NAVIGATING SME INNOVATION THROUGH FINANCE: A SYSTEMATIC REVIEW OF CAPITAL CHANNELS

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ABSTRACT

Objective: This study systematically synthesises the dynamics of SME innovation financing channels, highlighting how financing characteristics, internal capacity, and institutional support influence access to and effectiveness of financing in various countries.

Research Design & Methods: This study uses a Systematic Literature Review (SLR) approach on 65 articles indexed in Scopus and Web of Science published between 2013 and 2024. Analysis was conducted through thematic coding to group findings into internal, external, and interaction patterns of financing channels. Inclusion and exclusion criteria were determined based on the PRISMA method to ensure transparency and validity of the selection process.

Findings: The study results indicate that a combination of internal financial literacy, digital readiness, and the quality of the regulatory ecosystem highly determines the effectiveness of SME innovation financing. Patterns of complementarity and substitution among financing channels depend on SMES' growth phases. Developed countries have shown success through blended finance schemes and integrated incentive policies, while developing countries face policy fragmentation and data access gaps.

Implications & Recommendations: These findings have important implications for policymakers, namely the need to build an evidence-based regulatory framework that encourages cross-agency collaboration and support for alternative financing channels. For SMEs, improving digital and managerial literacy is key to maximising access to innovation financing opportunities. Strategic recommendations include strengthening the role of incubators, leveraging fintech, and integrating financing information systems.

Contribution & Value Added: This research contributes conceptually by developing an integrative framework between financing channels, internal capabilities, and institutional support in SME innovation. The study also expands cross-country understanding and offers a more adaptive policy basis for developing innovative financing systems in the digital age.

Keywords: SME Innovation, Financing Channels, Financial Literacy, Institutional Ecosystem, Alternative Financing.

JEL codes: G21, L26, O31.

Article type: research paper

INTRODUCTION

Innovation is seen as an essential foundation for maintaining the competitive advantage of small and medium-sized enterprises (SMEs), especially amid the ongoing uncertainty of the global market (Gunasekaran et al., 2011; Sharfaei et al., 2023). SMEs' ability to create new products, improve process efficiency, and respond quickly to changing consumer needs makes innovation the primary driver of their business growth and resilience (Schumpeter, 2021; Tripathy et al., 2016). Despite their operational flexibility and market proximity, SMEs often face internal barriers such as limited capital, managerial capacity, and infrastructure support to fund innovative activities that require long-term investment and complex risk management (Dorasamy & Kikasu, 2024; Wonglimpiyarat, 2015). These limitations not only slow down the commercialization of innovations but also widen the gap between the potential of ideas and their economic realization (Baycan & Stough, 2013). To address these challenges, this study presents a systematic review of the literature exploring various financing channels–both traditional ones such as bank loans and internal capital, as well as more innovative ones such as fintech lending, crowdfunding, and venture capital–in supporting innovation in the SME sector (Block et al., 2018; Bruton et al., 2015). This focus is increasingly relevant because the liquidity and information constraints faced by SMEs often make it difficult for them to access financing that aligns with the characteristics of their innovations, unlike large companies with access to capital markets and asset diversification (Feng et al., 2023). In a broader context, investment in science, technology, and innovation not only strengthens the innovative capacity of businesses but also drives structural economic transformation and long-term growth, where SMEs play a strategic role as agents of the national innovation system (Jia et al., 2020; Jjagwe et al., 2024). Schumpeter (2021) states that innovation has disruptive power that drives the creation of new value through products and processes that displace old orders and open up opportunities for sustainable economic expansion. Therefore, understanding the most effective financing channel configurations to strengthen SMEs' innovation capabilities is an important agenda in developing policies and a business ecosystem that is more inclusive and responsive to future dynamics.

Amidst the growing need for SMEs to innovate, advances in financial technology, the digitization of financial services, and the development of various financing schemes–both from the public and private sectors–have opened up new opportunities for this sector to access capital that was previously difficult to obtain (Block et al., 2018; Bruton et al., 2015). Alternative financing channels such as venture capital, angel investors, crowdfunding, and blended finance are seen as capable of addressing the classic limitations of SMEs, such as insufficient collateral, weak credit history, and high information asymmetry risks (Colombo & Grilli, 2007; Wonglimpiyarat, 2015). However, on-the-ground realities show that many SMEs still face barriers in leveraging these opportunities, primarily due to low financial literacy, administrative capacity, and insufficient institutional readiness to engage with complex financing instruments (Feng et al., 2023). Although the literature widely acknowledges the importance of innovation as a driver of growth, there remains a significant gap in understanding how various financing channels can be tailored to the unique characteristics of SMEs to effectively facilitate their innovative processes. SMEs are generally constrained by limited access to capital markets, high perceived risk from lenders, and a lack of financial products to support innovation activities (Cirera et al., 2021). From a Schumpeterian perspective, SMEs' ability to sustainably generate innovation heavily depends on the ease of access and sufficiency of available financing (Jia et al., 2020). Various studies show that SMEs isolated from the formal financial system are more vulnerable to stagnation in growth and a lack of innovative activity (Vavrek et al., 2022). Therefore, a systematic study evaluating the relationship between financing channel characteristics and innovation dynamics in the SME sector is crucial for strengthening these businesses' competitiveness and long-term resilience.

Global economic uncertainty, competitive pressure from large companies, and fiscal policy dynamics in various countries have reinforced the urgency for SMEs to understand and navigate an increasingly complex financing landscape (Hamza et al., 2024). Without a systematic understanding of the diversity of financing channels and their suitability for innovation needs in the SME sector, there is a significant risk of a mismatch between innovative capital requirements and the availability of appropriate financial support (Lee et al., 2015). A study is needed that maps the variety of

financing channels available and evaluates their effectiveness, limitations, and contextual application in supporting the innovative processes of SMEs across sectors and geographical regions (Makhdoom et al., 2019). This study aims to address this gap through a systematic review of various forms of financing channels–both traditional and non-conventional–used by SMEs to drive innovation, with the ultimate goal of strengthening the resilience and competitiveness of this sector in the long term.

This review also seeks to identify specific characteristics and interactions between financing channels and assess the effectiveness of each in facilitating innovative activities. Such analysis is crucial for addressing the structural barriers that innovative SMEs have long faced, ranging from insufficient policy support, limitations in human resource quality and leadership, to challenges in technology mastery and risk management (Hall & Lerner, 2010; Indrawati et al., 2020; Vavrek et al., 2022). Financing issues are not only about access to funds but also the appropriateness of selecting the type of financing to support different stages of innovation (Mazzucato & Semieniuk, 2018). Internal factors such as organizational creativity and leadership effectiveness influence how financing can be mobilized for innovative purposes (Saunila, 2020). A deep understanding of innovation financing in SMEs also contributes to developing a more resilient economic structure. The financial behavior of SMEs can be explained through several theoretical approaches such as the hierarchy theory (Myers & Majluf, 1984), the life cycle theory (Chittenden et al., 1996), agency theory (Jensen & Meckling, 1979), and the credit constraint theory (Stiglitz & Weiss, 1981). Therefore, identifying the most commonly used types of financing and evaluating their impact on innovation outcomes is crucial for testing the validity and applicability of these theories in the SME context. The interplay between R&D investment, innovation outcomes, and financing success also forms a critical foundation for formulating effective public policies.

