poverty rate, which turned out to be insignificant for all dependent variables. This may suggest that the poverty level of state's residents does not significantly impact their engagement in project funding. In contrast, the correlation of income per capita in a given state ranged from 0.4 to 0.6 with four variables, including the strongest positive correlation with the total planned fundraising amount for projects and the number of projects initiated by residents – similar to the correlation of these variables with GDP. The weakest influence of income is on the average actual fundraising amount per project. This confirms that the prosperity of residents encourages project authors to plan higher fundraising amounts and motivates residents to actively participate in funding projects.

In summary, the correlation results indicate a significant relationship between the economic prosperity of states and crowdfunding activity, with an increased number of projects per capita and overall financial support per capita in wealthier states. This demonstrates how economic well-being affects the ability and willingness of communities to support crowdfunding projects.

The next stage of the research procedure consists in calculating stepwise linear regression coefficients, taking into account the dependent variables related to projects, with the initial proposal including all six independent variables in the form of economic data. The aim of this procedure was to determine the covariability of several variables. The calculation results are presented in Table 6.

It should be noted that all model determination coefficients are statistically significant. The value of $R^2$ can be interpreted as the percentage quality or the accuracy of the regression model in explaining the variability of the dependent variable. For example, an $R^2$ value of 0.6684 suggests that 66.98% of the variability in the dependent variable can be explained by the independent variable "GDP per capita" in the regression model. The analysis of results indicates that the independent variable "GDP" in a given state, acts as a stimulant for all seven dependent variables included in the model.

The independent variable "income" also acts as a stimulant, but only concerning the dependent variable "the number of projects initiated by state residents." On the other hand, the independent variable "consumption" is a destimulant in this same case. Additionally, the independent variable "labor force participation rate" is also a destimulant and affects the average number of residents contributing to a given project, the average planned fundraising amount for a given project, and the average actual fundraising amount for a given project.

While the stimulating role of GDP and income in crowdfunding intensity is not surprising, the unexpected role of consumption and labor force participation rate as destimulants is intriguing. Although this pertains only to some of the independent variables, it is worthwhile to investigate this relationship further, for instance, in European countries.

The reason may be the fact that increases in consumption and labor force participation among residents indicate a lesser interest in engaging in crowdfunding, as their needs for certain goods

Table 6. The results of the regression analysis between economic conditions in U.S. states and crowdfunding data.

| | Average number of residents per project to the total population | Number of projects initiated by state residents | Number of residents supporting all projects | Total planned fundraising amount for projects | Total actual fundraising amount for projects | Average number of residents contributing to a given project | Average planned fundraising amount for a given project | Average actual fundraising amount for a given project |
|---|---|---|---|---|---|---|---|---|
| Free expression | NS | -0.122 | -12.2570 | -714.752 | -6.927 | 0.002 | -0.00004 | -0.006055 |
| GDP per capita | 0.607 | 0.000001 | 0.0004 | 0.017 | 0.0003 | 0.0000001 | 0.00000007 | NS |
| income per capita | NS | 0.000006 | NS | NS | NS | NS | NS | NS |
| consumption per capita | NS | -0.002 | NS | NS | NS | NS | NS | NS |
| poverty rate | NS | NS | NS | NS | NS | NS | NS | NS |
| unemployment rate | NS | NS | NS | NS | NS | NS | NS | NS |
| labor force participation rate | NS | NS | NS | NS | NS | -0.000002 | -0.000001 | -0.000002 |
| $R^2$ | 35.61 | 66.34 | 35.61 | 66.98 | 12.080 | 14.916 | 40.98 | 5.93 |

*Note*. NS = nonsignificant. Own elaboration.

(service, cultural, etc.) are being met in other ways. There is also likely an interest in so-called rewards for supporting projects.

The analysis of correlation and regression results allows for a deeper understanding of how the states' economic situation affects crowdfunding efficiency, ranging from the number of projects supported by residents to the actual amounts raised for a project. Economic data influence crowdfunding activity, although this relationship is not unequivocal for all aspects of crowdfunding. Variables such as the planned fundraising amount per person show a stronger connection with economic data, which may suggest that these data impact the level of ambition of state residents and their capability to finance projects.

Following the adopted research procedure, calculations were then performed for the global Moran's I, which examined the degree of crowdfunding intensity in the U.S. states. The calculations used information on the given values of dependent variables for individual states and information on which states border each other, accounting for the so-called weight matrix.

