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CROWDFUNDING PLATFORMS FOR GREEN INNOVATIONS: A SYSTEMATIC LITERATURE REVIEW

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Abstract

Crowdfunding platforms give green entrepreneurs the option to gain support from backers who share their values in sustainability. This Systematic Literature Review analyses the role of crowdfunding platforms in financing green innovations and provides the classification of crowdfunding platforms like Kickstarter, Indiegogo, GoFundMe, and specialized green crowdfunding platforms. The trends and patterns in green crowdfunding during the last decade have been visualized. Authors retrieved 1163 records published during 2015 to 2024, downloaded 104 records according to criteria and selected 12 studies for analysis. Meta-literature review done with quantitative and qualitative approaches. Word cloud and hierarchy tree has been depicted. The analysis shows that the reward-based platforms like Kickstarter and Indiegogo work for green consumer products but are somehow challenged by capital-intensive innovations; on the other hand, the donation-based platforms like GoFundMe are driven by emotional appeal and philanthropic support, while the specialized green platforms are more appropriate for Cleantech and Renewable Energy Projects. Key trends noted in this review include the transition from reward to equity-based models, increased adoption of technology, regional differences in success rates, and an increase in impact-driven investments. This literature review provides relevant insights for researchers, policymakers, and practitioners interested in this emerging field called green crowdfunding.

INTRODUCTION

The focus on sustainability is growing globally and resulting in a rise in green innovation projects. Sustainable development has received growing attention from academics, industry representatives, and policy-makers wherein the key area is the role of sustainability in enhancing innovation (Saunila et al., 2018). Le et al., (2022) stated that the adverse impact of society, ecological imbalance and increased emissions are affecting

the climate of earth. Green innovation is to counter these adverse effects. Green innovation refers to technologies for energy saving, pollution prevention, waste recycling, green product design, and corporate environmental management (Saunila et al., 2018). Human impacts, climate change, and land management practices have left woodlands vulnerable to multiple stressors whereas preventive measures require funds beyond the provisions (Quesnel Seipp et al., 2023). The study area of financial management has taken crowdfunding as an emergent topic and an innovative solution for financing the projects, especially during the second half of the last decade, which is gearing with the passage of time. Crowdfunding is a complex and multi-faceted phenomenon. It provides financial support by enabling the project's ability to raise money through crowdfunding platforms. It also enhances the visibility of the project and informational dynamics of the campaigns (Le et al., 2022). However, access to early-stage financing remains a key challenge. Crowdfunding has emerged as a viable alternative funding model, enabling green entrepreneurs to secure capital through online platforms. Carè et al. (2025) also emphasizes that green crowdfunding is an innovative and promising alternative for funding, especially for ventures facing high perceived risks. A systematic literature review (SLR) approach provides a comprehensive technique to enable researchers to review the existing literature in a specific domain and identify knowledge trends and gaps (Ma et al., 2025). This study hence aims to provide a systematic review of existing literature on crowdfunding for green innovations, addressing key trends, determinants of success, and research gaps in the area.

Adamska-Mieruszewska et al. (2024) states that Theory of Planned Behaviour and Value Belief Norms theory explains the intention to support green crowdfunding projects. Whereas Theory of Planned Behaviour does it a little better. Both altruistic and biospheric values influence positive behavioural intention toward supporting green crowdfunding campaigns through the Value Belief Norms framework. It has significant effects on attitudes, subjective norms, and perceived behavioural control concerning the intention to support green crowdfunding within the Theory of Planned Behaviour framework. Corsini et al. (2024) evidenced that green product codesigns and green market insights have a positive effect on the success of a campaign. Environmental legitimacy has no significant effect on campaign success. The stage of development has a positive effect on campaign success but moderates and weakens the positive relationship between green codesign practices and crowdfunding campaign success (Corsini et al., 2024).

Keeping in view the emergent needs of green innovation and financing the projects through crowdfunding platforms along with other sources, this Literature Review has focused on the issue for analysis; and has given directions to future research.

2. Methodology

This study adopts a systematic literature review to assemble, evaluate, and synthesize existing knowledge on Crowdfunding Platforms for Green Innovation. A systematic literature review provides a transparent, rigorous, and reproducible method for identifying relevant knowledge, minimizing selection bias, and generating an evidence-based understanding of developments in a particular field (Wehnert & Beckmann, 2023). This study incorporates both quantitative (bibliometric) and qualitative analytical approaches and follows a structured, multistage protocol designed to support methodological rigor and clarity. The review starts defining the research scope and clarifying the central objectives of the study, to examine how crowdfunding platforms support green innovation; and to identify key themes, patterns, and gaps in academic literature. Establishing the scope has guided the selection of databases, keywords, and screening criteria, as well as the development of the overall review strategy. A preliminary scanning of terms and publications was carried out to make sure that the keywords used express the most relevant conceptual combinations. The results of such preliminary search were employed to refine a formal protocol

of the review, which covered the databases, keywords, criteria of eligibility, and the procedures of screening, assessment of quality, and synthesis of data. Such protocol formed the basis for the systematic search.