Literature that comprehensively discusses the relationship between financing and innovation is still limited. Previous studies such as Hall & Lerner (2010) highlight the theoretical basis of R&D investment and its relationship with financing. Agency issues in financing innovative projects (Chishti & Sinha, 2022), emphasize the role of debt in supporting innovation Croce et al., (2019) and focus on the interaction between innovation and corporate finance (He & Tian, 2018). Unlike previous approaches, this study explicitly focuses on SMEs and objectively evaluates the impact of various funding sources on their innovation outcomes. This review also highlights the emergence of alternative actors such as crowdfunding platforms that have the potential to enhance financial inclusion in innovation financing (Burger et al., 2020; Halim, 2024). The contribution of this article not only fills a gap in the literature, which has traditionally been too focused on large companies, but also provides important insights through mapping the most frequently studied funding sources, identifying key features of funding channels, and analyzing their functional relationships with SME innovation performance across various contexts. Additionally, this review highlights the most influential authors and works in this field, which can serve as primary references for further research and evidence-based policy development.

LITERATURE REVIEW

Financing plays a crucial role in driving the innovative performance of small and medium-sized enterprises (SMEs), especially given the limitations of internal resources, which are often the main obstacle to initiating and developing innovation processes (Zhang et al., 2022). Innovation in SMEs is often experimental and requires medium- to long-term financial support, both in the initial research phase and during commercialization. Literature indicates that access to appropriate funding sources can enhance SMEs' capacity to explore new technologies, develop products, and expand market reach through structured innovative activities (Brown et al., 2009; Indrawati et al., 2020). Timely and relevant financing also enables SMEs to improve operational efficiency, strengthen their competitive position, and accelerate the time-to-market process of developed innovations (Canepa & Stoneman, 2007). Without adequate financial support, the innovative potential within SMEs tends to remain underutilized and even risks stalling at the idea exploration or prototype stage (Radas & Bozic, 2012; Yao et al., 2024).

Not all forms of financing are suitable for SMEs, which typically require flexible, non-standardized solutions and often operate in high-risk environments (Amadasun & Mutezo, 2022). Conventional financing channels, such as bank loans, often require collateral and a strong credit history, which pose significant challenges for SMEs in their early stages or those without established financial records. Information asymmetries, high interest rates, and stringent administrative requirements trap many SMEs in what is known as the "funding gap," hindering the realization of innovative ideas into marketable solutions (Cressy, 2012; Esho & Verhoef, 2022). In response to these limitations, various forms of alternative financing have emerged rapidly over the past decade, such as venture capital, angel investors, crowdfunding, revenue-based financing, and public–private financing schemes (blended finance) (Block et al., 2018; Bruton et al., 2015). The emergence of these alternatives offers hope for innovative SMEs that are underserved by traditional mechanisms. Venture capital and angel investors, for example, not only provide funding but also bring strategic expertise, business networks, and managerial guidance that are highly valuable to new entrepreneurs (Colombo & Grilli, 2007). On the other hand, crowdfunding provides SMEs the opportunity to secure public support without having to relinquish ownership or bear interest burdens, while also serving as a tool to directly validate market demand (Belleflamme et al., 2014; Stefanelli et al., 2022).

Alternative financing also has limitations, including high levels of competition, reliance on digital literacy and marketing communication, and uneven availability of platforms in rural areas and developing countries (Ozili, 2020). This indicates that financing solutions must consider contextual factors such as digital infrastructure, investment culture, and the readiness of the local financial ecosystem (Kabakova & Plaksenkov, 2018). At the macro level, the design and effectiveness of the national financial system significantly influence SMEs' access to financing. Countries with inclusive financial systems and pro-innovation regulations tend to have more diverse and responsive financing ecosystems tailored to SME needs (Jordão & Novas, 2024; Yasir & Majid, 2017). Developing countries facing macroeconomic instability and institutional weaknesses often encounter greater structural barriers in providing innovative financing. The literature emphasizes the importance of policy interventions in the form of fiscal incentives, credit guarantee programs, research grants, and the establishment of specialized financing institutions for innovative SMEs (Feng et al., 2023; Xiang & Worthington, 2017). Not only external factors, but financing dynamics are also significantly influenced by internal factors within SMEs. Financial literacy, managerial capacity, entrepreneurial orientation, and innovative leadership are key elements that impact SMEs' ability to access and utilize financing (Isichei et al., 2020; Saunila, 2020). Proactive and visionary business leaders tend to be more open to external financing, better able to develop credible business proposals, and more prepared in risk management. Conversely, a lack of financial literacy often leads SMEs to fail to understand the intricacies of financing instruments, ultimately making them reluctant or unable to complete the funding application process (Hussain et al., 2018).

Several conceptual frameworks are used to understand financing behavior in the SME sector. Due to transaction costs and information asymmetry, the pecking order theory explains that companies prefer internal financing, debt, and external equity (Myers & Majluf, 1984). In the context of SMEs, this theory is highly relevant because limitations in accessing external capital often force owners to rely on personal resources or retained earnings. Agency theory highlights potential conflicts between business owners and financiers, particularly in innovative projects with high uncertainty and long-term outcomes (Jensen & Meckling, 1979). The credit rationing theory by Stiglitz & Weiss (1981) also explains why financial institutions tend to limit credit to SMEs due to moral hazard risks, adverse selection, and high monitoring costs. The life cycle theory also asserts that SME financing preferences change as the company progresses through its development phases—starting with personal and family funds, then shifting to external capital as the company grows (Chittenden et al., 1996).

The literature has also begun to adopt an innovation ecosystem approach, emphasizing the importance of collaboration between businesses, financing institutions, academics, government, and other supporting communities (Autio et al., 2018). In this approach, financing is not viewed in isolation but as part of a mutually reinforcing support network. Therefore, financing policies must be linked to strengthening the innovation ecosystem to ensure more sustainable impacts. Although

research on financing and innovation is growing, a significant literature gap remains, particularly regarding the SME context. The study by Hall & Lerner (2010) did review R&D financing in general, but most of its focus was on large companies and did not delve deeply into the SME context. Innovation in large corporations and the dynamics of capital markets may not be relevant to SMEs, which have different scales, business models, and risk preferences (He & Tian, 2018). A systematic review of innovative financing channels in the SME context is crucial for developing policies and business practices that better align with their needs. It is important to emphasize that mapping innovative financing channels is useful from an academic perspective and contributes to formulating public policy, designing financial institution interventions, and strengthening of SME competitiveness. Such studies pave the way for breakthroughs in bridging the financing gap and strengthening the position of SMEs as important agents in economic growth and innovation-based industrial transformation.

