

A Systematic Review of the Start-Up Financing Research from 2010 to 2023

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Abstract: This paper presents a systematic review of start-ups financing research from 2010 to 2023, analyzing trends, methodologies, and findings across the field. Our work highlights the significance of start-ups in driving economic growth and innovation, while addressing the challenges they face in securing financing. Through a detailed search strategy and analysis of selected studies, the study shows preferences for empirical data and statistical analysis, with a broad geographical scope and varied financing methods. The paper proposes a conceptual model to explain how startup-specific characteristics, entrepreneur attributes, macroeconomic factors, and financing sources interact to influence financing decisions. The review also identifies gaps in current research and suggests future directions, particularly in areas related to technology-based financing, green funding, and cross-regional comparative studies.

Keywords: systematic literature review; start-ups financing; new and traditional methods

1 Introduction

Start-ups are defined as newly established businesses that are typically characterized by their technological innovation and high growth potential [1] [2]

Start-ups have emerged as critical drivers of economic growth, employment, and innovation in the global economy [3] [4] [5] [6]. Access to finance is a crucial factor

in the business development cycle stages of start-ups [7]. Indeed, start-up firms often face challenges in accessing external finance as they are assumed to be "the most informationally opaque" type of firms [8] [9].

These companies face many challenges as they have a small size, but also, they are a novelty in the market which implies that there are no historical data and lack transparency. These factors lead to information asymmetries and potential moral hazard issues with investors [5]. Given that the cost of funds increases with information asymmetry, innovative young firms are often excluded from a credit worthy category by financial institutions [10] [11].

The early phase difficulties include a lack of profitability and insufficient security or proven success metrics, complicating their capital acquisition efforts [12], [13].

The importance of financing grows over time for start-ups. Initially, financial resources are critical for growth, but as companies progress through subsequent funding rounds, the relationship between funding and growth becomes more complex, influencing future growth strategies [14] [2].

Over the last decade, there have been major transformations in the landscape of startup financing. Traditional financing methods like venture capital (VC) and angel investors [15] [16] have been augmented by fintech solutions.

The emergence of crowdfunding and other fintech services as alternative financing methods has notably expanded the funding ecosystem [17] [18]. The development of the fintech industry has further underscored the critical role of innovation in financial services, with significant investments flowing into IT technology to bolster the sector [19] [20].

In recent years, this issue has become one of the main topics of interest for policymakers, investors, and academics alike. However, a review that aggregates and synthesizes the various studies on start-up financing is notably lacking. A search on the Web of Science using terms such as "start-up financing review" and "entrepreneurship finance review" shows a limited number of review articles, and those that exist often focus on narrow aspects rather than providing a holistic view. This study aims to fill this gap by offering a thorough analysis of the existing research on start-up financing. This study aims to fill this gap by offering a thorough analysis of the existing research on start-up financing. The 2010-2023 time frame aligns with previous studies examining the evolution of start-up financing and entrepreneurial ecosystems [21] [22] [23].

Reviewing a timeframe of more than 10 years is essential for a complete analysis, an understanding of the complexities and dynamics of start-up financing. A review should capture comprehensive trends, evaluate the impact of major economic events, understand evolving behaviors, assess market dynamics, and identify research gaps [24] [25] [26]

Our work sets specific objectives to aggregate and synthesize data from various studies, offering a view of the trends, methodologies, and findings in this area. The review aims to enhance the understanding of how start-ups navigate the complexities of financing, considering various economic and regional contexts.

To this end, the objectives of this systematic literature review are:

- a. To analyze methodological approaches
- b. To evaluate sources and types of financing
- c. To synthesize data collection and analysis techniques.
- d. To construct a conceptual model that integrates the findings from the literature.
- e. To identify future research directions

2 Material and Methods

A computerized search of the Web of Science database was conducted using the keywords "start-up financing," "sources of financing," and "traditional and new forms of financing" in the titles, abstracts, and keywords of the articles. This initial search yielded a total of 935 articles. To refine the focus, we applied specific inclusion and exclusion criteria (see Table 1) to screen the articles. After reviewing the abstracts and eliminating irrelevant studies, 324 articles were selected for further analysis.

Notably, approximately 36% of the selected articles were published in three leading journals with high impact factors and citation numbers: *Journal of Business Venturing*, *Small Business Economics*, and *Journal of Financial Economics*.