The screening process was guided by predefined inclusion and exclusion criteria. All non-peer-reviewed material or articles lacking any of the key thematic elements or those unrelated to the intersection of crowdfunding and green innovation were dropped conforming to predefined criteria which have been explained in detail in preceding paras under appropriate headings. The identification, screening, eligibility assessment, and final inclusion of articles were based on a PRISMA-type logic. After identifying the studies, a structured data extraction process was carried out to ensure that similar information is extracted in a consistent manner across all sources. The attributes extracted included publication year, authorship, journal outlet, research focus, key findings, and research gaps as identified by the respective authors. These processes allowed for comparisons to be made systematically across the identified studies and ensured that the synthesized output was based on a systematic way. The qualitative data synthesis explored the themes, conceptual patterns, and theoretical approaches identified in the selected articles whereas the bibliometric observations noted the publication patterns, methodological approaches, and topics identified over time. The combination of both the techniques provided a complete summary about the focused topic and helped to identify the other relevant emerging trends in the field.

Conducting a literature review of high quality requires an in-depth understanding of the necessary processes and skills and is by no means a trivial endeavour because it requires some experience in the respective field (Fisch & Block, 2018). A well-established protocol for the systematic review has been used comprising the preceding six steps which has been determined keeping in view the six review protocols cited by Van Dinter et al. (2021) and five phases for conducting a review as mentioned by Tranfield et al. (2003): Defining the Research Scope and Objectives; Developing a Research Protocol; Conducting a Systematic Literature Search; Screening and Selecting Relevant Studies; Quality Assessment and Data Extraction; Data Synthesis and Analysis.

3. Research Scope and Objectives

The research questions and objectives of this systematic analysis were set as follows: (a) To analyze the role of crowdfunding platforms in financing green innovations. (How do different crowdfunding models support green projects?); (b) To classify crowdfunding platforms based on their suitability for green innovations. (What are differences and similarities in crowdfunding platforms like Kickstarter, Indiegogo, GoFundMe, and specialized green crowdfunding platforms?); (c) To assess trends and patterns in crowdfunding for green innovations during the last decade. (What trends of green crowdfunding have remained during the last decade?); (d) To propose future research direction on the topic of crowdfunding for green innovation. (What are research gaps and recommended research directions in the literature relevant to crowdfunding for green innovations?).

4. Research Protocol

Before proceeding for data searching and data gathering, following inclusion and exclusion criteria were designed.

4.1. Inclusion Criteria:

a) Articles published in English language will be included subject to fulfilling other inclusion conditions.

b) Articles with two or more of the following three keywords in their title or in their abstract will be included subject to fulfilling other inclusion conditions: (i) crowdfunding OR alternative funding; (ii) green OR sustainable OR eco-friendly; (iii) innovation OR advancement

c) Articles published during the last 10 years (2015 to 2024) will be included subject to fulfilling other inclusion conditions.

d) Articles published in peer reviewed journals will be included subject to fulfilling other inclusion conditions.
e) Articles available full text in pdf format will be included subject to fulfilling other inclusion conditions.
f) Articles available as open access (without any download fee) will be included subject to fulfilling other inclusion conditions.

4.2. Exclusion Criteria:
a) Articles published before 2015.
b) Proceedings of conferences and chapters of the Books
c) Articles not containing any of the predefined keywords will be excluded

5. Systematic Literature Search
The sources to be searched for the articles were decided as Google Scholar, IEEE and Science Direct. Main concepts (variables) to be studied were green innovation and crowdfunding. There are certain other commonly used terms which are alternatively used in place of said two variables. While drafting the string for putting into databases, certain other equivalent terms were also included as keywords. Finalized keywords were crowdfunding, platforms, green, innovation, funding-websites, sustainable, eco-friendly, renewable-energy. Based on these keywords, the following string was initially drafted: ("crowdfunding" OR "peer-to-peer funding" OR "alternative financing") AND ("platforms" OR "funding websites") AND ("green" OR "sustainable" OR "eco-friendly" OR "renewable energy") AND innovation.
After critically reviewing the terms, "peer-to-peer funding" and "alternative financing"; these were removed because these make different sense than crowdfunding from the point of view of funding source, primary focus and nature of repayment. The terms "eco-friendly" and "renewable energy" were also removed to refine and narrow the scope. Revised string was crowdfunding AND ("platforms" OR "funding websites") AND ("green innovation" OR "sustainable innovation"). The string was executed to google scholar, which yielded initially 2370 articles / records / studies. The records fetched from SSRN and ResearchGate were dropped due to their compromised quality from the point of view of peer review. The string was further refined as “crowdfunding” AND ("platforms" OR "funding websites") AND ("green innovation" OR "sustainable innovation") for searching in IEEE, ,Google Scholar and Science Direct as well.
On executing the strings, IEEE URL yielded no record, however, certain number of articles published by IEEE were retrieved from the URL of Google Scholar. On the other hand, Science Direct yielded 23 articles whereas Google Scholar yielded 1140 articles. Out of these 1163 records, 104 were downloaded after applying the inclusion and exclusion criteria. These reduced to 100 after removing 4 duplicates.

