sustainability

MDPI

Review

Crowdfunding in Transport Innovation and Sustainability: A Literature Review and Future Directions

Marta Mańkowska [1], Dominika Kordela [2] and Monika Pettersen-Sobczyk [3,*]

[1] Institute of Management, University of Szczecin, 71-004 Szczecin, Poland; marta.mankowska@usz.edu.pl
[2] Institute of Economics and Finance, University of Szczecin, 71-101 Szczecin, Poland; dominika.kordela@usz.edu.pl
[3] Institute of Spatial Management and Socio-Economic Geography, University of Szczecin, 71-101 Szczecin, Poland
* Correspondence: monika.pettersen-sobczyk@usz.edu.pl; Tel.: +48-605-696-262

Abstract

Sustainable transport innovation often faces funding gaps, as traditional public and private sources rarely support early-stage or high-risk initiatives. Crowdfunding, enabled by digital transformation, is emerging as a complementary financing mechanism for this sector. This study presents a literature review combined with bibliometric mapping to examine the evolving research landscape on crowdfunding in transport. Three research questions guide the analysis: RQ1—What are the dominant research areas at the intersection of crowdfunding and transport? RQ2—What types of transport projects are financed via crowdfunding? RQ3—What research gaps and future directions emerge for transport innovation financing? Findings reveal three core research areas: (1) Sustainability and finance, (2) Fintech and blockchain, and (3) Management and consumer behavior. We propose a typology of crowdfunded transport projects comprising five categories: (1) Large-scale transport infrastructure, (2) Sustainable local mobility, (3) Innovative start-ups, (4) New business models, and (5) Advanced systems and technologies. This demonstrates crowdfunding's versatility beyond traditional infrastructure, supporting high-risk innovations critical for decarbonization and technological transformation. The study highlights domain-specific challenges—such as integrating PPP models with digital finance and ensuring investor protection—and emphasizes crowdfunding's role as an enabler of low-carbon transition aligned with global climate strategies (EU Green Deal, SDGs). Despite its potential, investor safety remains a major concern. Policy implications include sandbox regulation, standardized risk assessment, and operationalizing PPP–crowdfunding hybrids to unlock large-scale and innovative transport projects.

Keywords: crowdfunding; transport innovation; decarbonisation

Check for updates

Academic Editors: Larysa Neduzha and Iryna Bondarenko

Received: 27 November 2025
Revised: 24 December 2025
Accepted: 4 January 2026
Published: 6 January 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

1. Introduction

Information and Communication Technologies (ICT) contribute to the digital transformation of transport by enabling platform-based financing and novel business models. One recognized financial innovation resulting from this development is crowdfunding. As both an alternative financial instrument and an internet-native business model, crowdfunding leverages digital payments and online communities to transfer capital at low coordination cost [1].

In recent years, crowdfunding has gained recognition as a vital form of financing across various industries with high demand for external funding and limited access to

traditional financial sources. Simultaneously, it has become the subject of extensive scientific study, exploring its mechanism, entities' motives, investor behavior, platform development, and regulation dilemmas [2–13]. Research also focuses on crowdfunding's impact on supporting innovation, the influence of the concept of openness, and the role of platforms' innovation in campaign success [14,15].

However, while the crowdfunding literature is extensive, the transport-specific evidence remains fragmented. This is even though the importance and potential of crowdfunding for the transport sector have been highlighted in key documents, such as the 2017 OECD report, given its indication as one of the innovative financing mechanisms proper for sustainable transport and mobility [16]. Data from this report confirm this scarcity, showing transport projects account for a very small share (e.g., 1.0% of projects) but frequently require the highest average funding goals, suggesting a specific, capital-intensive niche.

This makes the consideration of crowdfunding even more relevant when viewed against the backdrop of global and regional climate strategies—including the EU Green Deal and the United Nations Sustainable Development Goals (SDGs)—which face significant challenges in financing the decarbonization of transport and mobility systems. Current research highlights the critical need for innovative financing approaches beyond traditional public funding to achieve net-zero objectives [17]. Studies indicate that while policy momentum is strong, investment decisions often lag behind net-zero scenarios [18]. Investors remain cautious due to risk expectations and profitability uncertainties in green technologies. Green climate funds are emerging as potential solutions, with evidence suggesting they can enhance capacity to channel both public and private funding [19]. Technological innovations are seen as key enablers, and scholars recommend a favorable regulatory environment to generate positive short-term effects and create significant environmental, economic, and social impacts [20]. The research underscores that no single solution exists, and a combination of financial, technological, and policy innovations will be crucial to achieving climate objectives. Within this landscape, crowdfunding emerges as a promising complementary mechanism—yet remains underexplored in transport and mobility research—underscoring the need for deeper studies on its potential role in advancing sustainable, innovative, and climate-aligned transport solutions.

The current research evidence is insufficient to determine the extent to which crowdfunding can address funding gaps for high-risk transport and mobility innovations with decarbonization potential. This review addresses that gap and examines how crowdfunding can support the technological transformation and decarbonisation of the transport sector, including early-stage, high-risk projects. To achieve this, we employed a methodology that combined literature review and bibliometric keyword co-occurrence mapping to map current research, classify crowdfunded transport projects, and identify future research directions for sustainable mobility.

2. Research Method and Tools

Three research questions (RQ) guide this study:

RQ1—What are the dominant research areas at the intersection of crowdfunding and transport?

RQ2—What types of transport projects are financed via crowdfunding?

RQ3—What research gaps and future directions emerge for transport innovation financing?

To answer these questions, we adopted elements of the systematic literature review method [21,22], integrating a scoping review technique [23–26] to effectively map concepts, evidence, and research gaps. The review protocol was comprehensive, covering search strategy, screening, data extraction, and synthesis. The analysis was complemented by bibliometric keyword co-occurrence mapping using the VOSviewer IT tool (version 1.6.20) [27,28].

This technique was specifically employed to address RQ1 by visualizing the main research areas and their interrelationships within the corpus. Figure 1 shows the three distinct stages of the SLR process.