METHODS

This study uses a Systematic Literature Review (SLR) approach to analyze the relationship between financing channels and SME innovation performance, following the PRISMA guidelines to ensure transparency and replicability. Literature was collected from five major databases: Scopus, Web of Science, ScienceDirect, Emerald Insight, and Google Scholar, using relevant keywords. Of the 1,258 articles found, 65 were selected for in-depth analysis.
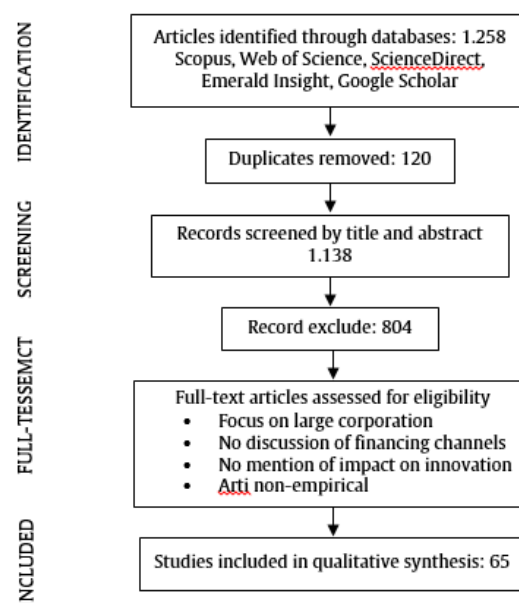

Figure 1. The PRISMA flow chart

The PICO framework was used to formulate research questions, focusing on SMEs (Population), financing channels (Intervention), comparisons between channels (Comparison), and innovation outcomes (Outcome). Analysis was conducted through thematic synthesis to identify key patterns regarding the role of financing in supporting innovation. This study produced a conceptual framework showing that the effectiveness of innovation financing is highly dependent on the suitability of the type of funding to the internal conditions of SMEs and external support. The validity of the results is maintained through database triangulation, double review, and audit trails. The main methodological contribution lies in synthesizing empirical evidence and conceptual mapping relevant to policy and further research.

Table 1 **PICO Format for the research question**

Element	Description	Explanation (in research context)
P *(Population)*	Small and Medium Enterprises (SMEs)	The study's analysis unit is SMEs that innovate in various sectors and regions.
I *(Intervention)*	Access to various capital/financing channels (e.g., bank loans, venture capital, crowdfunding, government grants)	The study examines traditional and alternative forms of financing used to support innovation.
C *(Comparison)*	Different types of financing channels and their effectiveness	Comparisons are made between financing channels in promoting innovation (e.g., bank loans vs. venture capital).
O *(Outcome)*	Innovation performance and resilience of SMEs	The results examined include innovation intensity, commercialization success, and business resilience in the face of uncertainty.

Institutional and Geographical Mapping of Data Sources in SME Innovation Financing Studies

To strengthen the geographical and institutional dimensions of the literature analysis, this study also mapped the types and number of databases used by previous studies in various countries. As shown in Table 2, some countries such as Germany, South Korea, and China have access to several public databases that support research on SME innovation financing. In contrast, developing countries such as Nigeria and Vietnam rely relatively on limited data sources.

Table 2 **Databases used in research studies across various countries**

Country	Number of Databases	Databases Used
China	5	Wind database, CSM, AR & Choice, NEEQ, national SME survey, stock market data
South Korea	5	Technology Development Assistance Fund (TDAF), NTIS, NICE Information System, R&D project reports, Korea Science and Technology Promotion Fund (KOSEF)
Germany	8	Bureau van Dijk (BvD), BvD Orbis, Mannheim Innovation Panel (MIP), Creditreform, 'Deutsches Patent-und Markenamt' (DPMA), innovation panel, and European patent data
Europe	1	SAFE survey of SMEs involving 24,663 companies across 20 European countries
Italy	3	Italian Manufacturing Firms Survey, Italian Community Innovation Survey (CIS), and AFIF accounting data (2011–2012)
Poland	2	POIR 2014–2020, COS
United Kingdom	3	FAME, Amadeus, Bankscope
Australia	1	Business Characteristics Survey (BCS)
Bangladesh	3	Bangladesh Economic Review, National Accounts Statistics, Microcredit Regulatory Authority Reports (MRA 2017)
Belgium	1	Flemish Innovation Database
Spain	1	CDTI, EIT, PITEC
Netherlands	1	Kompass Business Database
India	1	Indian Enterprise R&D Survey
Nigeria	1	Nigerian Innovation Survey (NIS)
Norway	1	National R&D Survey
Portugal	1	SABI (Iberian Corporate Financial Database)
Arab Region	1	World Bank Enterprise Surveys
MENA	1	World Bank MENA Enterprise Surveys
Vietnam	1	Vietnam SME Survey conducted by CIEM with IDS support

Country	Number of Databases	Databases Used
Indonesia	2	Indonesian Business Survey by Statistics Indonesia (BPS), and Innovation Research Reports from BRIN and Ministry of Industry (2022)

Note: This table lists the datasets used in various countries to examine how financing channels impact SME innovation. Only publicly accessible or published data sources are included; proprietary or private survey-only studies are excluded.

To enrich contextual understanding of the geographical distribution of research examining the relationship between financing channels and SME innovation performance, this study also maps the geographical distribution of the reviewed articles. This spatial analysis provides an overview of which countries are the focus of attention in the relevant literature and indicates the academic intensity and availability of data in each region. Thus, this mapping serves as additional information and directs readers to potential geographical gaps in existing scientific studies. The following map visually represents the number of studies identified based on country of origin.
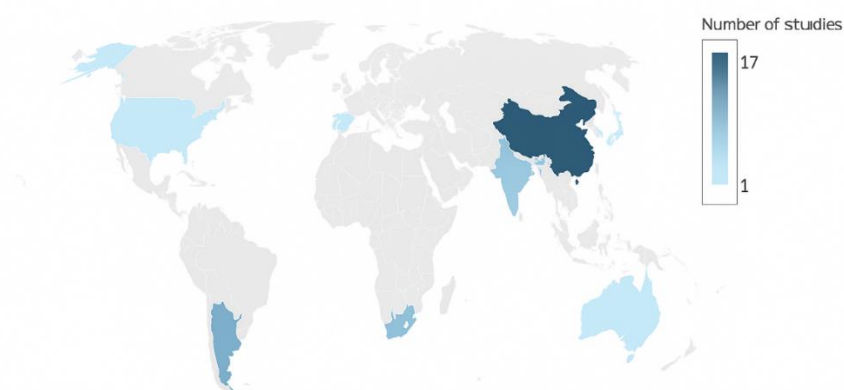
Figure 2 Number of Studies by countries

The choropleth map illustrates the geographical distribution of studies in this systematic literature review. The map shows that China, South Korea, India, Germany, and the United Kingdom are the countries with the highest concentration of academic contributions related to SME innovation financing. These countries benefit from well-established research infrastructure and easily accessible public databases to support empirical research. On the other hand, studies from developing regions such as Southeast Asia, Sub-Saharan Africa, and South America are severely underrepresented, highlighting a geographical research gap that requires further investigation. The number of studies ranges from 1 to 17, with darker colors indicating higher frequencies.