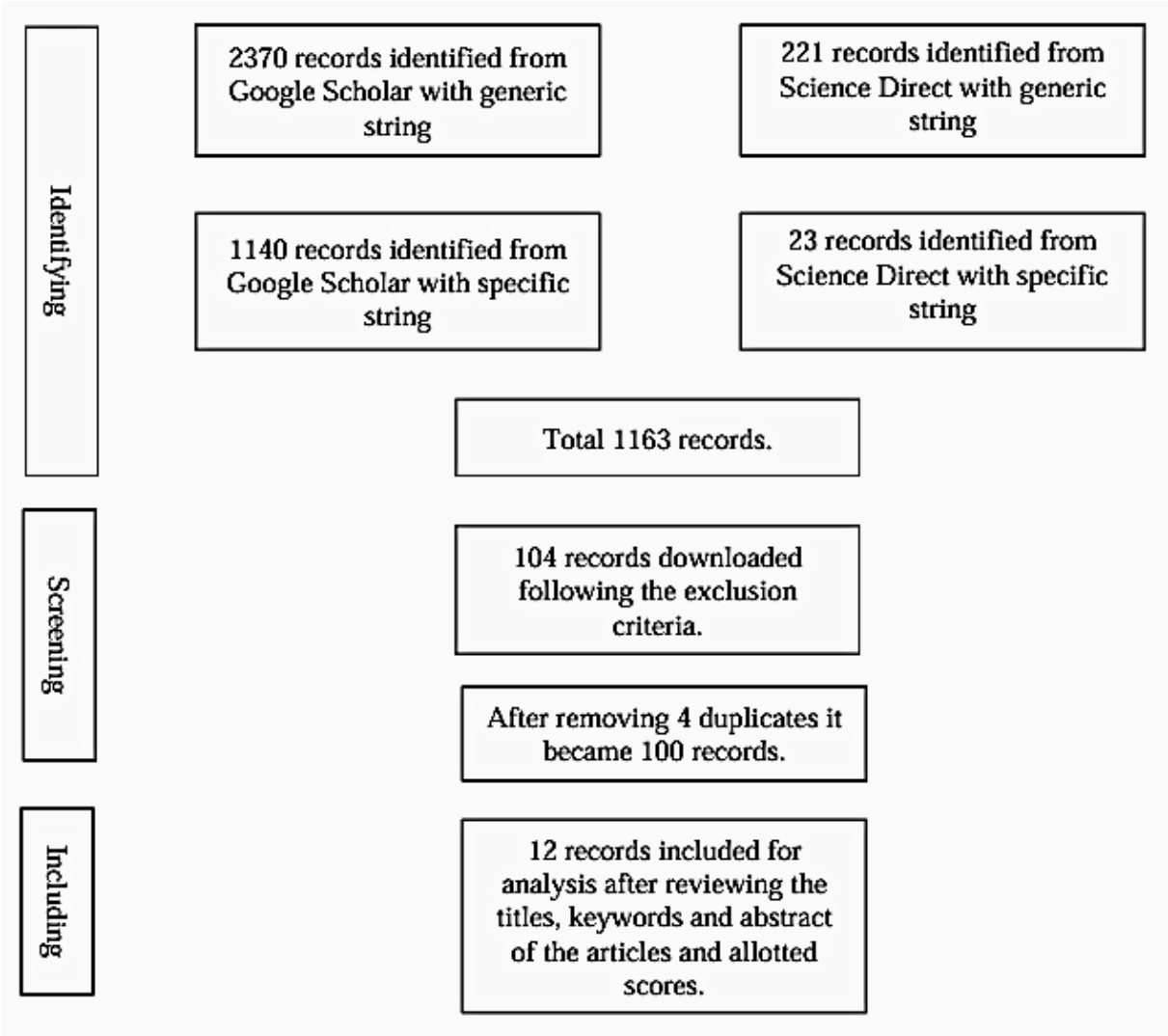

Figure 1: PRISMA Design

6. Quality Assessment and Data Extraction

The articles were allotted scores based on the key terms falling in titles, keywords and abstracts. One for single concept anywhere in the article, two for both the concepts in titles, keywords and abstracts and three for both the concepts in title and keywords. Keeping in view the scores depicting the relevancy of the study, 15 records left out of which 3 were SLRs. The studies with the score equal to 3 were finally included for analysis. Data extraction form was designed for data extraction which includes the fields like, year, journal, publisher, title, authors, methodology, focus, findings, gaps and future directions. Extracted data is tabulated as follows:

Table 1: Data Extraction

Sr. No.	Year	Journal	Publisher	Title	Author	Methodology	Focus	Findings	Gaps and Future Directions
1	2020	Baltic Journal of Management	Emerald	Sustainable crowdfunding: insights from the project perspective	Maehle, Natalia	Qualitative Study with 11 interviews	Explored experiences and views of entrepreneurs about sustainable crowdfunding.	Sustainability shapes motivation, costs, platform choice, and backer relationships; legitimacy and community engagement are central.	Recommends comparing successful vs. unsuccessful cases; explore varied sustainable project types.
2	2021	International Journal of Bank Marketing	Emerald	Greening crowdfunding campaigns: an investigation of message framing and effective communication strategies for funding success	Rossolini, Monica; Pedrazzoli, Alessia; Ronconi, Alessandro	Mixed method used. (Content analysis and probit regression)	Examined the relationship between framing message emphasizing green information and success of green campaign.	Project categories moderate the effects of message framing. Positive message framing works for agri-food while negative for climate/energy. Quantitative goals increase success.	Recommended to study visual text interactions; more platforms and categories; examine green product attributes.
3	2023	IEEE Transactions on Engineering Management	IEEE	Environmental Sustainability Orientation, Reward-Based Crowdfunding, and Venture Capital: The Mediating Role of Crowdfunding Performance for New Technology Ventures	Roma, Paolo; Vasi, Maria; Testa, Stefania; Perrone, Giovanni	Quantitative Study (OLS and probit)	Established relationship between ESO, crowdfunding performance, and VC funding.	ESO harms crowdfunding performance but increases VC attraction. Performance of crowdfunding negatively mediates the link between ESO and VC.	Explore communication strategies and tech attributes. Study platform differences.
4	2023	IEEE Transactions on Enginee	IEEE	Financing Early Stage Cleantech Firms	O'Reilly, Sean; Mac An Bhaird,	Quantitative Study (Regression)	Studied antecedents of cleantech equity	Smaller firms & those with more cash raise more funds whereas	Study long-term impacts, cross-country differences and

		ring Management			Ciaran; Cassells, Damien		crowdfunding and post-crowdfunding financing.	positive signalling increases post-crowdfunding equity. Asset structure also matters.	regulatory effects.
5	2024	IEEE Transactions on Engineering Management	IEEE	Green Crowdfunding: An Empirical Study of Success Factors	Corsini, Filippo; Appio, Francesco P.; Frey, Marco	Quantitative Study (Survey, SEM)	Examined the effects of codesign, market insight, legitimacy, development stage.	Codesign & market insights increase success. Legitimacy is not significant. Development stage boosts success but weakens codesign effect.	Recommended to explore additional constructs; role of platforms; long-term sustainable product outcomes.
6	2024	Journal of Alternative Finance	Sage	Identifying Factors Affecting Intention to Support Pro-Environmental Crowdfunding Campaigns: Mediating and Moderating Effects	Adamska-Mieruszewska, Joanna; Zientara, Piotr; Mrzygłód, Urszula; Fornalska, Anna	Quantitative Study (PLS-SEM)	Explored determinants for intention to support green crowdfunding.	Warm glow and willingness to sacrifice influence intention. Biospheric values do act through mediators. Green trust strengthens willingness-intention link.	To examine trust mechanisms; motivations for sharing campaigns; cross-cultural generalization.
7	2023	Environment, Development and Sustainability	Springer	Motivations for participation in green crowdfunding: Evidence from the UK	Adamska-Mieruszewska, Joanna; Zientara, Piotr; Mrzygłód, Urszula; Fornalska, Anna	Quantitative Study (PLS-SEM)	Attempt to compare TPB vs. VBN in predicting green crowdfunding support.	TPB and VBN both explain the intention while TPB do stronger. Altruistic & biospheric values do matter. Norms, attitudes, control shape behaviour.	Integrate TPB and VBN. Test across countries. Explore other socio-psychological factors.
8	2024	Financial Innovation	Springer	Crowdfunding innovative but risky new ventures: the importance of less ambiguous tone	Liu, Ye; Zhang, Ke; Xue, Weili; Zhou, Ziyu	Quantitative Study (logistic, OLS; PSM)	Examining how tone ambiguity affects risky/innovative project success.	Less ambiguous tone increases success, effects stronger for cleantech. Endorsements strengthen the signal.	New research should explore other drivers for risky ventures; study endorsement types; expand

									across industries.
9	2024	Financial Innovation	Springer	Information disclosure and funding success of green crowdfunding campaigns: a study on GoFundMe	Yin, Ziyi; Huang, Guowei; Zhao, Rui; Wang, Sen; Shang, Wen Long; Han, Chunjia; Yang, Mu	Quantitative Study (logistic regression, NLP, CV)	Exploring disclosure factors of drive success.	The duration, longer titles and introductions increase success. Whereas goal size, city size, emotional tone, human faces are not significant.	Studies should be conducted on cultural/ regional variations. Integrate qualitative insights and explore funder demographics.
10	2024	Quality and Quantity	Springer	New data and descriptor for crowdfunding and renewable energy	Salerno, Dario; Gatto, Andrea; Russo, Simona	Quantitative Study (multisource dataset)	Developed dataset linking crowdfunding and renewable energy indicators.	Orientation of country sustainability predicts success; four renewable-energy variables strongly linked to outcomes.	Need integrated financial-environmental datasets. Study platform effects and policy impacts.
11	2024	International Journal of Cultural Policy	Tylor and Francis	At the juncture of funding, policy, and technology: how promising is match-funding of arts and culture through crowdfunding platforms?	Loots, Ellen; Piecyk, Kaja; Wijngaarden, Yosha	Qualitative Study (interviews, grounded theory)	Probed motivations, operations, challenges of match-funding	Match-funding improves accessibility and democratization. Barriers include low recognition & sustainability concerns.	Researchers should study socio-political contexts; evaluate models; apply co-finance logic to other policies.
12	2024	Emerging Markets Finance and Trade	Tylor and Francis	Launching Prosocial Crowdfunding Campaigns: The Final Countdown	Duarte, Fábio; Emanuel-Correia, Ricardo; Tomé, Sabrina; Gama, Ana Paula Matias	Quantitative Study (probit, OLS on 979,765 Kiva campaigns)	Examined temporal effects on prosocial crowdfunding success.	Sunday-Tuesday launches perform best; reverse turn-of-month effect; strong winter-effect.	Need to explore causes of reverse TOTM; test across platforms; examine weather and seasonal influences.