Table 7. The results of Moran's autocorrelation coefficient calculations for all dependent variables.

| | |
|---|---|
| Average number of residents per project to the total population | 0.244 |
| Number of projects initiated by state residents | 0.387 |
| Number of residents supporting all projects | 0.268 |
| Total planned fundraising amount for projects | 0.320 |
| Total actual fundraising amount for projects | 0.210 |
| Average number of residents contributing to a given project | 0.244 |
| Average planned fundraising amount for a given project | 0.345 |
| Average actual fundraising amount for a given project | 0.232 |

The following designations have been adopted:

Income per capita (related to Figure 1)

> 90,000 USD  80,000–90,000 USD  70,000–80,000 USD  70,000 USD

GDP per capita (related to Figures 2 and 3)

The color scale in all figures containing the map of U.S. states is provided as a legend beneath each figure. The calculation results of the Moran's autocorrelation coefficient for all dependent variables are presented in Table 7. The visualization of Moran's coefficient for these 3 variables is presented in Figures 1–3.

Figure 1. Number of projects initiated by state residents – Moran's coefficient visualization with income per capita.

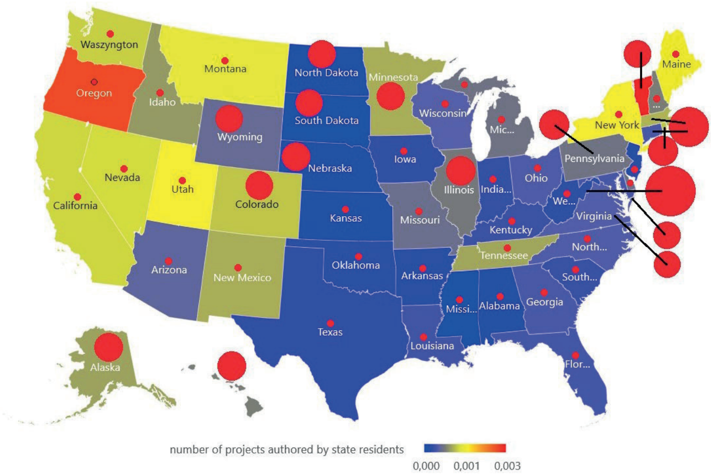


Figure 2. Total planned fundraising amount for projects – Moran's coefficient visualization with GDP.

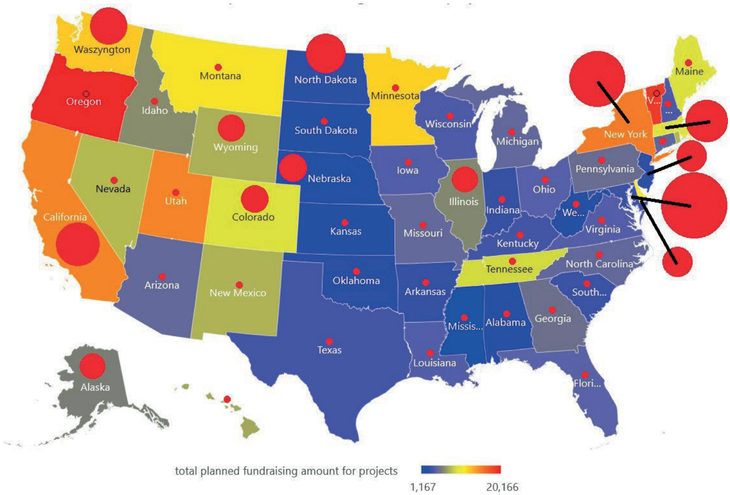
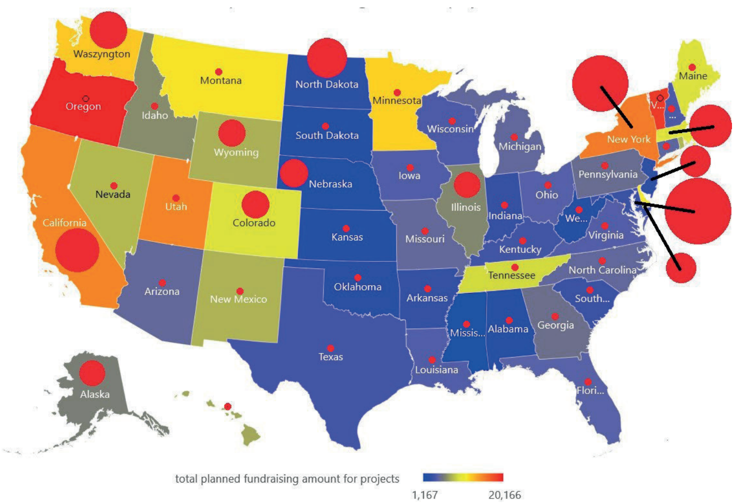



Figure 3. Average planned fundraising amount per project – Moran's coefficient visualization with GDP.