Following a detailed review of the full texts and the application of citation tracking, the final selection was narrowed down to 34 papers, which were deemed the most relevant and methodologically sound for the purposes of this study. This rigorous selection process ensured that the review remains comprehensive and focused on the most pertinent studies in the field of start-up financing.

Table 1
Inclusion and Exclusion Criteria

Language	English
Publication Date	Articles published between 2010 and 2023.
Topic Relevance	Studies that specifically address start-up financing, including both traditional and new forms of financing.
Source Quality	Research published in peer-reviewed journals with high impact factors and citation numbers.
Scope	Papers related to technological and innovative companies, as the definition of start-ups in this paper is linked to these types of firms.

The retrieved articles were exported into Mendeley, where duplicates were removed. The remaining articles were then screened based on the predefined inclusion criteria. Selected articles were read in detail, and relevant data were extracted using a structured data extraction form. The extracted data were subsequently synthesized and analyzed using a content analysis approach, ensuring a systematic examination of the literature.

3 Results and Discussion

In the following section, we will report the findings. Initially, we will present the outcomes of the descriptive analysis conducted on the analysed articles, aiming to highlight the key themes identified. This analysis focuses on the study country/countries, methodology, sample size and technique, study period, sources of financing, variables, data collection, analysis methods, and findings. For a more detailed evaluation, please refer to Table 4.

3.1 Characterization of the Literature

3.1.1 Country/Countries

The literature review includes a collection of studies, covering a broad geographical scope ranging from established economies like the USA, UK, and European countries, to emerging markets and global analyses as shown in Figure 1.

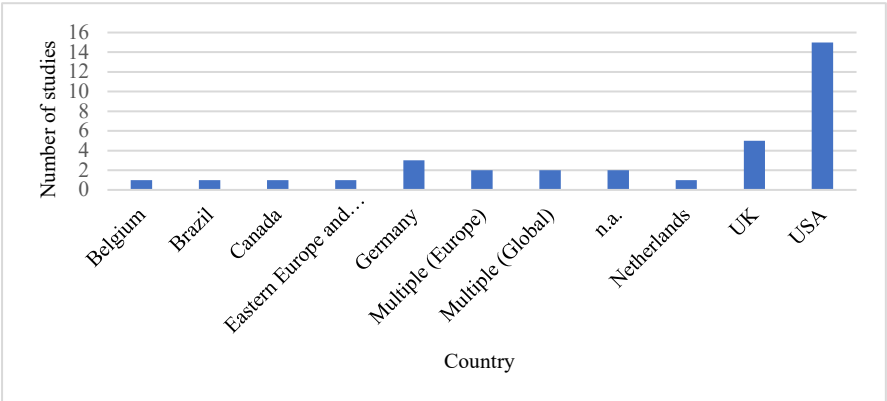


Figure 1
Number of studies according to country/countries
Source: Compiled by the authors

This wide range accurately captures the multifaceted landscape of entrepreneurial ecosystems and financing climates across various regions, offering a holistic

understanding of the complexities and potential of entrepreneurial finance on a global scale.

3.1.2 Approach/Methods

76.47% of the studies follow a quantitative research approach, which indicates that the field is primarily driven by empirical data and statistical analysis.

In the context of start-up financing, these studies likely focus on numerical data such as financial metrics, investment amounts, return rates, and other quantifiable aspects. This high percentage reflects a strong preference for studies that provide measurable and objective insights into how start-ups secure and use funding. About 12% of the studies in this review apply a mixed-methods approach, offering a comprehensive view of the start-up financing landscape. This method is particularly useful in start-up financing as it allows researchers to enhance financial data with qualitative insights, including investor motivations, founder experiences, and the subjective impact of funding on start-ups success.

These studies yield a deeper understanding by combining numerical analysis with the exploration of attitudes, perceptions, and non-quantifiable factors [27] [28].

8% of the studies apply a qualitative research approach, exploring the narratives and experiences of entrepreneurs and investors in the context of start-up financing. This approach includes case studies and in-depth semi-structured interviews with C-level managers, investors, or founders [29] [30].

Finally, only one of the reviewed papers is focused on theoretical research, providing managerial and empirical insights for designing optimal crowdfunding initiatives. It examines the effects of capital requirements, product type, market size, and emphasizes the importance of creating a suitable "community of crowdfunders." [31, p. 587].

These results suggest that researchers prioritize tangible, data-driven insights to guide entrepreneurs, investors, and policymakers. However, it is also given a special importance in understanding the human and societal aspects of financing, as well as the necessity for solid theoretical foundations to inform empirical investigation. The distribution of research methods reflects a comprehensive approach to understanding the complex nature of financing in the start-ups landscape.