7. Data Synthesis and Analysis

Word cloud and word hierarchy tree for the articles selected for data synthesis as listed in table 1 were generated using data analysis software, NVivo. This provides a visual imprint of the terms used in said 12 articles.

Figure 2: Word Cloud

Table 2: Word Hierarchy Tree

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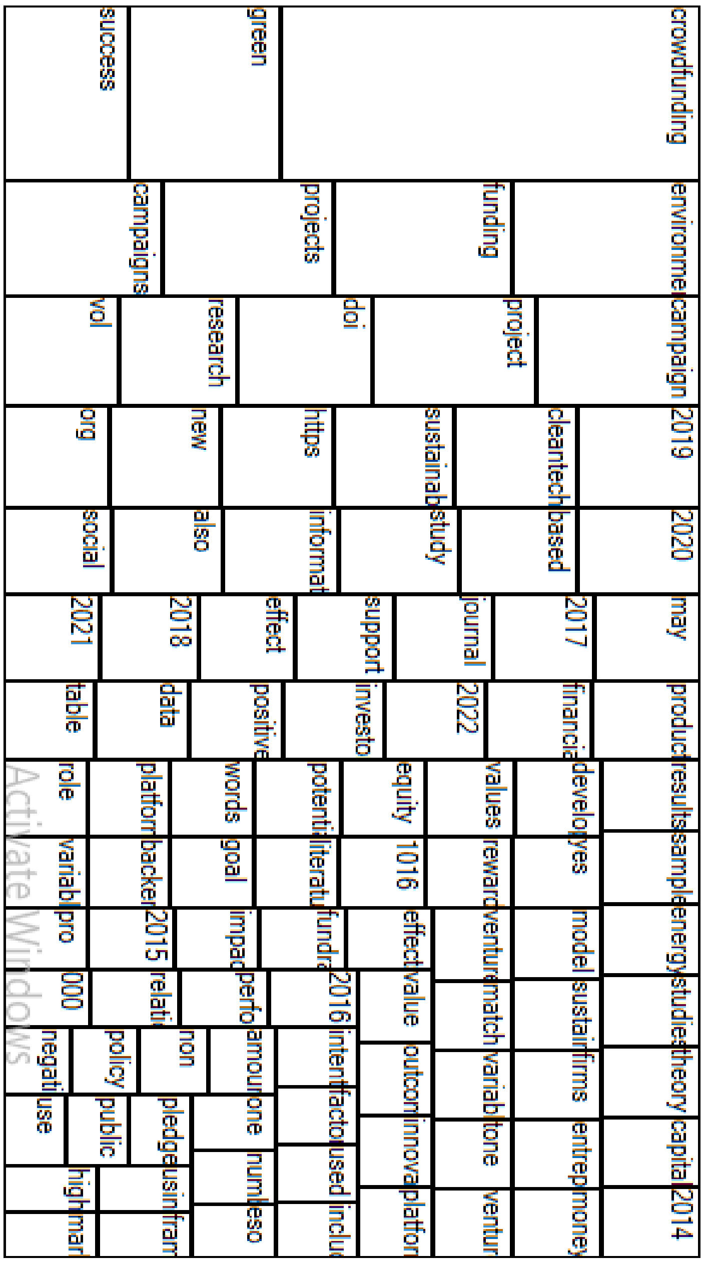

7.1. Thematic Synthesis of Records:

The thorough study of the above-referred 12 articles reveals critical themes about the landscape of green crowdfunding. These themes tell us how different crowdfunding models support for green innovations projects, provides for the classification of crowdfunding platforms, trends of crowdfunding models over the last decade, and future research directions.