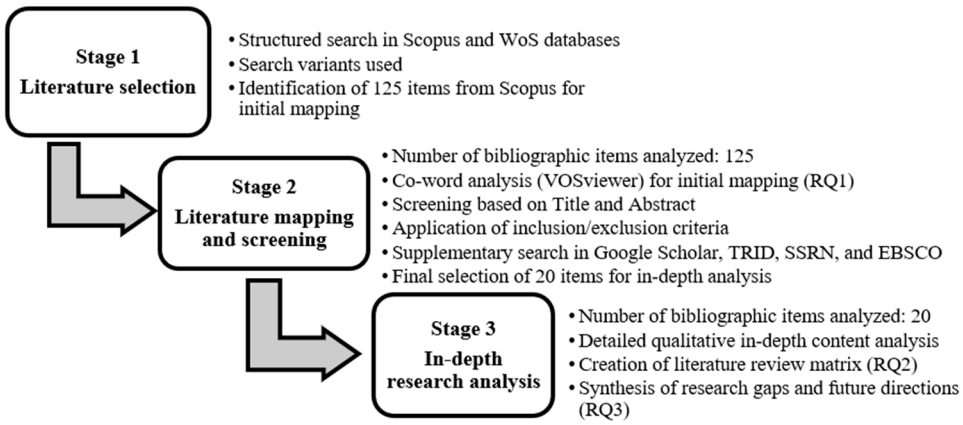


Figure 1. Stages of the literature review process on crowdfunding in transport.

Stage 1: literature selection was conducted using the Scopus and Web of Science (WoS) databases (as of 13 January 2025). These databases were selected because they are comprehensive and widely recognized sources for management, transport, and innovation studies, providing robust metadata for bibliometrics. Given the recent emergence of the topic, we applied an open time window up to the search date.

We used structured queries combining terms for crowdfunding and transport (e.g., 'crowdfunding AND transport'). To address term variability and maximize coverage, the search was conducted in two primary variants: 'crowdfunding refined by transport' and 'transport refined by crowdfunding'. Table 1 summarizes the full queries and corresponding initial item counts.

Table 1. Search queries and initial results for crowdfunding in transport.

Database	Number of Bibliographic Items by Search Variants (Query)		
	Crowdfunding and Transport	**Crowdfunding Refined by Transport**	**Transport Refined by Crowdfunding**
Scopus	16	125	116
WoS	8	30	22

The search for the query 'crowdfunding refined by transport' in Scopus yielded the largest number of results (125). Since these Scopus results included items found in the WoS search, the 125 articles from the Scopus database were selected for the initial literature mapping (Stage 2).

In Stage 2, a co-occurrence analysis of keywords was conducted using the VOSviewer IT tool on the 125 items exported in RIS format. This bibliometric analysis primarily addressed RQ1 by visualizing the main research areas in crowdfunding for transport projects and their interrelationships within the corpus. This full dataset of 125 items was intentionally used for bibliometric mapping (RQ1) because a preliminary analysis using only highly relevant items produced insufficient density and a low-quality visualization.

Following the bibliometric mapping, the 125 items were subjected to a rigorous screening based on titles and abstracts, applying standard inclusion/exclusion criteria:

1. Inclusion: peer-reviewed articles, conference papers, and book chapters in English that examine crowdfunding applied to transport projects, organizations, or policies.

2. Exclusion: studies focusing solely on crowdsourcing without financing, purely conceptual pieces without transport relevance, non-scholarly sources, and duplicates.

Due to the narrow scope of the topic and the limited number of highly relevant studies, the screening and selection of the final corpus were performed independently by the three co-authors to ensure maximum coverage and minimize the risk of omitting valuable items.

Given the severely limited number of highly relevant results (just a dozen) from the primary databases, the search was supplemented by a targeted review using Google Scholar to identify valuable studies not indexed in Scopus or WoS. The top 100 literature items (based on relevance for the keyword 'crowdfunding and transport') were reviewed. After discarding repetitions from earlier stages, 4 additional literature items were identified.

Following suggestions made during the first round of article review, in December 2025, we further expanded our search using the same criteria to include additional databases: TRID (Transport Research International Documentation), SSRN (Social Science Research Network), and EBSCO. After removing duplicates from previous results in WoS, Scopus, and Google Scholar, we identified two additional references—one peer-reviewed paper from EBSCO and one preprint from SSRN. This brought the final corpus to 20 references for in-depth content analysis in Stage 3 (14 from primary databases, 4 from Google Scholar, 1 from SSRN, and 1 from EBSCO).

Additionally, to strengthen the conclusions drawn from the scientific literature review, we used EBSCO to access its non-academic content (including press reports, descriptive articles, and project summaries) to identify six examples of crowdfunding projects not covered in scholarly research but directly demonstrating the application of this financing mechanism in the transport sector. This complementary analysis allowed us to better illustrate the practical implementation of the discussed funding models and to contextualize the research findings with a broader set of illustrative cases.

In Stage 3, the final corpus of 20 literature items was subjected to in-depth qualitative content analysis. Data extraction and synthesis were performed by coding the study context, crowdfunding model, methodological approach, and key findings. This analysis was complemented by the illustrative examples from EBSCO, which provided additional insights into how the identified models operate in practice. The analysis primarily addressed RQ2 through the creation of a literature review matrix and RQ3 through the synthesis of emerging research gaps and future directions.

The keyword co-occurrence mapping based on 125 items served as an exploratory step to visualize the broad conceptual landscape (RQ1), while the in-depth qualitative analysis focused on a refined corpus of 20 highly relevant studies to address RQ2 and RQ3. This two-tiered approach combines bibliometric mapping, which provides a comprehensive overview of thematic clusters—even including peripheral sources—with targeted content analysis to extract detailed insights.

3. Results and Findings

3.1. Literature Mapping (RQ1)

Keyword co-occurrence analysis was carried out using the VOSviewer IT tool to address RQ1 by identifying the dominant research areas. The minimal number of occurrences of the keyword was set at level 5, which yielded 12 keywords that met the threshold for inclusion in the network analysis. The total strength of the co-occurrence links was calculated for each of these 12 keywords, which were subsequently divided into 3 distinct clusters (Figure 2). The co-occurrence map clearly demonstrates the central importance of the terms 'crowdfunding' and 'crowdsourcing' within the network, indicated by their large node size and the density of their links. This confirms that these concepts form the core methodological and conceptual foundation of the transport financing research.