For data collection, these studies predominantly used databases like WGI Indicator, Index of Economic Freedom, Doing Business, World Bank Enterprise Surveys (WBES), Business Environment and Enterprise Performance Survey (BEEPS), National survey databases, SAFE Amadeus BvD, CapitalIQ, Bureau van Dijk's Orbis, Thomson Reuters' VentureXpert, Dow Jones' VentureSource, AngelList, CrunchBase, Innovestment, Coin Schedule, US Patent and Trademark Office database, PSED I & II dataset, etc., or surveys. The reliance on existing datasets, which provide a wealth of structured and often longitudinal data, indicates that future studies will continue using these sources. These databases contain *financial*

data (balance sheets, income statements, cash flow statements, and financial ratios), *economic data* (economic freedom, governance quality, and macroeconomic performance), *business environment data* (microeconomic environment such as regulations, infrastructure, access to finance, and market conditions), and *firm-level data* (detailed profiles of startups, investment activities, ownership structures, and performance key metrics like funding rounds, valuations, and exits).

3.1.3 Data Analysis

Data analysis included a variety of statistical methods, such as descriptive statistics and a broad range of regression methods (e.g., OLS, logit, probit, Tobit, and linear regression), alongside thematic analysis and content analysis. These approaches were employed to comprehensively understand the factors influencing start-up access to finance.

A significant 67.65% of the studies used regression analysis, with the breakdown of regression methods as follows:

Table 2
Distribution of regression methods used in start-ups finance studies

Regression Method	Percentage Used
OLS	34.78%
Logit	21.74%
Probit	17.39%
Tobit	13.04%
Linear	8.70%
Other	4.35%

Source: Compiled by the authors

OLS regression emerged as a core method, frequently paired with other models such as logit, probit, and tobit. In some cases, specialized regression techniques, like regression discontinuity designs or Heckman selection models, were employed to address specific issues such as selection bias or causal inference.

3.2 Content Analysis

3.2.1 Sources of Financing

Referring to the distribution of studies by forms of financing (see table 3), 40% of the research papers focus on new forms of financing. This percentage highlights significant academic interest in how start-ups are adapting to newly expanded financing options that have arisen alongside technological advancements. These new forms of financing include venture capital from unconventional entities, crowdfunding platforms, initial coin offerings (ICOs), or reward-based financing [32] [33] [34].

They are attractive to start-ups because they offer more flexible terms, greater access to capital, and conditions that are better aligned with the various stages of a start-up's growth compared to traditional financing methods. In contrast, 60% of the research papers focus on traditional financing methods, including personal savings, support from friends and family, bank loans, venture capital, angel investors, and public markets.

This larger percentage of studies focusing on traditional forms of financing suggests that, despite the emergence of new financing options, there is still a predominant interest within the research community in traditional sources.

The continued focus on traditional financing underlines its ongoing relevance and necessity in the startup ecosystem. This might also indicate the availability of historical data for these methods, enabling more comprehensive and longitudinal research. Furthermore, traditional financing methods are widely recognized and understood by both entrepreneurs and investors and are crucial for the growth and scaling of startups.

Table 3
Studies according to financing forms

Author(s)	New forms of financing	Author/ Authors	Traditional forms of financing
Belleflamme et al.2014, Bongini et al.2021	Debt Crowdfunding	Hellmann et al. 2021/ Lerner et al.2018, Edelman et al.2016, Ewens et al.2020/ Edwards et al.2020, Gomper et al.2020, Nanda et al.2012, Ouimet et al.2014	Angel and Venture Capitalist/ Angel investors/ Venture Capital (VC)
Block et al.2018, Mochkabadi et al.2020, Walthoff-Born et al.2018, Estrin et al.2018, Guarana et al.2022	Equity Crowdfunding	Freel et al. 2010, Motta 2020, Rostamkalaei et al. 2016	Bank Loans
Fisch 2019, Schückes et al.2021	Initial Coin Offerings (ICOs)	Chua et al.2011, Molly et al.2019, Hechavarria et al.2016/ Degryse et al.2012	Debt/Internal/External Equity Funds/ External Financing
Fischer et al.2014	Patent-based Loan Financing	Hochberg et al.2018	Debt Patents VC
Mochkabadi et al.2024, Mollick 2014, Viotto da Cruz 2018	Reward-based Crowdfunding	Guerini et al.2016, Islam et al.2018	Governmental venture capital

		Gartner et al.2012	Personal Savings/Friends and Family
		Mateut 2018	Public Subsidies/Internal Finance/External Fund

Source: Compiled by the authors

3.2.2 Proposed Conceptual Model

Based on the variables and findings (see table 4) from the reviewed studies, and drawing upon the conceptual model for SME-s proposed by Kumar et al. 2015 [35], we adopted the following conceptual model for startups:

1. Startup-Specific Characteristics (Independent variables)

These characteristics are inherent to the startup itself and directly impact its financial decisions and access to finance.