7.1.1. The Role of Crowdfunding Platforms in Financing Green Innovations:

The primary objective of this study is to analyze how crowdfunding platforms facilitate green innovations. The literature review indicates that traditional funding mechanisms, such as venture capital and bank loans, often hesitate to invest in sustainability focused startups due to high risk, longer return periods, and intangible environmental benefits. Crowd funding platforms have emerged allowing green entrepreneurs to obtain support from backers. Roma et al. (2023a) has highlighted the role of reward-based crowdfunding, demonstrating that green ventures often struggle to secure funds on mainstream crowdfunding platforms due to their "public good" nature, which do reduce direct consumer incentives. However, successful campaigns signal legitimacy to professional investors, increasing the likelihood of subsequent venture capital funding. Whereas O'Reilly et al. (2023) has focused on equity crowdfunding for cleantech startups, revealing that firms with strong cash positions but lower assets raise greater amounts of funding. The study emphasizes that investors prioritize their projects with long-term sustainability rather than short-term profitability. These studies refer different crowdfunding models like donation-based, reward-based, equity-based, and peer-to-peer lending, unique advantages and disadvantages for green innovations. Platform selection plays a crucial role in determining funding success.

7.1.2. Classification of Crowdfunding Platforms Based on Suitability for Green Innovations

Crowdfunding platforms differ significantly based on their terms of funding models, target backers, and project suitability. Green innovations require funds, but platform selection is a key determinant of success. Platform Classification is given in the table below:

Table 3: Classification of Crowdfunding Platforms

Crowdfunding Platform	Funding Model	Suitability for Green Innovations	Limitations
Kickstarter	Reward-Based	Green consumer products, sustainable technology	High competition, all-or-nothing funding structure can lead to campaign failure if the goals are not met.
Indiegogo	Reward & Equity-Based	Broad sustainability projects, flexible funding allows campaigns to keep partially raised funds	Less credibility for long-term sustainability ventures compared to equity-based platforms.
GoFundMe	Donation-Based	Environmental activism, community-driven green initiatives	No financial returns for backers, only relies on philanthropy and emotional appeal.

Specialized Green Crowdfunding Platforms	Equity, Lending, Donation-Based	Renewable energy, cleantech startups, carbon offset projects	Often region-specific, limited market reach requires investor awareness of green finance.

Rossolini et al. (2021) has stated that message framing in green crowdfunding on Indiegogo, showing how sustainability-focused campaigns perform under reward-based models. Corsini et al. (2024) has highlighted the role of product co-design and environmental legitimacy in reward-based crowdfunding, focusing on Kickstarter. Yin et al. (2024) has explored funding success factors in green crowdfunding and highlight differences between Kickstarter and Indiegogo in terms of campaign flexibility and success rates. Yin et al. (2024) examined information disclosure in green crowdfunding campaigns on GoFundMe, demonstrating with quantitative sustainability goals improve funding outcomes. Adamska-Mieruszewska et al. (2023) has observed pro-environmental crowdfunding motivations, finding that donation-based models rely heavily on biospheric values and emotional engagement rather than financial incentives.

O'Reilly et al. (2023) presented his study about equity crowdfunding for cleantech startups, showing that platforms like Trine and Abundance Investment attract investors interested in sustainable energy finance. Salerno et al. (2024) has provided a longitudinal analysis of renewable energy crowdfunding, highlighting the role of country specific policies and investor incentives in the success of green crowdfunding platforms. This classification differentiates the categories of crowdfunding and guides that reward-based crowdfunding (Kickstarter, Indiegogo) works for green consumer products but struggles with capital-intensive innovations; Donation-based platforms (GoFundMe) support grassroots environmental initiatives; and equity-based specialized green platforms are better for cleantech and renewable energy startups, providing long-term investment opportunities.

7.1.3. Trends in Green Crowdfunding Over the Last Decade

During the past ten years (2014–2024), significant evolution in green crowdfunding, with noticeable shifts in funding models, investor behaviour, and technological adoption has been observed.

7.1.4. Key Trends in Literature

a) Transition from Reward to Equity-Based Models: Salerno et al. (2024) portrays post-2018 equity crowdfunding and green investment platforms starting to take off as the sustainability projects demanded bigger capital investments; in early green crowdfunding (2014–2018), reward-based models were dominating the scene, represented by Kickstarter and Indiegogo.

b) Increased Adoption of Technology: Yin et al. (2024) point out that the adoption of blockchain and smart contracts in green crowdfunding improves transparency, reduces fraud, and makes environmental projects accountable. Duarte et al. (2024) discussed how AI-driven campaign optimization is improving the likelihood of funding success by analysing donor behaviour and personalizing funding appeals.

c) Regional Differences in Green Crowdfunding Success: Loots et al. (2024) analyze government-backed green crowdfunding initiatives in Europe and find that regions with sustainability policies and tax incentives have higher crowdfunding success rates. In contrast, O'Reilly et al. (2023) argue that green crowdfunding projects based in the U.S. attract more individual investors, while European projects strongly rely on institutional or government-backed crowdfunding initiatives.

d) Rise of Impact-Driven Investments: Yin et al. (2024) find that investors are moving to hybrid models where financial return is balanced with social and environmental impact. These trends in green crowdfunding indicate that it is

transitioning from traditional, consumer-driven donations to structured, impact-focused investments.