Variations in Research Models in Studies of SME Innovation Financing

To identify the dominant methodological approaches in studies of innovation financing in SMEs, the research models used in 65 selected articles were classified. This analysis is important for understanding the epistemological trends and analytical techniques evolving in the literature, whether from quantitative, qualitative, or mixed approaches (Adegboye & Iweriebor, 2018; Pickernell et al., 2013). As presented in Table 3, the most frequently used models originate from empirical and econometric approaches, reflecting the dominance of studies based on quantitative data. Econometric models such as the Generalized Method of Moments (GMM), panel regression, and Probit/Logit regression are commonly used techniques to test the relationship between financing channels and innovation performance (Brown et al., 2020; Guijarro et al., 2016). Additionally, two-stage approaches like PSM-DID (Propensity Score Matching and Difference-in-Differences) demonstrate the adoption of quasi-experimental methods in assessing the impact of financing. From a statistical perspective, models such as Structural Equation Modeling (SEM), cluster

analysis, and Data Envelopment Analysis (DEA) are also used to explain the effectiveness and efficiency of financing on innovation output. Meanwhile, conceptual research often utilizes pecking order, agency, and life-cycle theories to develop frameworks (Hall & Lerner, 2010; Myers & Majluf, 1984).

Table 3 Categorization of Research Models Used in SME Innovation Financing Studies

Research Models	Econometric	Empirical	Statistical	Theoretical	Total
ARDL (Autoregressive Distributed Lag) model	1				1
Tweedie count data models		1			1
Two-step econometric procedures	1				1
Pearson correlation and multiple regression		2			2
Descriptive statistics with DiD			1		1
Factor analysis with regression		2			2
PSM & DiD hybrid	1				1
GMM (Generalized Method of Moments)	1	1			2
Structural Equation Modeling (SEM)			1		1
Conceptual frameworks (agency, pecking order, life-cycle)				2	2
Multilevel/panel regression models	1	1			2
Probit / Logit / Tobit models	1	1			2
SVAR (Structural VAR)	1				1
RDD (Regression Discontinuity Design)	1				1
Survival (duration) analysis		1			1
Data Envelopment Analysis (DEA)			1		1
Time-series forecast models	1				1
Dynamic panel threshold regression	1				1
Bayesian regression	1				1
Cluster analysis			1		1
Path analysis		1			1
Input-output analysis	1				1
Case study multiple comparative		3			3
Delphi technique		2			2
Meta-analysis			2		2
Literature-based conceptual synthesis				3	3
Thematic synthesis (SLR-based qualitative)		3			3
Interview-based inductive coding		3			3
Qualitative comparative analysis (QCA)	1	1			2
Mixed-methods integration	1	1			2
Fuzzy-set qualitative comparative analysis (fsQCA)		1	1		2
Innovation radar framework		1			1
Stakeholder mapping & innovation ecosystem modeling		1			1
Grand Total	16	34	7	8	65

These variations in models not only demonstrate the complexity of the phenomenon of innovation financing in the SME sector, but also illustrate a methodological shift from simple linear regression analysis to multi-level, mixed-methods, and even more in-depth qualitative analysis approaches. This indicates that researchers increasingly recognize the need for a holistic approach to capture the dynamics between financial, organizational, and environmental factors in supporting SME innovation. Therefore, it is recommended that future studies consider using mixed-methods

designs or integrating more exploratory theoretical models to strengthen findings and policy generalizations.

RESULT

Diversity of Financing Channels

This study reveals that financing channels to support innovation in the SME sector are not homogeneous, but are greatly influenced by geographical context, financial market structure, and industry sector characteristics. Studies reviewed indicate that conventional financing channels such as bank loans, leasing, and collateral-based financing remain the dominant choice, particularly in developed countries with established banking systems and regulatory frameworks supporting SMEs (Dorasamy & Kikasu, 2024; Feng et al., 2023). Bank loans remain the go-to option due to ease of access, long-term trust, and relatively stable interest rates in developed markets (Jordão & Novas, 2024). This conventional financing approach often does not suit innovative SMEs with high-risk profiles, fluctuating cash flows, and insufficient revenue track records (Harel & Kaufmann, 2016). Issues such as asymmetric information, limited assets for collateral, and faster time-to-market are major obstacles when SMEs seek financing from banks (Wonglimpiyarat, 2015). This is where non-traditional financing channels play a crucial role as catalysts for innovation. Over the past decade, channels such as venture capital (VC), angel investment, crowdfunding, private equity, and blended finance have seen a significant increase in adoption, particularly in the technology, innovation-based manufacturing, and creative industries sectors (Block et al., 2018; Bruton et al., 2015; Helmchen et al., 2020).

Studies such as those by v opens access to strategic resources like mentoring, business networks, and market validation. Crowdfunding, especially reward-based and equity-based, offers benefits such as direct engagement with consumers and early testing of innovative products (Belleflamme et al., 2014). Meanwhile, schemes like government-backed venture funds (GVFs) that have developed in East Asian countries (e.g., China and South Korea) have proven effective in increasing the availability of risk financing for SME startups without eliminating private sector profit incentives (Owen et al., 2019). Geographically, innovation in these financing channels is most prominent in China, India, South Korea, Brazil, and Northern European countries. These countries have strong startup ecosystems, widespread business incubators, and active government policies in creating legal and fiscal frameworks that encourage private investment in the SME sector (Botelho & Almeida, 2024). Developing countries such as Indonesia, Kenya, Vietnam, and Nigeria also show progress despite facing various structural limitations. In Indonesia, for example, the emergence of equity crowdfunding regulated by the Financial Services Authority (OJK) since 2018 has opened new opportunities for innovative SMEs to access financing from the general public, in line with the implementation of OJK Regulation No. 37/POJK.04/2018 on Crowdfunding Services Through Technology-Based Share Offerings (Equity Crowdfunding). However, the penetration of this channel is still limited by low digital literacy and investor confidence in local startups (Tambunan, 2019).