Profitability and Growth: Profitability and growth serve as crucial indicators of a startup's financial health and future potential. Startups with higher profitability and growth rates typically attract more external funding from sources like venture capitalists and banks [36]. However, less profitable startups can still secure financing, particularly on crowdfunding platforms, by leveraging innovative ideas and external endorsements [34].

Size and Age: Larger and more mature startups tend to have better access to financing, owing to their established presence and proven performance [37]. On the other hand, younger and smaller startups often rely on alternative financing methods such as crowdfunding or ICOs, allowing them to bypass traditional funding obstacles [30].

Tangibility and Non-Debt Tax Shield: The tangibility of assets and available tax benefits significantly influence a startup's capital structure. Startups with tangible assets can more easily secure debt financing by using those assets as collateral [38]. Non-debt tax shields, such as depreciation and investment credits, further impact financing choices by reducing taxable income, thereby influencing debt decisions.

2. Entrepreneur Attributes (Independent variables)

These variables pertain to the personal characteristics of the entrepreneur(s) and affect the startup's financial strategies and access to capital.

Risk Aversion and Control Aversion: Entrepreneurs with a higher degree of risk aversion are more likely to prefer internal financing, such as retained earnings or safer external options like government grants [39]. Conversely, entrepreneurs with control aversion may opt for equity financing, even at the cost of diluting ownership.

Growth Strategy: A startup’s growth strategy heavily influences its financing preferences. High-growth startups, particularly in the seed and early stages, tend to seek external equity financing from angel investors or venture capital to support rapid scaling [40].

Experience and Education: The experience and education of the entrepreneur significantly affect investor confidence. Entrepreneurs with a strong track record and higher education levels tend to be more successful in securing both debt and equity financing [41].

3. Macroeconomic Factors (Independent variables)

These external environmental variables, while beyond the control of individual startups, play a significant role in determining access to finance.

Monetary Factors: Fluctuations in interest rates, inflation, and general economic stability directly impact the availability and cost of debt financing. In periods of low-interest rates, startups may prefer debt financing due to lower borrowing costs [47].

Political and Technological Factors: A stable political environment with favorable regulatory support creates an ecosystem conducive to startup growth and access to external funding [61]. In addition, technological advancements, such as the presence of patents, can enhance a startup's ability to attract external investment by signaling innovation and potential [36].

4. Sources of Finance (Moderator variable)

These include the various internal and external financing options that startups can leverage depending on their specific characteristics and macroeconomic conditions.

Internal Sources: Startups often begin by using internal sources of financing, such as retained earnings and bootstrapping, to maintain control and reduce financial risk [48].

External Sources: External financing includes angel investors, venture capital, bank loans, government grants, and equity crowdfunding. The choice of external funding sources varies depending on the stage of the startup's life cycle [62]. For example, startups in their seed or early stages often rely on angel investors or crowdfunding, while those in the growth or expansion stages typically seek venture capital or bank loans [63].

5. Financing Preferences (Dependent variables)

These reflect the startup’s preferred financing options based on its characteristics, strategic goals, and external circumstances.