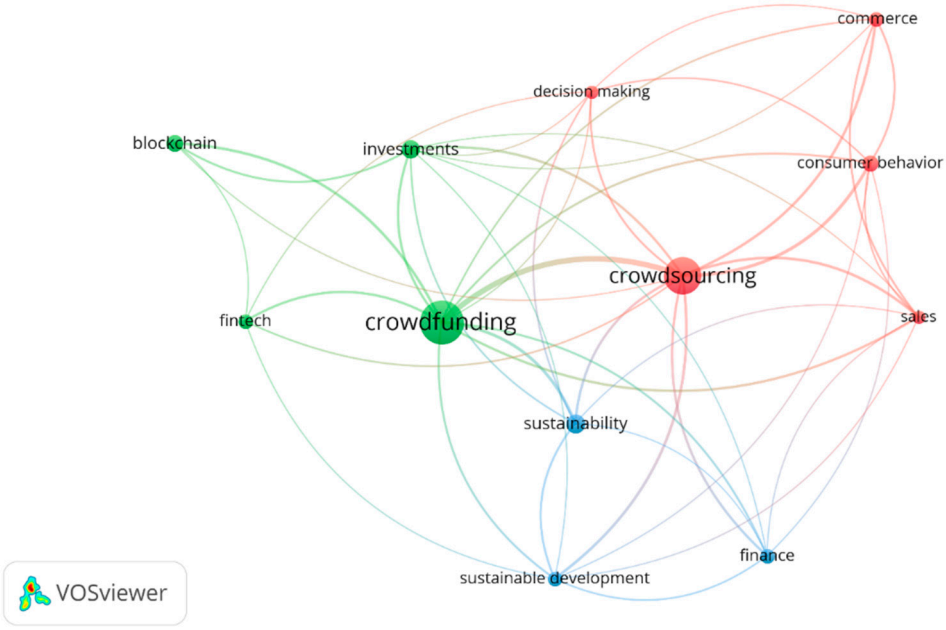


Figure 2. Co-occurrence network map of keywords related to crowdfunding in transport (network visualization).

The resulting network visualization revealed three primary, interconnected research areas constituting the current landscape of crowdfunding in transport:

Cluster 1 (blue): Sustainability and finance shows links with sustainability, sustainable development, and finance. In general studies on crowdfunding, researchers focus on the influence of sustainable orientation on the success of crowdfunding campaigns and society's engagement in sustainable projects. However, there is an emerging interest in issues regarding sustainable transport financing.

Cluster 2 (green): Fintech and blockchain covers crowdfunding, blockchain, fintech, and investments. This cluster links to the innovation perspective, focusing on financial services as a technology for faster and easier capital transfer and access to funding, rather than the core product itself. Cluster 2 represents a fast-growing area.

Cluster 3 (red): Management and consumer behavior includes research on crowdsourcing, commerce, consumer behavior, decision-making, and sales. These publications are more management-oriented, focusing on consumer decision-making and shifting business models toward the sharing economy, co-production, and co-creation. The research concentrates on modern systems and applications that are user-friendly, easily accessible, and mostly digital.

The mapping analysis confirms a close relationship between crowdfunding and crowdsourcing, which is understandable as both are based on harnessing the power of the internet community. Both terms demonstrate a nexus to sustainability, sustainable development, and finance (C1). Moreover, the study area is closely linked to management (C3) and financial innovations (C2).

The distribution of the publication over time provides deeper insights into the field's evolution (Figure 3).

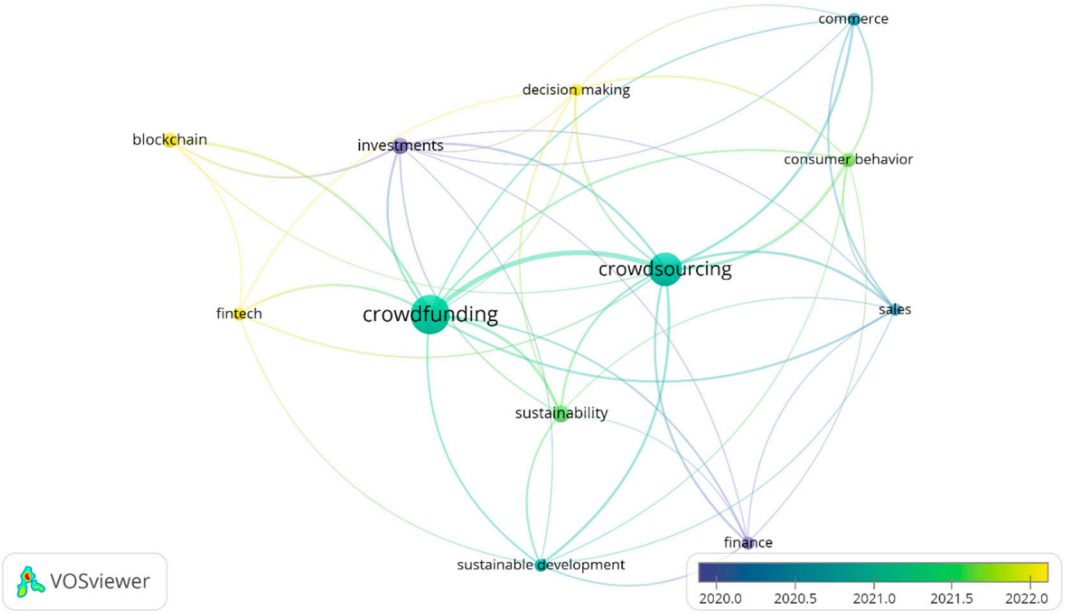


Figure 3. Co-occurrence network map of keywords related to crowdfunding in transport (overlay visualization).

Mapping shows that the intersection of crowdfunding and transport is a relatively new area of study. While the oldest publications are from 2017 and study infrastructure projects, the growth has been visible since 2020. The overlay visualization reveals specific temporal trends:

Emerging frontiers (newest): keywords related to the fintech/blockchain (C2) and sustainability (C1) clusters, such as blockchain, fintech, sustainability, and sustainable development, represent the newest research focus (average publication year 2021–2022, indicating these are the emerging frontiers of the field.

Initial focus (older): terms in the management cluster (commerce, sales, consumer behavior) (C3) show slightly earlier activity (cooler colors), suggesting they formed the initial layer of research interest, focusing on the commercial and behavioral aspects of using crowdfunding.

The overall trend shows rising attention to fintech/blockchain and decision-making, confirming the high innovative potential of this research area, driven by IT-backed decision-making linked strongly to innovative services and products and digitalization.

3.2. In-Depth Research Analysis (RQ2, RQ3)

The mapping of 125 literature items revealed general research areas on crowdfunding and transport. To identify the types of transport projects financed through crowdfunding, we conducted a detailed review of 20 selected articles (Stage 3). We focused on studies that describe real-transport projects funded via crowdfunding. The results are presented in Table 2.

We identify five types of projects: large-scale transport infrastructure; sustainable local mobility; innovative start-ups; innovative business models; and innovative systems and technologies. Definitions are provided to clarify boundaries. Categories may overlap, and classification reflects the dominant focus.

Table 2. Categorization of transport projects financed via crowdfunding.