Figure 3 shows that while the Western region still leads in conventional financing channels, the Asia-Pacific region is more progressive in adopting digital and participatory alternative financing channels. This finding aligns with literature emphasizing the importance of adapting financing channels to regional contexts, technological readiness, and institutional characteristics (Adegboye & Iweriebor, 2018; Agyei et al., 2022; Fombang & Adjasi, 2018). This graph reinforces the finding that SME financing channel choices are significantly influenced by institutional infrastructure, the availability of financial instruments, and the level of financial and digital literacy in each region (Fombang & Adjasi, 2018). Furthermore, financing channels are not merely substitutive but complementary, depending on the growth phase of SMEs and the characteristics of their sector (Adegboye & Iweriebor, 2018; Agyei et al., 2022). Geographical differences also reflect the state's role in shaping an innovative and inclusive financing ecosystem.
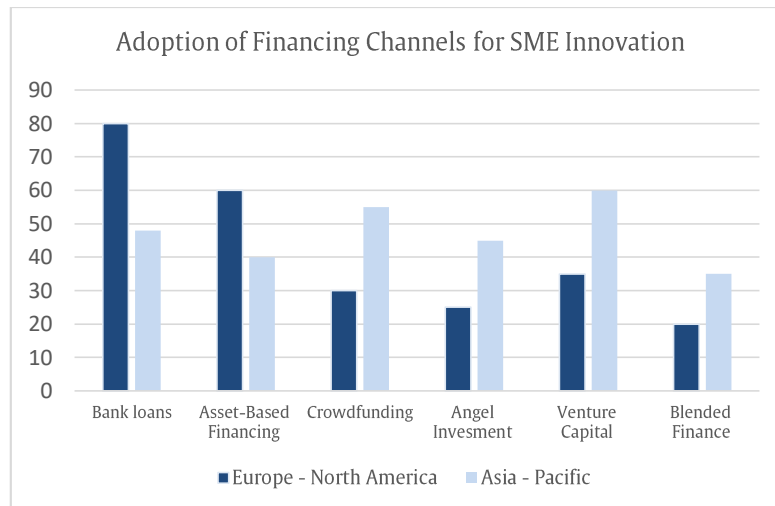
Adoption of Financing Channels for SME Innovation

Figure 3 Adoption of Financing Channels for SME Innovation by Region

The thematic analysis results indicate that the financing channel choice also correlates with the stage of the SME life cycle (Nicolas, 2022; Song et al., 2021). In the early-stage and seed funding phases, angel investors and crowdfunding channels are more dominant because they do not require collateral and offer high flexibility (Bessière et al., 2020; Capizzi & Carluccio, 2016). On the other hand, companies in the expansion or scale-up stage are more likely to choose bank loans or venture debt, which provide greater leverage with more controlled risk levels. Theoretically, this variation in financing channels can be explained through the life-cycle and pecking order theories. The life-cycle theory explains that the optimal type of financing varies depending on the company's age, scale, and level of innovation readiness (Chittenden et al., 1996). Meanwhile, the pecking order theory explains the tendency of SMEs to prefer internal financing, debt, and external equity–primarily due to management control and information asymmetry (Myers & Majluf, 1984). The diversity of financing channels is not merely a technical choice but a reflection of risk management strategies, local institutional structures, and a country's entrepreneurial culture. In countries with a low-risk culture, equity-based financing often faces resistance, while in countries with tax incentives for innovative investments, channels like venture capital grow rapidly (Bonini & Capizzi, 2019; Dowling et al., 2019). Thus, the conclusion that can be drawn from this section is that there is no "one-size-fits-all" approach to selecting SME innovation financing channels (Yao et al., 2024). The combination of local market structure, SME internal readiness, and public policy support significantly determines the effectiveness of financing on innovation outcomes (Didonet & Villavicencio, 2020; Wonglimpiyarat, 2015). Therefore, policy interventions should not only focus on providing funds but also strengthen financing institutions, expand networks of stakeholders, and enhance SMEs' financial literacy so they can strategically and sustainably utilize these channels.

Mismatch between Innovation Needs and Financing Characteristics

One of the main findings in this literature study is the structural mismatch between the characteristics of available financing and the unique needs of SME innovation. Most traditional financing, especially that sourced from financial institutions such as banks and microcredit institutions, is based on the prudential principle, which emphasizes collateral, cash flow stability, and short-term return certainty (Dorasamy & Kikasu, 2024; Wonglimpiyarat, 2015). In contrast, innovation–especially in the form of research and development (R&D), prototyping, or disruptive business models–has very different characteristics: high risk, uncertainty, intangibility, and a long-term nature. SMEs in the early stages of developing new technologies or products often face difficulties in obtaining suitable financing. Innovative projects require flexible funding, high risk tolerance, and a longer investment return horizon. Conventional financial institutions are often reluctant to finance such activities because they do not align with their traditional risk assessment models (Colombo & Grilli, 2007).

Literature indicates that this disparity is most pronounced in developing countries that lack mature innovation ecosystems. In many Asian, African, and Latin American countries, financial infrastructure does not yet support the development of risky financing instruments such as venture capital, innovation bonds, or risk-sharing schemes (Feng et al., 2023; Mazzucato & Semieniuk, 2018). As a result, many SMEs with high innovation potential face stagnation due to their inability to bridge the funding gap they encounter (Wonglimpiyarat, 2015). Some solutions emerging from the literature include the government's role as a catalyst in providing de-risking instruments, such as innovation credit guarantees, matching funds for research projects, and triple-helix partnerships between government, universities, and industry (Guerrero & Urbano, 2017). In European countries, the use of schemes such as Horizon 2020 and EIC Accelerator has become a model for providing milestone-based funding that aligns with the characteristics of the innovation cycle (Anderson B et al., 2022; Anderson et al., 2019). Studies also highlight the importance of differentiating funding based on the stage of innovation. Incremental innovations with low risk may be financed through conventional bank loans, but radical or disruptive innovations require more sophisticated approaches such as equity financing or blended instruments. This mismatch often explains the high failure rate of innovations in SMEs, especially when they are forced to use financing instruments that do not align with their product development cycle. The gap between financing supply and innovation needs must be addressed through adaptive financial policy design, the provision of innovative financing products, and the strengthening of SME institutional capacity to navigate the complexity of available financing sources (Sierra, 2019). In addition, it is also important to improve the financial literacy of SME actors so that they can understand the risks, capital structure, and appropriate investment strategies to encourage long-term innovation.

Internal Factors as Mediators of Financing Effectiveness

One crucial aspect identified in the literature on SME innovation financing is the role of internal factors as mediators in determining how effectively external funds can be used to support innovative activities. This means that even if financing is available and accessible, its success depends heavily on the internal quality of the organization managing the funds (Isichei et al., 2020). Financial literacy is one of the basic prerequisites. SMEs with adequate understanding of financing structures, investment risk calculations, and cash flow management are better equipped to navigate various financing options and develop sustainable funding strategies (Aliano et al., 2024). Low financial literacy has been proven to be one of the main causes of SME failure in utilizing financing, both from the public and private sectors (Feng et al., 2023). Managerial capacity plays a strategic role in integrating financing with business innovation plans. This includes the ability to develop credible business plans, manage innovation projects with discipline, and adapt organizational structures to meet the demands of innovative processes. SMEs with professional management are more likely to utilize funds optimally and generate higher innovation outputs (Saunila, 2020). A leadership style oriented toward innovation also acts as a catalyst in creating an organizational culture that supports risk-taking, learning, and experimentation. Visionary leaders who are responsive to market dynamics and capable of fostering cross-functional collaboration are more successful in translating funding support into long-term innovative advantages (Hooi, 2021). Previous studies emphasize that the effectiveness of funding is not solely determined by the amount of funds obtained but is highly dependent on the organization's internal readiness to manage and utilize them productively and strategically (Isichei et al., 2020; Saunila, 2020). This means that even substantial funding can be ineffective if it is not supported by competent internal structures, good governance systems, and an organizational culture that is adaptive to change and innovation risks (Feng et al., 2023).