When analyzing the values of this coefficient, we can observe that there is a weak positive autocorrelation, indicating the presence of areas with positive dependence. This is most evident for three dependent variables: the number of projects initiated by state residents (0.387), the planned total fundraising amount for projects (0.320), and the average planned fundraising amount for a given project (0.345).

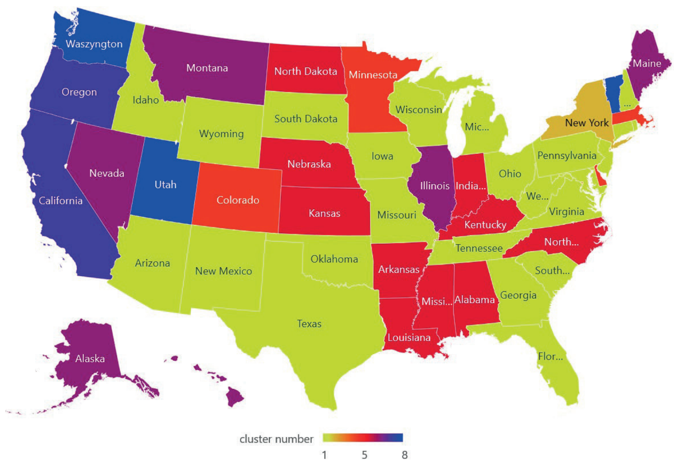
In subsequent steps of the research procedure, data clustering was performed using the K-Means algorithm concerning individual variables related to crowdfunding. As a result, the first iteration produced eight clusters, as illustrated in Figure 4.

- **Cluster 1:** Groups 24 states with moderate crowdfunding activity, including diverse regions (Arizona, Connecticut, Florida, Georgia, Idaho, Iowa, Maryland, Michigan, Missouri, New Hampshire, New Jersey, New Mexico, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia, Wisconsin, and Wyoming). This group may reflect states with average support rates for crowdfunding projects per capita.
- **Cluster 2:** Includes only New York, which may suggest exceptionally high crowdfunding activity, distinguishing it from other states.
- **Cluster 3:** Includes only the District of Columbia, which may indicate unique conditions related to crowdfunding, potentially associated with a high concentration of politically or socially oriented projects.
- **Cluster 4:** Encompasses the states of Colorado, Delaware, Massachusetts, and Minnesota, which may exhibit similar patterns of crowdfunding project support, possibly due to strong startup ecosystems or innovative business environments.
- **Cluster 5:** Contains ten states with lower crowdfunding activity (Alabama, Arkansas, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Nebraska, North Dakota, and North Carolina),

which may reflect limitations in capital availability for projects or less interest in crowdfunding in these regions.

- **Cluster 6:** Consists of a mix of states (Alaska, Hawaii, Illinois, Maine, Montana, and Nevada), which may manifest specific regional preferences for types of crowdfunding projects or differences in the level of support from local communities.
- **Cluster 7:** Identifies California and Oregon, which may reflect their unique position as centers of innovation and startup activity, with strong traditions in crowdfunding.
- **Cluster 8:** Comprises Utah, Vermont, and Washington, suggesting that these states may have similar trends in crowdfunding, possibly due to specific economic sectors or shared socio-cultural values supporting crowdfunding initiatives.

Figure 4. Data clustering regarding individual crowdfunding variables – Procedure 1.