Study	Project Type				
	Large-Scale Transport Infrastructure	**Sustainable Local Mobility**	**Innovative Start-Ups**	**New Business Models**	**Advanced Systems and Technology**
Arifin & Wisudanto, 2017 [29]	v				
Corona-Treviño, 2017 [30]				v	
Soto, 2017 [31]	v				
Zhu et al., 2017 [32]		v			v
Miller & Coutts, 2018 [33]		v			
Kelemen et al., 2019 [34]			v		
Polishchuk et al., 2019 [35]			v		
Berawi et al., 2020 [36]	v				
Fadhil et al. 2020 [37]		v			
Klein et al., 2020 [38]				v	
Harris & Wonglimpiyarat, 2021 [39]					v
Zhang et al., 2021 [40]				v	
De Crescenzo et al., 2022 [41]		v			
Kosheleva et al., 2022 [42]					v
Ling et al., 2022 [43]				v	
Pranata et al., 2022 [44]	v				
Shukla et al., 2022 [45]	v		v		
Tavmen, 2024 [46]					v
Erfani et al., 2024 [47]		v			
Yin et al., 2024 [48]				v	

Legend: The symbol 'v' indicates that the respective study addresses the given project type.

The studies on crowdfunding in transport infrastructure projects are the earliest and can be divided into large-scale infrastructure projects and smaller sustainable mobility projects. The studies on large-scale transport infrastructure development focus on using crowdfunding in financing initial project stages [31] and also explore its integration with the public–private partnership (PPP) model [36]. They highlight the potential of implementing this financing model in countries with less developed infrastructure and limited public funds, such as those in the Asian region [29,44]. These studies also indicate significant barriers, including the risk of insufficient funds and the lack of experience among communities or crowdfunding organizations in managing large-scale transport projects, which are often considered unbankable, highly risky, and characterized by long return periods. They underline the need for appropriate regulations to ensure investment security. It is worth mentioning that in the case of debt crowdfunding for public transportation projects, the risk is lower because the local government or municipal company often serves as the guarantor [37]. A practical illustration of integrating crowdfunding into the PPP model is the InfraShares platform, launched in the United States in 2015 by Brian Ross. InfraShares enables citizens to invest directly in large-scale transport assets, such as toll roads and transit hubs, through equity crowdfunding [49]. This approach transforms residents from passive taxpayers into active stakeholders, bridging funding gaps while strengthening transparency and local accountability. Although still at an early stage, the

concept demonstrates how crowdfunding can scale to major infrastructure projects and democratize transport financing.

Research on the application of crowdfunding in sustainable local mobility includes projects like bicycle infrastructure [33] and public transportation networks in smaller communities [41]. Crowdfunded projects in this sector are often smaller in scale, community-driven, and tailored to the specific needs of local populations. Recent studies also explore crowdfunding for equitable electric vehicle (EV) charging infrastructure, emphasizing social equity and access for underserved communities [47]. The findings suggest that crowdfunding can be an effective tool when combined with other financing mechanisms, even in cases where public budgets are limited. For illustration, practical examples of sustainable local mobility initiatives financed through crowdfunding include projects promoting micromobility and clean transport solutions. Early cases feature equity crowdfunding for innovative e-bike concepts, such as the Freygeist Bikes campaign on the Companisto platform in 2015, which raised approximately €1.5 million from over 1000 investors to launch an ultralight electric bicycle with a range of up to 100 km [50]. More recent initiatives leverage global platforms like Indiegogo to introduce electric scooters, as in Yadea's ElitePrime campaign in 2023, offering a high-performance "Urban SUV" model with a range of 120 km and super early bird pricing starting at $1299 [51]. These examples illustrate how crowdfunding supports the diffusion of sustainable micromobility technologies and complements traditional financing mechanisms.

Crowdfunding is a new and desirable research direction in implementing innovative transport projects, such as start-ups, business models, systems, and technologies.

The area of innovative start-up research primarily focuses on transportation projects that do not meet the funding criteria of traditional financial institutions, particularly in the context of seed funding. Like infrastructure project studies, they highlight that crowdfunding is especially vulnerable to risks such as fraud, unethical practices, and lack of transparency, which may discourage potential investors, particularly those with limited expertise in the transportation industry. Therefore, these studies concern supporting decision-making processes and propose quantitative risk assessment models of start-up projects in the transport sector, aimed at increasing the security of crowdfunding platforms and minimizing investment risks [34,35]. An example of such a project is Hackrod, a California-based start-up founded in 2018, which launched an equity crowdfunding campaign on StartEngine to raise $1 million for a custom 3D-printed car platform [52]. The concept integrates VR design, AI optimization, and additive manufacturing, with its La Bandita speedster featuring a recycled Tesla powertrain and a 3D-printed chassis. This case demonstrates how crowdfunding accelerates disruptive automotive technologies and democratizes vehicle manufacturing.

Research on innovative business models in transport is grounded in the concept of the sharing economy, also known as uberization, whose main idea is to connect owners of underused assets with clients via digital platforms. Early studies analyze services such as Uber and BlaBlaCar [30] and crowdfunding platforms like GoFundMe.com [38], focusing on technological management of capital assets, market risks, and revenue distribution. Complementing these multi-campaign analyses, recent work examines individual campaigns to understand how personalized narratives and transparent cost framing influence donor engagement [48]. GoFundMe campaign demonstrates how emotional appeals and clear cost breakdowns can mobilize donors for individual mobility needs. The newest research topic is the concept of flight crowdfunding, where individuals or organizations raise funds to cover the cost of flights using online platforms. Zhang et al. [40] analyze airline crowdfunding as a novel airline sales strategy to optimize ticket pricing and reduce costs. They highlight its potential to enhance airline profits while generating social benefits,

such as reduced greenhouse gas emissions. Ling et al. [43] examined the collaboration between airlines and online travel agencies (OTAs) in airline crowdfunding. The study finds crowdfunding is more likely to be adopted in highly competitive markets or when fixed flight costs are high. The findings suggest that, under optimal market conditions, crowdfunding can create a win-win scenario for airlines, OTAs, and consumers. A practical illustration of this type of project is also the Crowdfunding-Rail project initiated by Locomore in Germany in 2015 [53]. The railway operator pioneered a hybrid financing model combining ticket pre-sales with equity crowdfunding to launch its Stuttgart–Berlin open-access route. The campaign raised approximately €460,000 from over 1000 supporters, who could pre-purchase tickets at discounted rates or invest in company shares. This approach not only secured start-up capital but also created strong customer loyalty and brand identity before operations began.

These projects show how crowdfunding enables new business models in passenger transport, fostering community engagement and offering alternatives to incumbent operators.