This is in line with the results-based financing approach, which is a financing policy paradigm that emphasizes the importance of linking fund disbursement to the achievement of tangible and measurable results, rather than solely to administrative processes or the amount disbursed (Chen et al., 2024; McIsaac et al., 2018). In the context of innovative SMEs, this approach requires a more dynamic and flexible performance evaluation system, including the ability to assess innovative potential from the outset and tailor financing schemes to the growth needs of each SME (Mazzucato & Penna, 2016).

Table 4 Internal Factors Mediating the Effectiveness of Innovation Financing in SMEs

Internal Factor	Role/Function	Impact on Innovation Financing	Supporting Studies
Financial Literacy	Ability to select appropriate financial instruments and manage risk	Enhances funding decision-making and reduces default risk	Feng et al., (2023); Isichei et al., (2020)
Managerial Capability	Planning, resource allocation, project management	Increases absorption capacity of external funds	Radas & Božić, (2009); Saunila, (2020)
Innovative Leadership	Encourages experimentation, tolerance for failure, and visioning	Translates financial resources into productive innovation outcomes	Hooi, (2021); Sattayaraksa & Boon-itt, (2016)
Organizational Learning	Captures, retains, and applies knowledge from funded innovation	Sustains innovation performance and financing continuity	Nasir et al., (2022)
Digital Competence	Adoption of financial technology, data-driven innovation	Facilitates efficient financial reporting and investor trust	Li et al., (2023); Shahadat et al., (2023)

For this reason, intervention programs focused on internal capacity building become crucial (Shahadat et al., 2023). Financial capacity building, for example, not only enhances SMEs' ability to prepare financial statements or draft funding proposals but also equips them with knowledge about capital structure, financial risk management, and long-term financing strategies (Isichei et al., 2020). This helps SMEs build credibility in the eyes of investors and financial institutions, as well as strengthen their bargaining power in financing negotiations (Feng et al., 2023). Additionally, managerial capacity plays a strategic role in integrating financing with business innovation plans (Saunila, 2020). This includes the ability to develop credible business plans, manage innovation projects with discipline, and adapt organizational structures to meet the demands of innovative processes (Nasir et al., 2022). Studies show that SMEs with professional management are more successful in leveraging external funds and generating higher innovation outputs (Radas & Božić, 2009).

Innovative leadership styles also act as catalysts in creating an organizational culture that supports risk-taking and experimentation (Hooi, 2021). Visionary SME leaders who are responsive to market changes and collaborative are more effective in directing funding toward innovative activities that have an impact (Sattayaraksa & Boon-itt, 2016). Such leadership styles have also been proven to enhance an organization's capacity to adopt new technologies and build strategic partnerships (Shahadat et al., 2023). Furthermore, the integration of external financing and internal organizational strengths creates a sustainable innovation cycle, where each successfully managed funding round strengthens internal structures, thereby enhancing the capacity to access future financing (Li et al., 2023). This creates a strategic learning loop where SMEs not only survive financially but also grow adaptively in the face of market and technological dynamics (Autio et al., 2018). Therefore, policy interventions should not stop at creating innovative financing products but should be expanded to include capacity-building support for SMEs (Feng et al., 2023). This approach requires collaboration between financial institutions, government, universities, training institutions, and SME support communities in forming an innovative financing ecosystem based on capabilities (Isichei et al., 2020). Such an ecosystem is more resilient to external shocks and creates a foundation for inclusive and sustainable innovative growth (Mazzucato & Semieniuk, 2018).

The Role of Institutional Ecosystems and Policies

One of the key findings of this literature review is the importance of institutional ecosystems in creating conditions that enable SMEs to access and utilize innovation financing effectively (Nasir et al., 2022). This ecosystem encompasses regulatory frameworks, fiscal incentives, institutional quality, availability of public data, and the active role of both public and private financial institutions (Jordão & Novas, 2024). In many developed countries, there is good policy integration between research institutions, financing institutions, and relevant ministries in

designing innovation funding schemes (Breuer et al., 2023). This coordinated approach has proven to improve the efficiency of fund distribution, reduce information asymmetry, and accelerate innovation growth in the SME sector (Wang et al., 2022). Countries like Germany, for example, through the KfW Development Bank, provide soft financing supported by statistical data integrated with the national innovation monitoring system (Carreras, 2023). Similarly, South Korea has the KOBIZ scheme and the government's Venture Capital Matching Fund, supported by technology institutions like KOTEC and KISED (Kim & Lee, 2025). Meanwhile, developing countries face significant challenges such as limited data infrastructure, weak policy evaluation systems, and insufficient incentives for private investors (Dorasamy & Kikasu, 2024). This institutional infrastructure gap implies low effectiveness of innovation financing programs, even when funds are available.

To illustrate the systemic framework of external factors that play a role in supporting SME innovation financing, Figure 4 below presents an ideal institutional ecosystem diagram based on a synthesis of the literature.
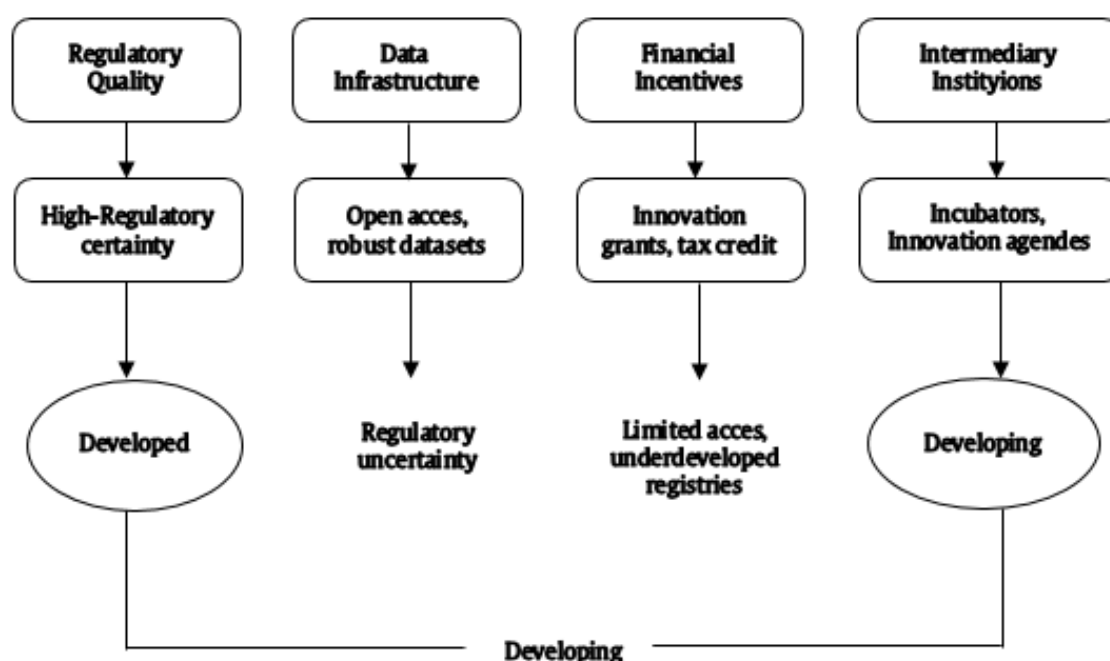
Figure 4 **Institutional Ecosystem Support for SME Innovation Financing**