7.2. Qualitative & Quantitative Synthesis

After thematic synthesis, we move to Qualitative Synthesis (Analyzing the studies based on patterns, methodologies, and theoretical perspectives) and Quantitative Synthesis (Presenting numerical patterns, trends, and measurable insights from the selected studies)

7.2.1. Qualitative Synthesis

The selected studies utilize various methodologies patterns, data collection techniques, and theoretical frameworks to examine crowdfunding platforms for green innovations. By synthesizing these aspects, we can derive key patterns across the literature. The reviewed studies have adopted qualitative, quantitative, and mixed-method approaches, depending on their research objectives. Maehle (2020) conducted in-depth interviews with representatives of 11 successfully crowdfunded green projects, identifying platform selection criteria and sustainability-driven motivations whereas Loots et al. (2024) has used semi-structured interviews to analyze match-funding models for green crowdfunding.

7.2.2. Quantitative studies

Roma et al., (2023a) used sstatistical and regression analysis along with quantitative approach with robust OLS and probit regression models. The sample consisted on hardware ventures that launched crowdfunding campaigns on Kickstarter between 2005 and 2014. Yin et al. (2024) applies logistic regression to a dataset of 720 GoFundMe campaigns and shows how information disclosure and transparency impact funding successes in such projects. Duarte et al. (2024) has used OLS regression and AI-based behavioural finance models, and has tested how green crowdfunding influenced by donor behaviour patterns. Corsini et al. (2024) also conducted quantitative study and obtained data from 113 campaign initiators. O'Reilly et al. (2023) also used quantitative approach, employing ordinary linear regression models to analyze a dataset of 177 Cleantech firms that have successfully raised equity crowdfunding for the first time on various European platforms. Adamska-Mieruszewska et al. (2023) used quantitative approach and gathered data through a questionnaire survey among over 300 UK citizens in 2022 to explore how biospheric values and warm-glow effects impact crowdfunding decisions. Corsini et al. (2024) conducted quantitative study using questionnaires to gather data from 113 campaign initiators. Liu et al. (2024) conducted a quantitative study and has collected information on cleantech crowdfunding projects and matched non-cleantech crowdfunding projects from Kickstarter, covering the period from January 2013 to October 2018. The study by Salerno et al. (2024) compiled a new dataset by combining data on crowdfunding campaigns from the Zephyr Bureau Van Dijk database with renewable energy data from the World Bank's World Development Iindicatorss, covering a period from 2009 to 2021.

7.2.3. Mixed Methods

Rossolini et al. (2021) used mix-method approach Qualitative Content Analysis for in-depth analysis of crowdfunding campaigns published on the Indiegogo platform from 2015 to 2020 and Quantitative Analysis for empirical examination using probit regressions to determine the factors influencing the success of green crowdfunding campaigns. probit regression models, analyses the role of message framing and green emphasis in crowdfunding success.

7.3. Theoretical Frameworks Used in Studies

Study 1: (Sustainable Crowdfunding: Insights from the Project Perspective) The study is founded on the literature of sustainable entrepreneurship, crowdfunding concepts, and sustainable crowdfunding models. This study delineates four areas for peculiarities in sustainable crowdfunding, which includes motivation, platform choice, crowdfunding costs, and relationships with backers.

Study 2 (Greening Crowdfunding Campaigns: An Investigation of Message Framing and Effective Communication Strategies for Funding Success): The investigation deploys the message framing theory to examine the influence of positive vs. negative framing, green emphasis, and quantitative goals on green crowdfunding campaigns. The research centers on the following subsectors: agri-food, climate preservation, and clean energy.

Study 3 (Environmental Sustainability Orientation, Reward-Based Crowdfunding, and Venture Capital): Drawing on previous literature on environmental sustainability, crowdfunding, and venture capital financing, the study investigates trade-offs between environmental and economic performance and explores how these trade-offs influence funding outcomes.

Study 4 (Financing Early-Stage Cleantech Firms): The paper extends the current literature on cleantech financing and crowdfunding by investigating accounting metrics and financial decision-making before and after crowdfunding.

Study 5 (Green Crowdfunding: An Empirical Study of Success Factors): The study uses legitimacy theory and new product development (NPD) concepts to examine factors that determine the success of green crowdfunding campaigns.

Study 6 (Identifying Factors Influencing Intention to Support Pro-Environmental Crowdfunding Campaigns): This study integrates multiple theoretical frameworks, including the Theory of Planned Behaviour (TPB), Values-Beliefs-Norms (VBN) theory, warm-glow theory, and theories related to green trust and environmental concern.

Study 7 (Motivations for Green Crowdfunding Participation: Evidence from the UK): The study applies TPB and VBN theories to explain an individual's intention to support the green crowdfunding project. It compares the two frameworks about explanatory power.

Study 8 (Crowdfunding Innovative but Risky New Ventures: The Importance of Less Ambiguous Tone): The article employs signalling theory, incorporating both the signal production cost and the concept of consequence costs in describing the success of crowdfunding projects. The success depends on tone ambiguity in project descriptions.

Study 9 (Information Disclosure and Funding Success of Green Crowdfunding Campaign): The present study applies the signalling theory in the investigation of the different information disclosure elements on the success rate of green crowdfunding campaigns. The study integrates insights from prior literature on crowdfunding by applying NLP and Computer Vision techniques.