A very timely topic is using crowdfunding to implement innovative technical and technological advances in transportation, such as electric personal vehicles (e-scooters, e-bikes), smart city solutions (intelligent traffic management systems, transport/logistics-information clusters), and large-scale R&D projects, such as hyperloop or autonomous vehicle projects. The research of Zhu et al. [32] on charging piles for electric vehicles indicates that crowdfunding has similar effects to subsidies and is more efficient and straightforward in promoting the expansion of new technological solutions in transport. Harris & Wonglimpiyarat [39] analyze the potential for large-scale development of Hyperloop technology, using the case study of SpaceX Hyperloop. They showed crowdfunding as a key component of the financial infrastructure in innovative projects alongside corporate venture funding, initial coin offerings, and traditional financing. The survey by Kosheleva et al. [42] presented crowdfunding as one of the models that enable the development of the intelligent city system. The earliest studies by Tavmen [46] analyzed the role of open data in the development of smart cities based on the case study of the Citymapper transportation app in London (TfL), which became the fastest fundraising campaign in the platform's history. The campaign attracted 9000 individual investors, raising £6.7 million within 24 h, despite concerns regarding the company's financial projections and long-term sustainability. The study highlights that Citymapper's success in the crowdfunding campaign reflects the app's strong public appeal rather than a demonstration of a sustainable and profitable business model. The potential for financing complex technical assets is further exemplified by the APOC Aviation case. APOC Aviation, a Netherlands-based aviation aftermarket company specializing in aircraft part-out and component trading, launched an equity crowdfunding campaign in 2019 to finance the acquisition of two Boeing 737–700 airframes. The campaign successfully raised USD 2.6 million from private investors, enabling the purchase of low-cycle airframes previously configured as Boeing Business Jets [54]. This innovative financing approach illustrates how crowdfunding can support high-value, capital-intensive operations in the aviation sector, particularly in niche markets such as asset recovery and sustainable reuse of aircraft components. The case involves complex technical assets and demonstrates the potential of alternative funding models for specialized transport technologies.

The reviewed studies reveal five distinct categories of transport projects financed through crowdfunding, each with specific characteristics and risk profiles. Large-scale infrastructure initiatives typically employ early-phase crowdfunding and, in some cases, community bonds, but face substantial challenges related to construction risk, demand uncertainty, and long payback periods. Local sustainable mobility projects are small-scale and community-driven, aiming to improve accessibility and encourage modal shift

toward greener transport options. Innovative start-ups often rely on seed-stage crowdfunding to support unbankable concepts, yet remain exposed to technological, execution, and fraud risks, highlighting the need for decision-support tools. New business models, such as sharing-economy platforms and service innovations, raise governance and fairness concerns in platform design and market regulation. Finally, advanced systems and technologies—including e-mobility solutions, smart-city applications, and deep-tech projects—are characterized by high techno-economic uncertainty and interoperability challenges, requiring robust frameworks for risk assessment and investor protection.

Evidence from the reviewed studies and project cases indicates that campaign design and governance strongly influence outcomes across project types. Community-scale initiatives, such as cycling routes, benefit from reward-based structures and transparent information disclosure, which increase pledging likelihood. In contrast, airline crowdfunding performs well only under specific market conditions—high fixed costs or intense competition—while start-ups and deep-tech projects remain highly exposed to fraud and execution risk, reinforcing the need for platform-level risk-rating and advanced assessment models. At a systemic level, weak or absent regulation consistently emerges as a critical barrier, amplifying uncertainty and limiting adoption.

The analysis of these studies also indicates clear regional variation. In Asia, PPP–crowdfunding hybrids and blockchain-based models are explored as mechanisms to bridge public funding gaps, while North America demonstrates policy-driven adoption through local mobility projects, equity-based EV initiatives, and airline crowdfunding strategies. Europe combines strong retail participation with concerns over the long-term viability of platform-based mobility models. These context-specific factors—market competition, fiscal constraints, equity policies, and regulatory maturity—shape success dynamics across project types.

The five identified project types align closely with the three thematic clusters revealed in the keyword mapping (Section 3.1). Large-scale transport infrastructure projects show strong links to Sustainability and Finance (C1) and Fintech and Blockchain (C2), reflecting debates on regulatory frameworks and PPP integration. Sustainable local mobility projects primarily connect to Sustainability and Finance (C1), emphasizing environmental goals and community-driven funding. Innovative start-ups, new business models, and advanced systems and technologies exhibit multi-label associations with Fintech and Blockchain (C2) and Management and Consumer Behavior (C3), particularly in discussions on risk assessment, platform governance, and user engagement. To capture these relationships without introducing composite labels, we map each project type (RQ2) onto the original research areas (RQ1) and indicate primary (●) and secondary (○) linkages. This alignment is summarized in Table 3.

Table 3. Mapping of crowdfunded transport project types onto research areas.

Type of Projects/ Research Areas	(1) Sustainability and Finance	(2) Fintech and Blockchain	(3) Management and Consumer Behavior
Large-scale transport infrastructure	●	●	○
Sustainable local mobility	●	○	○
Innovative start-ups	○	●	○
New business models	○	○	●
Advanced systems and technologies	○	●	○

Legend: The symbol "●" indicates a primary linkage while the symbol "○" indicates a secondary linkage between project types and research areas.

To sum up, the analysis of RQ2 confirms that crowdfunding is moving beyond traditional sustainable infrastructure projects to encompass innovative and intelligent transport solutions with a high level of investment risk. This mapping illustrates that project types often span multiple research areas (RQ1), reflecting diverse technological, financial, and behavioral dimensions. Across all categories, the overarching common denominator is the critical need to strengthen investor safety and security—through appropriate regulations, risk assessment models, and platform governance—given the significant barriers and high-risk profile of emerging transport innovations. These findings set the stage for RQ3, which addresses research gaps and future directions.

4. Discussion and Future Research Directions

The three clusters identified through keyword mapping provide an interpretive framework for the five project types analyzed in RQ2. These relationships are multi-layered: infrastructure and local mobility align with sustainability-oriented finance, while start-ups and advanced technologies connect financial innovation to user behavior and platform governance. Building on this alignment, RQ3 synthesizes three emerging research streams: (S1) risk, regulation, and hybrid finance; (S2) behavioral and geographic expansion; and (S3) methodological and technological evolution.

Our study indicates that although crowdfunding is well described in the literature (several thousand records in WoS and Scopus), its application to transport projects remains rarely addressed. The literature review conducted here, complemented by an analysis of illustrative crowdfunding projects retrieved from EBSCO's non-academic content (such as press reports and descriptive sources), reveals that this emergent field is highly dynamic, covering a wide spectrum of projects—from large-scale infrastructure [29,31,36,44,45], to local mobility initiatives [33,37,41], innovative start-ups [34,35], new business models [30,38,40,43], and advanced systems and technologies [39,42,46].

Despite this diversity, the field faces a critical tension: while research signals strong innovative potential (e.g., fintech, Hyperloop, smart city), practical implementation remains constrained by significant barriers and low awareness among decision-makers [45]. This gap underpins the need for future research directions outlined in Table 4, aimed at addressing operational challenges and unlocking the innovative potential of crowdfunding in transport.

Table 4. Research gaps and future directions for crowdfunded transport projects.