Table 4
Summary of literature review analysis
Source: Compiled by the authors

Edwards et al. 2020 [45]	USA	Random sampling/ 13,431	Implementation of the 2010 Small Business Jobs Act (SBJA)	Capital raised by start-up firms in each funding round	Crunchbase data and U.S. Securities Exchange Commission (SEC)
Edelman et al. 2016 [27]	USA	Random sampling / 117	Various signals of quality (e.g., referrals, previous investments, industry experience)	Success in passing investment decision stages	Investment proposals submitted to a large angel-financing group/ crisp-set
Degryse et al. 2012 [44]	Netherlands	Random sampling /	Firm and industry characteristics	External financing	Panel data by Rabobank Firms/ Regression analysis
Chua et al. 2011 [43]	USA	Random sampling / 1267	Family ownership, governance, management, intention for transgenerational succession	Amount of debt financing, relationship with lenders,	National survey database from the U.S. Small Business Development
Bongini et al. 2021 [42]	Belgium, France, Finland, Germany, Italy,	Random sampling/ 45.316	Firm-specific characteristics; country-specific factors	The use of market based financial instruments: debt securities and equity	SAFE Amadeus BvD; WGI Indicator; Index of Economic Freedom; Doing Business / Weighted probit model
Block et al. 2018 [22]	Germany	Random and purposive sampling/ 71;	Team; business model; external certification; product development; cooperation	The number of investments and the amount of capital	Seedmatch and Companisto/ Regression analysis
Belleflamme et al. 2014 [31]	n.a.	n.a.	Team; business model; external certification; product development; cooperation	The number of investments and the amount of capital	Theoretical analysis; Mathematical model
Author/s (date)	Country	Sampling technique /size	Independent variable	Dependent variable	Data collection/ Data analysis

Guerini et al. 2016 [51]	Belgium Finland France	Guarana et al. 2022 [50]	Gomper et al. 2020 [49]	Gartner et al. 2012 [48]	Freel et al. 2010 [47]	Fischer et al. 2014 [38]	Fisch 2019 [36]	Ewens et al. 2020 [46]	Estrin, et al. 2018 [29]
Random sampling; 183	USA	USA	USA	USA	UK	USA	World Global	USA	UK
Random sampling/ 205	Random sampling/ 205	Random sampling/ 885	Stratified random sampling/ 10942	Random sampling/ 10942	Patent properties 1000/14,100	No- random sampling/ 423	Random sampling/ 17,780	Purposive sampling 62	N/A
Financing by public VC firms	Circadian alignment (chronotype of investors: lark/owl); time of day	Deal sourcing, investment selection, valuation, deal structure, post-investment value-add,	The firm characteristics and the entrepreneurs' personal characteristics	Characteristics of the firm; the entrepreneur; firm strategy	Secured patent	Amount raised in ICOs	Investor interest, sharing, introduction	N/A	N/A
Financing private venture capitalist; successful exit	Quality of investment decisions	VC decision making processes	The type of financing that emerging firms used	discouraged borrowers	INPADOC database/ Logit regression analysis	CoinSchedule Coinmarketcap white papers, venture websites, etc/ OLS regression	Data obtained from AngelList/ Baseline regressions	Semi structured interview/ Gioia Methodology	
VICO dataset/ Endogenous switching regression model analysis	Online survey/	Survey/ Comparative analysis, Correlations	PSED I & II dataset Questionnaire / Binary logistic regression and OLS regression	Large-scale biennial survey of the Federation of Small Businesses					

Mochkabadi et al. 2024 [32].	UK	Random sampling/ 149 / 2544 /	Mochkabadi et al. 2020 [55]	Mateut 2018 [41]	Lerner et al. 2018 [40]	Islam et al. 2018 [39]	Hornuf et al. 2017 [54]	Hochberg et al. 2018 [53]	Hellmann et al. 2021 [18]	Hechavarria et al. 2016 [52]
	n.a.	Non-Random sampling/ 113	30 Eastern Europe and	Europe, Asia Pacific, Latin	USA	Germany	USA	British Columbia,	USA	
		Receipt of public subsidies, firm financial strength	Angel financing or not financing 2 level of venture activity; the entrepreneurship	Receipt of US government research grants	Campaign characteristics, investor sophistication, funding amount collected,	Fund characteristics; patent liquidity of the market; corporate specificity	Presence of angel and venture capitalist (VC) investors in current and previous	Start-up capital structure (Debt, Internal, External Equity Funds)		
		Firm innovative activities (introduction	Firm growth, performance survival	Likelihood of obtaining subsequent VC funding	Innovation, Investment, Companionist/ OLS regression analysis	Dow Jones' VentureSource (aka "VentureOne") database Sand Hill	New types of investors in the start-up current funding round	The timing of start-up Outcomes (Quitting;		
		Business Environment and Enterprise Performance Survey (BEEPS) data/	CapitalQ and Bureau van Dijk' s Orbis Thomson Reuters' VentureXpert,	Energy Acuity's Power Database, proprietary databases, company			Data collected from the BC Investment Capital Program, detailing	PSED I and PSED II databases/ competing risk and Cox regression		
		Journals, conferences/ Theme identification								
		Equity crowdfunding data, lab-in-the-field conjoint experiment/								