After reviewing the existing literature, it is clear that the effectiveness of innovation financing is not only determined by the availability of financial channels, but also by the systemic strength of the underlying institutional ecosystem (Mazzucato & Penna, 2016). This ecosystem approach emphasizes the importance of synergy among various actors–such as government agencies, the financial sector, research institutions, business incubators, universities, as well as industrial networks and entrepreneurial communities–in creating an enabling environment for the innovative growth of SMEs (Edquist & Zabala, 2012; Nasir et al., 2022). In this context, innovation is not viewed as the result of company activities alone, but rather as the product of interactions among actors within national and regional innovation systems (Stojčić, 2021). Countries that can build collaborative support systems between the public and private sectors tend to have SMEs that are more adaptive, responsive to new market opportunities, and better able to manage innovation risks (Jordão & Novas, 2024). For example, programs such as Horizon Europe in the European Union or Small Business Innovation Research (SBIR) in the United States have demonstrated how the integration of public funding, technological support, and fiscal incentives can accelerate the growth of innovation-based SMEs (Edler & Fagerberg, 2017; Elert et al., 2017). These policies not only provide initial capital for research and development (R&D) but also open access to markets through

government procurement and international research collaboration, expanding the reach of SME innovation.

Conversely, in developing countries, weak coordination among institutions, inconsistent regulations, and limitations in public information systems are major obstacles to the formation of an effective financing ecosystem (Dorasamy & Kikasu, 2024; Bruton et al., 2015). The absence of a one-stop system or digital public infrastructure for SME data collection and financing schemes often leads to a mismatch between policy and on-the-ground needs (Dorasamy & Kikasu, 2024). This is exacerbated by low digital literacy, poor bureaucratic quality, and minimal participation of research institutions in strategic decision-making (Sedeh et al., 2022). This situation limits the financing channels available to meet the needs of innovation-oriented SMEs, which typically require capital support with high-risk characteristics and long-term durations (Mazzucato & Semieniuk, 2018). In the case of Indonesia, for example, innovative financing constraints often stem from a lack of synchronization between ministries, regional financial institutions, and research institutions, leading to inefficiency and program duplication. Even when funding is available, lengthy and SME-unfriendly administrative procedures hinder its optimal utilization (Indrawati et al., 2020).

Furthermore, the effectiveness of policy interventions is also significantly influenced by the quality of governance and institutional transparency. Without accountable governance, various financing schemes tend to experience leaks or misallocation, thereby failing to create systemic impacts on SME innovation growth (Dorasamy & Kikasu, 2024). To address this, several studies recommend evidence-based policymaking designs that utilize real-time data, impact evaluations, and local actor participation in the design and implementation processes (Georghiou et al., 2014; Wang et al., 2022). Therefore, strategies for developing an innovation financing ecosystem should not only focus on mobilizing funds but also on strengthening institutional structures, incentive-based regulations, and the availability of publicly accessible data to support evidence-based decision-making (Feng et al., 2023; Wang et al., 2022). In this regard, fiscal regulations such as tax credits for R&D, the establishment of innovative credit guarantee institutions, and mission-oriented funding are considered effective in promoting market-driven research (Soumonni & Ojah, 2022). Overall, this literature emphasizes that strengthening the institutional ecosystem is not a supplementary aspect but a fundamental element that distinguishes between sustainable and stagnant innovation financing systems. Building this ecosystem requires a cross-sectoral approach, multi-level governance collaboration, and long-term investment in social and technological infrastructure that supports SME innovation (Edquist & Zabala, 2012; Mazzucato, 2021). A balance between state intervention and market dynamics must be maintained to create an inclusive, adaptive, and transformation-based support structure.

Innovation Financing Strategies: Complementarity, Substitution, and Their Impact on SME Performance

After understanding the strategic role of institutional ecosystems and policies in facilitating innovation financing, it is important to examine how these financing channels interact functionally at the operational level of SMEs. This study highlights not only the existence of various financing sources but also the patterns of relationships between these channels–whether they are complementary or substitutive–and how these dynamics impact innovation and financial performance. Innovation financing in the SME sector does not only depend on the availability of funds, but also on how these financing channels interact and contribute to value creation. Recent literature indicates that financing channels do not operate in a vacuum but tend to complement (complementarity) or substitute (substitution) one another, depending on the institutional context and organizational strategy (Fombang & Adjasi, 2018; Hall & Lerner, 2010; Rossi, 2015). Studies show that conventional financing such as bank loans and public funds are often used simultaneously to cover the limitations of self-financing, especially for SMEs that are not yet able to attract private investors (Adegboye & Iweriebor, 2018; Pickernell et al., 2013). Conversely, emerging channels such as venture capital, crowdfunding, and supply-chain finance tend to be more adaptive in supporting disruptive innovation and early-stage product development (Agyei et al., 2022; Bargoni et al., 2024). The effectiveness of this combination depends heavily on the alignment between the type of innovation being pursued and the characteristics of each funding source. Radical innovations or

those based on frontier technologies, for example, require high-risk equity capital such as venture capital or angel investors, while incremental innovations are typically supported by debt-based financing such as bank loans (Dorasamy & Kikasu, 2024; Mazzucato & Semieniuk, 2018).