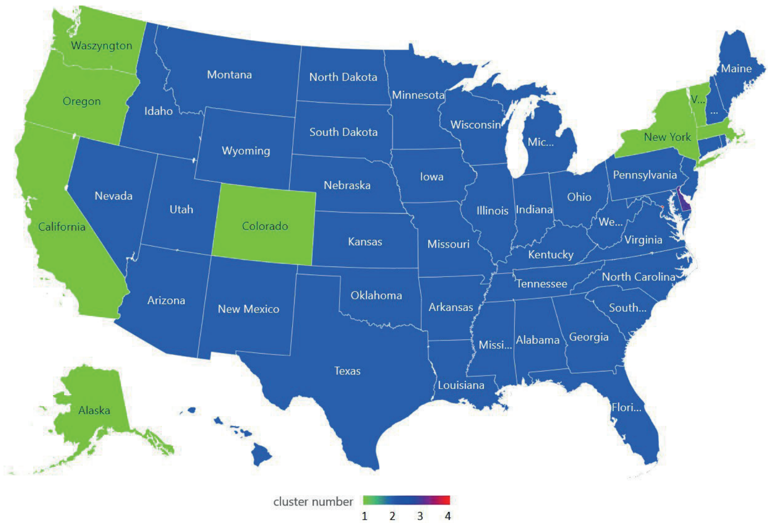



Each cluster obtained in this iteration represents a group of states that exhibit similar characteristics in terms of crowdfunding activity, potentially reflecting regional differences in approaches to crowdfunding, capital availability, and support for innovative and entrepreneurial initiatives. In Procedure 2, the K-Means algorithm was used again, but the procedure was limited to 4 clusters. Four groups of U.S. states were obtained. The division and characteristics of each cluster are illustrated in Figures 5 and 6.

- **Cluster 1:** Groups states characterized by relatively high crowdfunding activity, both in terms of the number of projects and community engagement (number of supporters, fundraising amounts). This cluster includes Alaska, California, Colorado, Massachusetts, New York, Oregon, Vermont, and Washington.
- **Cluster 2:** Includes states with moderate crowdfunding activity. These states may have average values across all analyzed crowdfunding variables. This cluster includes Alabama, Arizona, Arkansas, Connecticut, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, North Dakota, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming.
- **Cluster 3:** Contains only one state, Delaware, which may suggest unique characteristics of crowdfunding activity in this state, differing from other groups.
- **Cluster 4:** Includes the District of Columbia, which also stands out, possibly due to its particular characteristics related to its unique status and socio-economic structure.

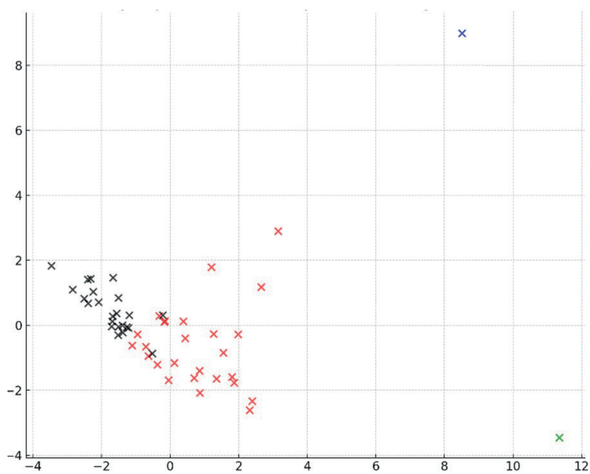
These clusters highlight regional variances in crowdfunding approaches, reflecting differences in community support, economic conditions, and the availability of capital for projects. The identification of these clusters can provide valuable insights into the regional dynamics of crowdfunding activity across North American states.

Figure 5. Clustering of U.S. states – Procedure 2: Cluster 1, Cluster 2, Cluster 3, Cluster 4.




*Note*. Own elaboration.

Figure 6. Visualization of clustering of U.S. states – Procedure 2.




*Note*. Own elaboration.

The division into clusters reveals the diversity in the implementation and support of crowdfunding projects across different states in North America. Cluster 1 may indicate states with highly active communities in crowdfunding, while Cluster 2 groups states with moderate activity in this field. Delaware and the District of Columbia stand out, suggesting the need for a deeper analysis of the factors influencing their unique patterns.