Walhoff-Born et al. 2018 [60]	Viotto da Cruz 2018 [34]	Schückes et al. 2021 [30]	Rostamkalaei et al. 2016 [59]	Ouimet et al. 2014 [37]	Nanda et al. 2012 [58]	Motta 2020 [57]	Molly et al. 2019 [56]	Mollick 2014 [33]
UK	USA	Germany	UK	USA	USA	Brazil	Belgium	USA
Random sampling / 277/277	Random sampling / 707	Random sampling / 37	Random sampling / 247	Random sampling / 4,374,025	Random sampling / 12285	Random sampling / 915	Random sampling / 327	Random sampling / 471
Financial ratios; # of patent applications; professional social networks	Review the campaign of the crowdfunding	n.a.	Growth story; growth ambitions; growth strategies	Firm age, Employee age	Stage of the investment cycle. The source of financing	Access to external finance, Project quality (measured by export activities)	Family-centered goals, family board representation	Project features; financing ratio; supporter features; Facebook friends of the
Search for equity crowd funding	Decision to release of the product	n.a.	Pay rate	Firm growth, Employee wages, Firm hiring patterns	Startup innovation (The number of patents)	SME labor productivity	Total debt rate, short-term debt rate, long-term debt rate,	Success of crowdfunding project
Crowdcube's website	Campaigns on the platform	In-depth semi-structured interviews / Content analysis	2007 UK Survey of SME Finance/ Probit regression analysis	U.S. Census Bureau data, including LEHD and LBD/ OLS regressions,	US Patent and Trademark Office database/ regression analyses,	World Bank Enterprise Surveys (WBES)/ Ordinary Least Squares (OLS)	Survey data and data from the Bel-First database/ Ordinary least squares	48,034 the platform Kick starter/ Logit regression analysis

Retained Earnings: Retained earnings are often the preferred internal financing method for startups that want to avoid external debt or equity, particularly when they are in the early stages or when profitability is strong [39].

Debt Financing: Startups with tangible assets and favorable macroeconomic conditions may prefer short-term or long-term debt financing. Family-owned startups, for instance, can benefit from family networks to secure debt financing [43].

Equity Financing: Startups in innovative sectors or those seeking rapid growth are more likely to pursue equity financing, particularly from venture capitalists or equity crowdfunding platforms [54].

4 Theoretical and Practical Conclusions

The landscape of start-up financing has evolved significantly over the past decade, and this systematic review sheds light on the various dimensions of this transformation. The implications of these findings can be categorized into theoretical, practical, and social aspects, each offering unique insights and contributions.

From a theoretical perspective, this review contributes to the development of a framework that aligns different types of investors with the specific stages and needs of start-ups. By extending existing theories, it challenges the traditional view of investors as mere substitutes and instead proposes a complementary approach. The proposed conceptual model illustrates how startup's internal characteristics, the attributes of its entrepreneur(s), external macroeconomic conditions, and available financing options all interact to shape its financial strategy and access to funding at various stages of its life cycle.

On a practical level, the findings of this review provide valuable guidance for both entrepreneurs and investors. For start-ups, the insights offer a roadmap for selecting the most appropriate investors based on their current stage and specific requirements. This strategic alignment can enhance their chances of securing the necessary resources and support for growth. For investors, the review highlights the importance of understanding the diverse needs of start-ups and tailoring their support accordingly. By doing so, investors can better meet the monetary and non-monetary needs of start-ups, fostering a more supportive and effective funding ecosystem.

The social implications of this review are particularly in the context of innovation and economic development. Start-ups play a crucial role in driving innovation and creating jobs, and their success is closely tied to the availability of appropriate funding. Moreover, the impact of start-up funding on regional development is

significant, suggesting that improved funding mechanisms can support economic growth and development in various regions. This, in turn, can lead to more equitable economic opportunities and a more vibrant entrepreneurial ecosystem.

Further Research

Several future research directions in entrepreneurial finance, particularly focusing on startups, are suggested by the findings and gaps in the systematic literature review:

- To investigate the impact of emerging technologies like blockchain, AI, and IoT on startup funding.
- To explore the role of green funding in supporting environmentally sustainable startups.
- To conduct comparative studies on startup funding across different countries or regions to assess cultural, economic, and regulatory influences on financing patterns.
- To examine how the startup financing ecosystem is shaped by FinTech and alternative finance platforms, such as crowdfunding and peer-to-peer lending.

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