Study 10 (New Data and Descriptor for Crowdfunding and Renewable Energy): This study combines data from the Zephyr Bureau Van Dijk database with World Bank's World Development Indicators (WDIs) to conduct an analysis on crowdfunding success and its relation to renewable energy variables.

Study 11 (At the Juncture of Funding, Policy, and Technology: How Promising is Match-Funding of Arts and Culture through Crowdfunding Platforms?): This article uses a qualitative framework and, by using interviews, analyses how matching-funding in local and regional cultural policy through crowdfunding platforms creates motivations, opportunities, and challenges.

Study 12 (Launching Prosocial Crowdfunding Campaigns: The Final Countdown): This study combines behavioural finance with crowdfunding literature to understand how time effects and calendar anomalies (TECA) influence crowdfunding campaign success. It applies concepts from the warm-glow theory to explain prosocial lending behaviour.

8. Conclusion

The synthesis of said twelve studies underlines the important role of crowdfunding platforms which these forums play in financing green innovations. In supporting green startups (which are mostly shunned by traditional investors due to perceived risk and longer return periods); crowdfunding platforms offer alternative funding mechanisms. Classification of crowdfunding platforms shows that each of these models, (i.e. reward-based, donation-based, equity-based, and specialized green platforms) has unique advantages and challenges, hence needs for a strategic platform

selection. Taken over the past decade, these trends point out the evolution from reward-based to equity-based models, increase in technological adoption, regional differences in success rates, and the rise of impact-driven investments. Future research should address the identified gaps, especially in the empirical study of success factors and the role of sociopsychological influences on backers' behaviour.

9. Discussion

Analysis of the studies on crowdfunding platforms for green innovations sheds light on important aspects regarding dynamics and effectiveness of different crowdfunding models during execution. Crowdfunding platforms level the playing field for access to capital for green innovators, enabling them to connect directly with backers who share their sustainability values. Crowdfunding is a unique place for green startups to gain visibility and legitimacy, often serving as a stepping stone toward further venture capital funding (Roma et al., 2023b). The reviewed studies indicate that the effectiveness of crowdfunding campaigns is influenced by platform selection, communication strategies, disclosure quality, sustainability orientation, and investor perceptions. Signaling theory explains how transparency, project framing, and disclosure practices shape investor confidence, where as the legitimacy theory emphasize the importance of aligning sustainability claims with stakeholder expectations. Similarly, Theory of Planned Behaviour and Value Belief Norms theory explains how environmental attitudes, biospheric values, and social norms influence backers' intentions to support green crowdfunding. However, the success of crowdfunding strongly depends on both the selected platform and strategic framing of a project (Rossolini et al., 2021).

Platform category would indicate that, due to their large user bases and all-or-nothing funding models, platforms like Kickstarter and Indiegogo are much more suited to hosting green consumer products. This could be of no use at all for capital-intensive innovations (Maehle, 2020). The reviewed studies demonstrate that platform suitability is closely linked with investors motivation and expected outcomes. Reward-based platforms mostly attract consumers interested in innovative and sustainable products, whereas donation-based platforms rely more on pro-environmental values and emotional engagement. In contrast, equity-based and specialized green crowdfunding platforms attract investors seeking long-term sustainability impact alongside financial returns. However, platforms that are donation-based, such as GoFundMe, prove good for small, grassroots initiatives oriented toward and fueled by means other than financial return. Specialized green crowdfunding platforms are increasingly showing themselves to be most suitable for cleantech and renewable energy projects, as they best fit the goals of sustainability and investor interests (Maehle, 2020; O'Reilly et al., 2023; Corsini et al., 2024).

The shift from reward to equity-based crowdfunding reflects the increasing need for substantial capital investments in sustainability projects. Integration of blockchain and AI technologies has brought increased transparency and accountability, thus attracting more sophisticated investors (Liu et al., 2024; Duarte et al., 2024). Success rates vary across different regions depending on local policies and incentives; European countries have higher success rates due to supportive sustainability policies (O'Reilly et al., 2023; Salerno et al., 2024).

10. Gaps and Future Directions

During research progress on crowdfunding for green innovations, the literature evidence certain gaps which remained unaddressed. Future research should focus on the following aspects: I) Examining the role of values, beliefs, and norms in driving backer behaviour in green crowdfunding campaigns. The area is still underexplored but extremely relevant to effective campaign design (Adamska-Mieruszewska et al., 2023; Adamska-Mieruszewska et al., 2024). II) Examination of the role played by emerging technologies like blockchain and AI particularly in increasing the efficiency and effectiveness of crowdfunding campaigns. The key here is to understand how these technologies can be

leveraged to improve project transparency, reduce fraud, and enhance the experience for backers (Liu et al., 2024; Duarte et al., 2024). III) The role of the regulatory environment in crowdfunding success should be analyzed, and comparative studies across different regions should also be provided to understand how policy frameworks can either promote or hamper green innovation financing (O'Reilly et al., 2023; Salerno et al., 2024). IV) Future SLRs may further review available literature with deep theoretical generalization, theoretical synthesis to provide explicit propositions or conceptual framework.

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