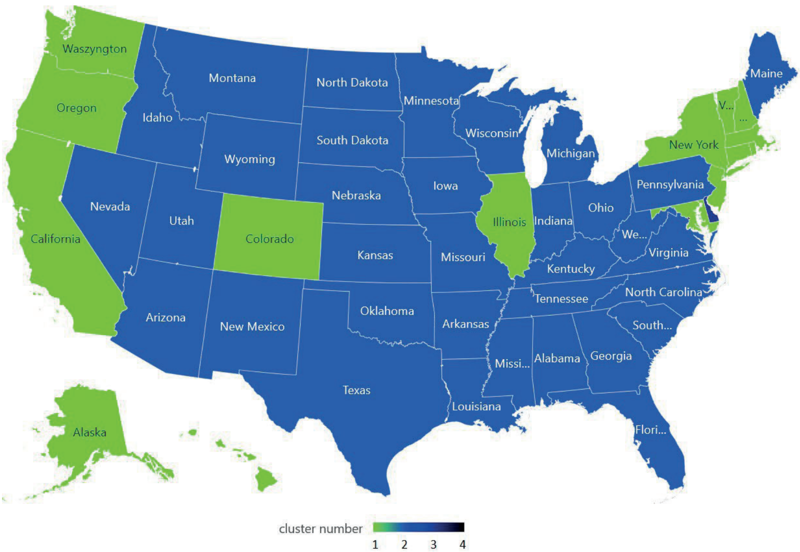
Another clustering of data using all available variables (without specifying the dependent variable), divided into a maximum of 4 clusters (Procedure 3), allowed for the identification of the following groups (Figure 7):

- **Cluster 1:** Includes states characterized by relatively high economic indicators and crowdfunding activity. This cluster includes, among others, Alaska, California, Colorado, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Oregon, Rhode Island, Vermont, and Washington. It can be assumed that these states have strong economies and show high community engagement in crowdfunding projects.
- **Cluster 2:** Groups states with moderate economic indicators and lower crowdfunding activity. This group includes, among others, Alabama, Arizona, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, and Wyoming. These states may be more conservative regarding investments in crowdfunding projects.
- **Cluster 3:** Consists exclusively of Delaware, indicating the unique characteristics of this state compared to the rest. Delaware is often recognized as a corporate and financial hub due to its corporate laws, which may influence its uniqueness in this analysis.

- **Cluster 4:** Contains only the District of Columbia, which stands out among other states, likely due to its particular demographic and economic structure, differing from other states.

This clustering highlights regional variations in crowdfunding approaches, reflecting differences in economic conditions, community support, and the availability of capital for projects. Identifying these clusters provides valuable insights into the regional dynamics of crowdfunding activity across North American states.

Figure 7. Visualization of clustering of U.S. states – Procedure 3.




*Note*. Own elaboration.

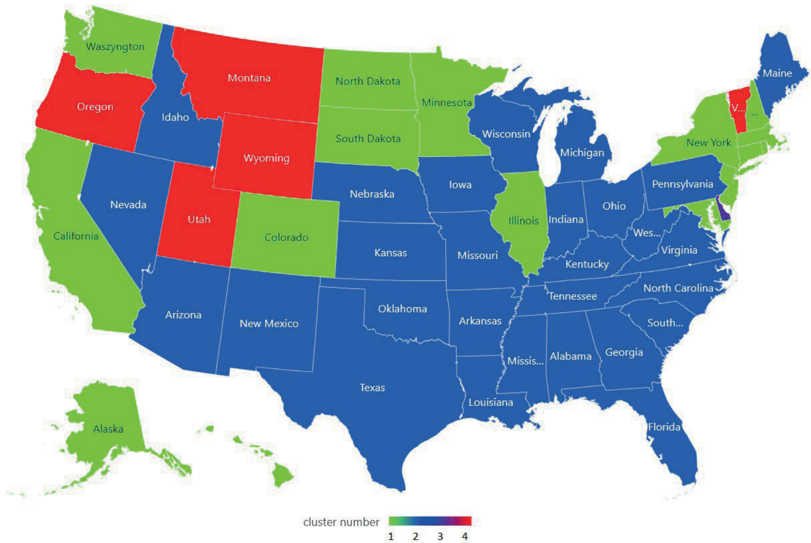
The visualization of these clusters, after reducing the dimensionality of the data to 2 dimensions using PCA, allows us to see the distinction between individual groups of states based on a wide range of variables. It clearly shows how various economic and social characteristics influence the clustering of states, demonstrating the differentiation between more and less economically active states in North America.

The next clustering of North American states was conducted using synthetic indicators for general data (X-axis) and crowdfunding data (Y-axis), divided into 4 clusters. This allowed for the identification of another version of different state groups (Procedure 4):

- **Cluster 1:** Encompasses states with high indicators in both general data and crowdfunding. This group includes Alaska, California, Colorado, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Dakota, Rhode Island, South Dakota, Washington. These states demonstrate strong economic performance and crowdfunding activity.
- **Cluster 2:** Groups states with moderate indicators in both categories. States in this cluster include Alabama, Arizona, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Mississippi, Missouri, Nebraska, Nevada, New Mexico, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, These states exhibit average levels in both economic data and crowdfunding activity.
- **Cluster 3:** Contains Delaware and the District of Columbia, indicating their uniqueness compared to other states, both in terms of general data and crowdfunding.
- **Cluster 4:** Focuses on states with low indicators in general data but higher indicators in crowdfunding data. This group includes Montana, Oregon, Utah, Vermont, Wyoming. This suggests that despite lower economic indicators, these states are active in crowdfunding.