Project Type	Key Gaps	Future Research Directions
Large-scale transport infrastructure	- unbankability - long payback periods - unclear PPP–CF integration	- develop hybrid PPP–crowdfunding models - regulatory pilots - risk-sharing contracts - viability assessments
Sustainable local mobility	- lack of standardized impact metrics (GHG, modal shift) - dispersed benefits	- create standardized GHG and energy metrics - implement civic CF governance - match-funding schemes
Innovative start-ups	- high failure risk - weak investor protection - limited screening mechanisms	- decision-support tools - sandbox regulation - comparative studies across platforms and jurisdictions

Table 4. *Cont.*

Project Type	Key Gaps	Future Research Directions
New business models	- user-investor heterogeneity - fairness and ethics in platform design	- behavioral studies on motives - equity and fairness frameworks - market design for competition
Advanced systems and technologies	- techno-economic uncertainty - interoperability - data scarcity	- open-data protocols - life-cycle and techno-economic analysis - trials for e-mobility and smart systems

Across all project types, three cross-cutting research streams emerge:

(S1) Risk, regulation and hybrid finance;
(S2) Behavioral and geographic expansion;
(S3) Methodological and technological evolution, including energy and emissions assessment.

Stream 1 focuses on institutional and market risks, investor protection, and integration with traditional financing (e.g., PPP models [29,31,36,44,45], municipal bonds [33,37,41]). Stream 2 emphasizes expanding geographic scope beyond Europe and Asia and exploring user-investor heterogeneity, including motivations and demographic differences [34,35]. Stream 3 calls for new analytical approaches to assess market dynamics and platform governance, examine technological innovations such as blockchain and ICOs [39,42,46] and evaluate environmental impacts through life-cycle and techno-economic assessments.

5. Conclusions

The primary aim of this literature review was to comprehensively map the emerging field of crowdfunding in the transport sector and to propose a structured research agenda. The findings underscore that while crowdfunding is a mature funding instrument across various sectors, its application in transport remains nascent, yet highly versatile—covering municipal infrastructure, innovative start-ups, and deep-tech solutions.

This study contributes to the literature on transport financing and crowdfunding in three primary, verifiable ways:

First, by identifying and delineating three main thematic research areas: (1) Sustainability and finance, (2) Fintech and blockchain, and (3) Management and consumer behavior (RQ1).

Second, by classifying transport projects utilizing crowdfunding into five distinct types: (1) Large-scale transport infrastructure, (2) Sustainable local mobility, (3) Innovative start-ups, (4) New business models, and (5) Advanced systems and technologies (RQ2).

Finally, by proposing three research streams—(1) Risk, regulation, and hybrid finance; (2) Behavioral and geographic expansion; and (3) Methodological innovation and technological evolution—offering a roadmap for future scholarly work (RQ3).

Unlike prior reviews that examine crowdfunding in general, this study embeds these thematic areas within the specific context of transport innovation and sustainability. By mapping the interplay between research clusters and project types, we reveal domain-specific linkages—such as PPP–crowdfunding integration for infrastructure, fintech-driven models for mobility start-ups, and governance challenges in platform-based transport services. These intersections provide novel theoretical and practical insights that underpin the three research streams proposed above.

Crowdfunding, as an internet-based financial innovation, reinforces the digital transformation of transport by integrating fintech and blockchain solutions.

Transport crowdfunding introduces unique regulatory, behavioral, and technological challenges—such as integrating PPP models with digital finance and ensuring investor protection in high-risk mobility innovations—issues not systematically explored in prior research.

The analysis suggests several recommendations for policymakers and practitioners. Policymakers should clarify the legal and regulatory frameworks that enable hybrid funding models (e.g., match-funding or PPP–crowdfunding hybrids) to mitigate risk and unlock large-scale infrastructure projects. Future research should operationalize PPP–crowdfunding hybrids through pilot frameworks and risk-sharing mechanisms, as indicated in Table 4. Given the capital-intensive nature of transport projects and investor risk aversion, crowdfunding offers a mechanism to mobilize resources for early-stage, high-risk innovations. Furthermore, crowdfunding should be promoted as an alternative source for innovative and environmentally friendly transport projects where traditional funding is limited, alongside efforts to foster adoption in under-studied regions (e.g., Latin America and Africa) to diversify the evidence base.

Crowdfunding thus emerges as a critical enabler of the low-carbon transition in transport by de-risking and funding projects—such as early-stage EV infrastructure or sustainable mobility concepts—that traditional financial institutions often avoid. These findings align with global climate strategies, such as the EU Green Deal and SDGs, emphasizing crowdfunding's role in bridging financing gaps for sustainable mobility. Policy frameworks should incorporate sandbox regulation and standardized risk assessment models to enhance investor protection.

Our analysis, while robust, is subject to methodological and empirical limitations that inform future research. Although the evidence base was expanded beyond WoS, Scopus, and Google Scholar to include TRID, SSRN, and EBSCO, and complemented by illustrative non-academic examples, the overall corpus remains small and unevenly distributed, concentrated mainly in Europe and Asia. To achieve a broad overview, our analysis adopted a general perspective without deeply considering country-specific regulatory contexts. We acknowledge that keyword variability and indexing limitations across databases may have led to omissions, and the categorization process, while transparently reported, involved subjective judgment. Further studies should examine success and failure factors using platform-level data and quantitative models to inform decision-support tools. Integrating transport-specific frameworks, such as sustainable mobility and innovation diffusion theory, could deepen the domain specificity of future research.

These limitations pave the way for future work: researchers should conduct detailed comparative case studies on regional regulatory frameworks, expand longitudinal diffusion studies to assess long-term viability, and develop qualitative research on user-investor heterogeneity and behavioral drivers of pledging decisions.

In sum, this review establishes a foundation for systematic research on transport crowdfunding, highlighting critical gaps and directions for future inquiry.

Author Contributions: Conceptualization, M.M., M.P.-S. and D.K.; methodology, M.M.; validation, M.M. and M.P.-S.; writing—original draft preparation, M.M., M.P.-S. and D.K.; writing—review and editing, M.M., M.P.-S. and D.K.; visualization, M.M.; supervision, M.M. All authors have read and agreed to the published version of the manuscript.

Funding: Co-financed by the Minister of Science under the "Regional Excellence Initiative".

Institutional Review Board Statement: Not Applicable.

Informed Consent Statement: Not Applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Xie, P.; Zou, C.; Liu, H. Research on Internet financial model. *Financ. Res.* **2012**, *12*, 11–22.
2. Belleflamme, P.; Lambert, T.; Schwienbacher, A. Crowdfunding: Tapping the right crowd. *J. Bus. Ventur.* **2014**, *29*, 585–609. [CrossRef]
3. Cumming, D.J.; Johan, S.A.; Zhang, Y. The role of due diligence in crowdfunding platforms. *J. Bank. Financ.* **2019**, *108*, 105661. [CrossRef]
4. Motylska-Kuzma, A. Crowdfunding and sustainable development. *Sustainability* **2018**, *10*, 4650. [CrossRef]
5. Yin, L.Y.; Khalil, F.C.; Khalil, L.J.; Kaspard, J.A. The Role of Project Description in the Success of Sustainable Crowdfunding Projects. *J. Risk Financ. Manag.* **2025**, *18*, 200.
6. Hervé, F.; Manthé, E.; Sannajust, A.; Schwienbacher, A. Determinants of individual investment decisions in investment-based crowdfunding. *J. Bus. Financ. Account.* **2019**, *46*, 762–783. [CrossRef]
7. Lukkarinen, A.; Shneor, R.; Wallenius, J. Growing pains and blessings: Manifestations and implications of equity crowdfunding industry maturation. *Decis. Support Syst.* **2022**, *157*, 113768. [CrossRef]
8. Nitani, M.; Riding, A.; He, B. On equity crowdfunding: Investor rationality and success factors. *Ventur. Cap.* **2019**, *21*, 243–272. [CrossRef]
9. Rossi, A.; Vismara, S. What do crowdfunding platforms do? A comparison between investment-based platforms in Europe. *Eurasian Bus. Rev.* **2018**, *8*, 93–118. [CrossRef]
10. Shneor, R.; Vik, A.A. Crowdfunding success: A systematic literature review 2010–2017. *Balt. J. Manag.* **2020**, *15*, 149–182. [CrossRef]
11. Vismara, S.; Wirtz, P. Fundraising, Governance and Environmental Ethics: Evidence from Equity Crowdfunding. *J. Bus. Ethics* **2025**, *200*, 841–865.
12. Szewczyk, A.; Stempnakowski, Z. Social energy as the driving force behind crowdfunding—Analysis and classification of selected attributes. *Energies* **2021**, *14*, 6062. [CrossRef]
13. Gai, L.; Algeri, C.; Ielasi, F.; Manganiello, M. Sustainability-Oriented Equity Crowdfunding: The Role of Proponents, Investors, and Sustainable Development. *Sustainability* **2025**, *17*, 2188. [CrossRef]
14. Bargoni, A.; Ferraris, A.; Bresciani, S.; Camilleri, M.A. Crowdfunding and innovation: A bibliometric review and future research agenda. *Eur. J. Innov. Manag.* **2024**, *27*, 1109–1133. [CrossRef]
15. Chu, C.C.; Cheng, Y.F.; Tsai, F.S.; Tsai, S.B.; Lu, K.H. Open innovation in crowdfunding context: Diversity, knowledge, and networks. *Sustainability* **2019**, *11*, 180. [CrossRef]
16. Charbit, C.; Desmoulins, G. *Civic Crowdfunding: A Collective Option for Local Public Goods?* OECD Publishing: Paris, France, 2017; Volume 2017.
17. Kurekova, L.; Cermakova, K.; Hromada, E.; Kaderabkova, B. Public funding in R&D and R&D outcome sustainable development: Analysis of Member States EU. *Int. J. Econ. Sci.* **2023**, *12*, 40–62.
18. Hunt, O.B.; Tilsted, J.P. 'Risk on steroids': Investing in the hydrogen economy. *Environ. Plan. A* **2025**, *57*, 1131–1150. [CrossRef]
19. Mohsin, M.; Dilanchiev, A.; Umair, M. The Impact of Green Climate Fund Portfolio Structure on Green Finance: Empirical Evidence from EU Countries. *Ekonomika* **2023**, *102*, 130–144. [CrossRef]
20. Brahmi, M.; Esposito, L.; Parziale, A.; Dhayal, K.S.; Agrawal, S.; Giri, A.K.; Loan, N.T. The Role of Greener Innovations in Promoting Financial Inclusion to Achieve Carbon Neutrality: An Integrative Review. *Economies* **2023**, *11*, 194. [CrossRef]
21. Hensel, P. *Systematyczny Przegląd Literatury w Naukach o Zarządzaniu i Jakości*; Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego: Warszawa, Poland, 2020; ISBN 9788366282193.
22. Munn, Z.; Peters, M.D.J.; Stern, C.; Tufanaru, C.; McArthur, A.; Aromataris, E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med. Res. Methodol.* **2018**, *18*, 143. [CrossRef]
23. Colquhoun, H.L.; Levac, D.; O'Brien, K.K.; Straus, S.; Tricco, A.C.; Perrier, L.; Kastner, M.; Moher, D. Scoping reviews: Time for clarity in definition, methods, and reporting. *J. Clin. Epidemiol.* **2014**, *67*, 1291–1294.
24. Tricco, A.C.; Lillie, E.; Zarin, W.; O'Brien, K.; Colquhoun, H.; Kastner, M.; Levac, D.; Ng, C.; Sharpe, J.P.; Wilson, K.; et al. A scoping review on the conduct and reporting of scoping reviews. *BMC Med. Res. Methodol.* **2016**, *16*, 15. [CrossRef]
25. Pettersen-Sobczyk, M.; Mańkowska, M. Artificial Intelligence in Optimizing the Selection of Incoterms Rules in Cross-Border Trade. State of Knowledge and Needs for Further Research. In Proceedings of the Proceedings of the 32nd International Conference on Information Systems Development, Gdańsk, Poland, 26–28 August 2024; University of Gdańsk: Gdańsk, Poland, 2024.
26. Cooper, S.; Cant, R.; Kelly, M.; Levett-Jones, T.; McKenna, L.; Seaton, P.; Bogossian, F. An Evidence-Based Checklist for Improving Scoping Review Quality. *Clin. Nurs. Res.* **2021**, *30*, 230–240. [CrossRef]
27. van Eck, N.J.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **2010**, *84*, 523–538.