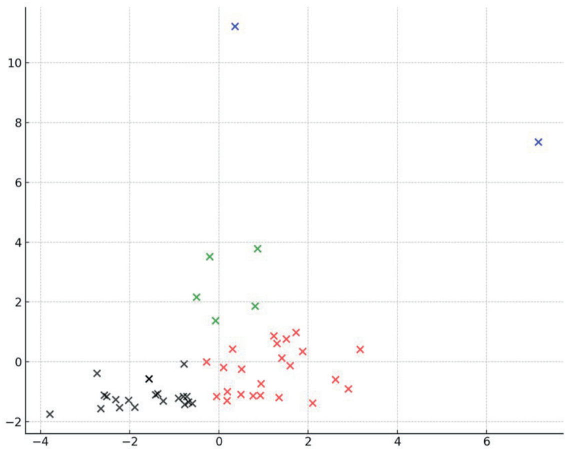
The results of this clustering are presented in Figures 9 and 9..

Figure 8. Clustering of U.S. states – Procedure 4: Cluster 1, Cluster 2, Cluster 3, Cluster 4.




*Note.* Own elaboration.

Figure 9. Visualization of clustering of U.S. states – Procedure 4.



*Note*. Own elaboration.

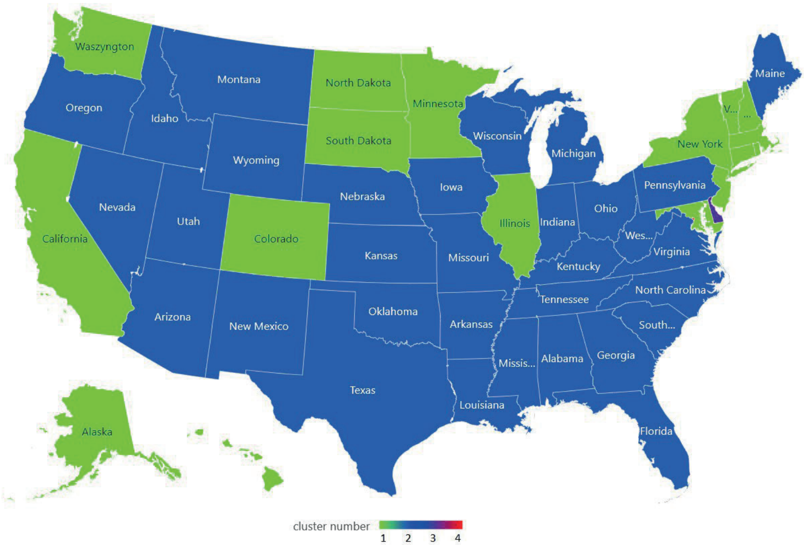
This analysis demonstrates how different states can be categorized based on complex economic indicators and crowdfunding activity. Clusters 1 and 2 represent states with higher or moderate levels in both categories, while Cluster 3 stands out for its uniqueness. Cluster 4 showcases states that, despite lower economic indicators, exhibit significant activity in crowdfunding, which may indicate a strong culture of supporting community initiatives.

Finally, spatial analysis was conducted again, not in two dimensions, but rather in dimensions derived from all available columns with data (Procedure 5). The clustering analysis without dimensionality reduction, performed directly on all available data columns (both economic- and crowdfunding-related), using the K-Means algorithm with a division into 4 clusters, resulted in the creation of the following state groups (Fig. 10):

- **Cluster 1:** Groups states with high economic and crowdfunding activity. States in this cluster include Alaska, California, Colorado, Connecticut, Hawaii, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Dakota, Rhode Island, South Dakota, Vermont, Washington. These states are characterized by having strong economies and intensive involvement in crowdfunding projects.
- **Cluster 2:** Focuses on states with moderate economic and crowdfunding indicators. States in this group include Alabama, Arizona, Arkansas, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Michigan, Mississippi, Missouri, Nebraska, Nevada, New Mexico, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming. They constitute the majority and exhibit average levels in both analyzed areas.
- **Cluster 3:** Includes only Delaware, indicating its uniqueness in the context of the analyzed data. The uniqueness of Delaware may stem from its particular economic profile and crowdfunding activity.