28. Bukar, U.A.; Sayeed, M.S.; Razak, S.F.A.; Yogarayan, S.; Amodu, O.A.; Mahmood, R.A.R. A method for analyzing text using VOSviewer. *MethodsX* **2023**, *11*, 102339. [CrossRef]
29. Arifin, S.R.; Wisudanto, W. Crowdfunding Sebagai Alternatif Pembiayaan Pembangunan Infrastruktur. In Proceedings of the Simposium II UNIID 2017, Palembang, Indonesia, 19–20 September 2017; Volume 2, pp. 309–314.
30. Corona-Treviño, L. Technology management of capital assets and risks in the service sharing economy: Cases of uberization of crowdfunding and transportation in Mexico. In Proceedings of the 2017 Portland International Conference on Management of Engineering and Technology (PICMET), Portland, OR, USA, 9–13 July 2017; Volume 6, pp. 346–357. [CrossRef]
31. Soto, E.G. *Built By the Crowd, Crowdfunding Transport Infrastructure Projects*; Tilburg University: Tilburg, The Netherlands, 2017.
32. Zhu, L.; Zhang, Q.; Lu, H.; Li, H.; Li, Y.; McLellan, B.; Pan, X. Study on crowdfunding's promoting effect on the expansion of electric vehicle charging piles based on game theory analysis. *Appl. Energy* **2017**, *196*, 238–248. [CrossRef]
33. Miller, S.; Coutts, C. A multiple case study of local & creative financing of bicycle and pedestrian infrastructure. *Case Stud. Transp. Policy* **2018**, *6*, 257–264. [CrossRef]
34. Kelemen, M.; Polishchuk, V.; Gavurová, B.; Szabo, S.; Rozenberg, R.; Gera, M.; Kozuba, J.; Andoga, R.; Divoková, A.; Blišťan, P. Fuzzy Model for Quantitative Assessment of Environmental Start-up Projects in Air Transport. *Int. J. Environ. Res. Public Health* **2019**, *16*, 3585.
35. Polishchuk, V.; Kelemen, M.; Kozuba, J. Technology Improving Safety of Crowdfunding Platforms Functioning in the Context of the Protection of the Start-Up Investors in the Financial and Transport Sectors. *J. Konbin* **2019**, *49*, 313–330. [CrossRef]
36. Berawi, M.A.; Reyes, G.; Sari, M.; Saroji, G. Developing public-private partnership model with blockchain-based crowdfunding concept for port city project. In ACM International Conference Proceeding Series, Proceedings of the 2nd International Scientific Conference on Innovations in Digital Economy (SPBPU IDE '20), St. Petersburg, Russia, 22–23 October 2020; Association for Computing Machinery: New York, NY, USA, 2020.
37. Fadhil, D.N.; Jinca, A.; Prakoso, P.; Hoegeng, J. Alternative Approach to Sustainable Urban Mobility in Developing Countries. *J. Infrastruct. Policy Manag.* **2021**, *4*, 19–25. [CrossRef]
38. Klein, N.J.; Tran, M.; Riley, S. "Desperately Need a Car": Analyzing crowdfunding campaigns for car purchases and repairs on Gofundme.com. *Travel Behav. Soc.* **2020**, *21*, 247–256. [CrossRef]
39. Harris, W.L.; Wonglimpiyarat, J. SpaceX Hyperloop: A future technology disruption of the transportation system? *Foresight* **2021**, *23*, 528–543. [CrossRef]
40. Zhang, Z.; Ling, L.; Yang, F. Pricing strategy and campaign design in flight crowdfunding: A creative way to sell flight tickets. *Nav. Res. Logist.* **2021**, *68*, 795–809.
41. De Crescenzo, V.; Simeoni, F.; Ulrich, K.; Ribeiro Navarrete, S. Searching for the crowd in sustainable tourism and leisure projects. *Eur. J. Innov. Manag.* **2022**, *26*, 110–126. [CrossRef]
42. Kosheleva, T.; Ksenofontova, T.; Yue, W. Chinese Experience in the Formation of Transport-Information Clusters on a Digital Basis. *Lect. Notes Netw. Syst.* **2022**, *402 LNNS*, 719–725.
43. Ling, L.; Bao, X.; Zhang, Z.; Yang, F. Mechanisms of cooperation between airlines and online travel agencies for flight crowdfunding. *Int. Trans. Oper. Res.* **2022**, *29*, 3537–3564. [CrossRef]
44. Pranata, N.; Firdaus, N.; Mychelisda, E.; Hidayatina, A. Crowdfunding for Infrastructure Project Financing: Lessons Learned for Asian Countries. In *Handbook of Research on Big Data, Green Growth, and Technology Disruption in Asian Companies and Societies*; IGI Global: Hershey, PA, USA, 2022; pp. 276–300.
45. Shukla, G.P.; Kumar, S.; Kumar, M.; Kumar, A.; Chhetri, M. A Fuzzy Ecosystem Benchmarking for Crowdfunding in Transport Sector. *J. Adv. Transp.* **2022**, *2022*, 7071279. [CrossRef]
46. Tavmen, G. "Open data means business": Infrastructural and economic implications of opening up data in smart London. *Digit. Geogr. Soc.* **2024**, *7*, 100098. [CrossRef]
47. Erfani, A.; Cui, Q.; Decorla-Souza, P. Crowdfunding for Equitable EV Charging Infrastructure. *arXiv* **2024**, arXiv:2406.14295. [CrossRef]
48. Yin, Z.; Huang, G.; Zhao, R.; Wang, S.; Shang, W.L.; Han, C.; Yang, M. Information disclosure and funding success of green crowdfunding campaigns: A study on GoFundMe. *Financ. Innov.* **2024**, *10*, 147. [CrossRef]
49. Cho, A. Entrepreneurs Hope to Bring Crowdfunding to P3 Projects. Available online: https://www.enr.com/articles/2146-entrepreneurs-hope-to-bring-crowdfunding-to-p3-projects (accessed on 19 December 2025).
50. Hobey, E. Freygeist Redefines E-Bike: Rides with Companisto for Its Sustainable Fun Equity Crowdfunding Campaign. Available online: https://www.crowdfundinsider.com/2015/03/64248-freygeist-redefines-e-bike-rides-with-companisto-for-its-sustainable-fun-equity-crowdfunding-campaign/ (accessed on 19 December 2025).
51. Yadea. Yadea Scooter ElitePrime Launches CrowdFunding Campaign on Indiegogo: The Urban SUV. Available online: https://www.prnewswire.com/apac/news-releases/yadea-scooter-eliteprime-launches-crowdfunding-campaign-on-indiegogo-the-urban-suv-301796285.html (accessed on 19 December 2025).

52. Jackson, B. Hackrod Launches Million Dollar Crowdfund for Custom 3D Printed Car Platform. Available online: https://3dprintingindustry.com/news/hackrod-launches-million-dollar-crowdfund-custom-3d-printed-car-platform-128997/ (accessed on 19 December 2025).
53. Herbstreuth, M. Konkurrenz zur Deutschen Bahn-Mit dem Crowdfunding-Zug von Berlin nach Stuttgart. Available online: https://www.deutschlandfunkkultur.de/konkurrenz-zur-deutschen-bahn-mit-dem-crowdfunding-zug-von-100.html (accessed on 19 December 2025).
54. AviTrader Aviation News APOC Aviation's Crowdfunding Campaign Raises US$2.6 Million. Available online: https://avitrader.com/2019/04/28/apoc-aviations-crowdfunding-campaign-raises-us2-6-million/ (accessed on 19 December 2025).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.