- **Cluster 4:** Contains only the District of Columbia, which also stands out from the other states, likely due to its unique demographic and economic structure, as well as crowdfunding specificity.

Figure 10. Visualization of clustering of U.S. states – Procedure 5.




*Note*. Own elaboration.

In summary, this cluster analysis highlights the diversity of U.S. states in terms of economic indicators and crowdfunding activity. Cluster 1 stands out with the highest performance, while Cluster 2 represents states with moderate results. Delaware and the District of Columbia, as single states in their respective cluster groups, underscore their uniqueness within the data analyzed.

A detailed description of the results from each stage of the research is provided under the tables and figures to facilitate real-time interpretation in conjunction with the visualizations. As noted in the introduction, the systematic review of the literature on the subject revealed a lack of studies addressing the issue as proposed in this work, namely the relationship between social energy and the economic situation of a given area. The closest related works are those by Haddad and Hornuf (2019), Strausz and Roland (2017), Ioannou et al. (2023), Barich et al. (2022), and Alam et al. (2021), but their research was conducted using different methodologies, and their findings pertain to specific individual cases.

The data analysis and statistical inference-correlation and linear regression coefficient calculations, as well as clustering of the studied areas based on similarity-enabled the verification of the initially formulated research hypotheses.

Hypothesis 1, "There are significant relationships between data on the intensity and effectiveness of social energy (crowdfunding) and parameters reflecting the economic situation of a given area," was partially confirmed, as the correlation coefficient results showed a significant relationship only between economic prosperity and residents' engagement in crowdfunding campaigns, particularly through an increased number of projects submitted and a willingness to support them.

Stepwise linear regression coefficients confirmed the above findings, as GDP in a given state is a stimulant for all dependent variables included in the model. However, income positively influences only the number of submitted projects.

A surprising finding is that consumption and labor force participation rate act as destimulants for crowdfunding activity. Another interesting result is the lack of influence of the poverty rate on the willingness to support projects, as its relationship with the dependent variables proved insignificant. Therefore, economic data do influence the intensity of crowdfunding, but this relationship is diverse and not always significant.

Hypothesis 2, "Spatial analysis enables the identification of potential relationships between the location and neighborhood of the studied areas and the intensity of social energy," was positively verified. Although Moran's coefficient values, which account for the neighborhood aspects of areas, indicated a weak positive autocorrelation for only three dependent variables-the number of projects authored by state residents, the total planned fundraising amount for projects, and the average planned fundraising amount per project-the visualization of these variables in relation to the main stimulants (GDP and income) effectively illustrated the calculated intensities of the relationships. This is especially valuable in the case of projects extending beyond a given area, such as social energy initiatives involving 2-3 neighboring areas, in the fields of transportation, tourism networks, or energy infrastructure.

Hypothesis 3, "The clustering processes, which graphically illustrate the relationships between the studied variables, will be helpful in identifying optimal locations for new projects, with social energy as a potential funding source," was also positively verified. Through various clustering procedures, the spatial analysis of the relationship between crowdfunding activity and economic conditions in different areas was further deepened. These analyses demonstrated diversity in terms of economic indicators and crowdfunding activity, with a particular emphasis on the uniqueness of several areas within the clustered groups.

Given the positive verification of the hypotheses, it can be concluded that the objective of this study-namely, identifying the relationship between social energy and the economic situation of a given area and presenting the intensity and effectiveness of this form of financing from both economic and social perspectives-has been achieved. The chosen example of several dozen North American states, which differ significantly in economic and social terms, effectively facilitated and supported the presentation of the results of our research methodology.

Data on the economic situation and social energy (crowdfunding) pertaining to any country or region, when processed using the proposed research procedure, will yield reliable results and provide a clear answer to the core question: whether and where social energy can serve as a potential funding source for small and medium-sized energy generation projects.

We hope that the category of "energy" will soon appear on many crowdfunding platforms online.

As crowdfunding is a growing phenomenon, it would be valuable to repeat this research in the future, as well as to expand its scope-for example, by exploring reward mechanisms for individuals who support projects or by conducting more in-depth analysis of the most and least active crowdfunding regions.

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