Traditional banking institutions, as providers of conventional financing, often face limitations in evaluating the potential of innovations based on intangible assets due to their conventional risk assessment approaches (Feng et al., 2023). This creates a need for SMEs to engage in financial orchestration, which is the ability to strategically and adaptively structure and manage a combination of financing options in response to market dynamics and regulations (Colombo & Grilli, 2007; Cumming et al., 2018). The literature also highlights the importance of layered financing strategies, where SMEs utilize various channels sequentially or in parallel according to the stage of the innovation lifecycle. For example, public grants or family financing can fund the initial research stage, crowdfunding supports market validation, and venture capital is used for commercialization (Block et al., 2018). Such combinations help reduce the risk of reliance on a single funding source and enhance SMEs' financial resilience. From a policy perspective, the blended finance approach is relevant in bridging market limitations and accelerating the growth of the innovation ecosystem. Blended finance combines public and private funds to reduce the risks borne by each party and mobilize financing for high-risk or small-scale sectors (Albats et al., 2023; Feng et al., 2023). In developed countries such as Germany and South Korea, this approach has been integrated with national industrial and innovation policies (Jordão & Novas, 2024; Park & Leydesdorff, 2010). In the context of developing countries such as Indonesia, the implementation of blended finance faces structural challenges such as low financial literacy, limited digital access, and a lack of incentives for private investors. Therefore, financing strategies must be developed holistically by involving the government, financial institutions, venture capital, and non-state actors in a mutually supportive financing ecosystem (Fund, 2020).

Table 5 Review of Financial Instruments: Complementary and Substitutive Roles and Their Effects on Innovation and Financial Outcomes

Type of channel	Financing channel	Complementarity	Substitution	Impact on innovation	Financial performance
Traditional	Bank credits	Complements public resources and self-financing	Substitutes self-financing if internal resources are low	High impact on mature companies (Pickernell et al., 2013)	Negative due to debt cost
	Public resources	Complements credits and self-financing	Can substitute insufficient private investment	Product innovation in manufacturing (Adegboye & Iweriebor, 2018)	Context-dependent, generally positive
	Self-financing	Complements credits and venture capital	Substitutes when external funding is limited	Supports innovation cycles. (Hall & Lerner, 2010)	Positive, reduces capital dependence
Emerging	Venture capital	Complements crowdfunding and self-financing	Can substitute in high-risk ventures	High-tech innovation stimulation (Rossi, 2015)	Supports networks and strategic value creation
	Crowdfunding	Complements venture capital	Replaces traditional funding for niche projects	Promotes early-stage innovation (Agyei et al., 2022)	Depends on campaign and audience success
	Supply-chain finance	Complements R&D and industry-specific investment	Not a full replacement	Enhances innovation response (Bargoni et al., 2024)	Optimizes operational resources
	Family and friends	Complements when other funding is inaccessible	Replaces formal mechanisms in early stages	Contextual and informal (Fombang & Adjasi, 2018)	Limited, based on trust and capacity

Table 5 summarizes the roles, characteristics of substitution and complementarity, and the impact of various financing channels on innovation and SME financial performance. Thus, the effectiveness of innovation financing is not merely a matter of availability of funds, but also encompasses the dimensions of orchestration (strategic coordination) and compatibility between various financing channels within a complex and interdependent innovation system (Cumming et al., 2018; Mazzucato & Penna, 2016). SMEs that can synergistically orchestrate financing from various sources–for example, by combining public grants for initial research, crowdfunding for product validation, and venture capital for commercialization–will have greater resilience in facing the risks and uncertainties of innovation (Block et al., 2018; Colombo & Grilli, 2007).

In this case, financial orchestration is not only about technical skills in managing funds, but also strategic abilities to build credible innovation narratives, establish relationships with investors, and read market momentum in a timely manner (Fasnacht, 2018). This becomes increasingly important in the face of a rapidly changing global economic landscape that demands SMEs to adapt to more flexible and performance-based financing systems (Feng et al., 2023; Fombang & Adjasi, 2018). The compatibility between the characteristics of the financing channel and the type of innovation being developed is a key factor in optimizing funding (Sierra, 2019). For example, disruptive technology-based innovations with high levels of uncertainty are better suited to be funded by equity investors such as angel investors or venture capitalists, who are willing to take on risks for high returns (Croce et al., 2019; Mazzucato & Semieniuk, 2018). Conversely, incremental innovations such as production process improvements or product diversification tend to be financed through debt-based financing, provided the company's cash flow is strong enough to meet payment obligations (Hall & Lerner, 2010). Future SME financing strategies need to be designed within the framework of an open innovation system, where the government, private actors, financial institutions, and research institutions collaborate to create an ecosystem that facilitates innovation-based financing (Albats et al., 2023). Within this framework, the state's role is not only as a provider of funds or a regulator but also as an active market shaper that creates incentives, reduces information asymmetry, and builds supporting infrastructure such as an SME innovation rating system or an open R&D project data platform. The policy implications of these findings emphasize the importance of developing an ecosystem-based approach and promoting a policy mix that enables complementary interaction among financing channels rather than competition. Thus, innovation financing is not only a tool for economic growth but also a catalyst for structural transformation in the national economy, particularly in the SME sector.

THEMATIC SYNTHESIS OF FINDINGS

The results of the literature synthesis show that the relationship between financing channels and SME innovation performance is not linear or singular. Instead, the study results indicate structural and contextual complexities that can be categorized into four main themes: (1) Inequality of Access to Financing Channels, (2) Institutional and Regulatory Roles, (3) Internal Capacity and Digital Literacy, and (4) Complementarity and Substitution between Financing Channels.

Accessibility Barriers to Innovation Financing

Access to innovation financing is a critical prerequisite for SMEs to pursue growth based on creativity and technology. However, the literature synthesis reveals that barriers to financing access are not merely technical or administrative issues but reflect the systemic complexity of the relationship between SMEs, financial institutions, and the institutional framework that shapes their interactions (Bruton et al., 2015; Dorasamy & Kikasu, 2024). Structural barriers emerge as a dominant theme in the literature, particularly in developing countries and markets with underdeveloped financial institutions. Market structures that still prioritize collateral-based financing, high interest rates, and the absence of risk mitigation schemes make innovation financing difficult to access for SMEs, which often have high-risk capital needs and long-term investment horizons (Colombo & Grilli, 2007; Feng et al., 2023). Even in developed countries, disparities persist, particularly for startups with disruptive business models that lack formal financial track records and focus on intangible assets (Hall & Lerner, 2010).

On the other hand, non-structural barriers include variables that are more social and cognitive in nature, such as low financial literacy, lack of understanding of investment risks, and limitations in developing convincing business proposals for potential investors (Bargoni et al., 2024; Pickernell et al., 2013). In some contexts, investor confidence in the informal and non-digitized SME sector is also very low, thereby limiting equity-based financing opportunities such as angel investment or crowdfunding. Several studies also highlight that low institutional capacity to intermediary financing–such as the absence of guarantee institutions, limited number of business incubators, and underdeveloped networks of mentors and financial advisors–exacerbates the situation (Mazzucato & Penna, 2016). Incubators and guarantee systems not only function as providers of initial capital but also as risk filters and facilitators bridging the specific needs of SMEs with the preferences of financial institutions. Conceptually, these access barriers can be mapped into three levels: (1) Micro) individual limitations of SMEs (capacity, literacy, self-confidence), (2) Meso) lack of institutional intermediation (incubators, guarantee institutions, business associations), and (3) Macro) rigidity of financial structures and absence of incentive regulations (subsidized loan schemes, tax breaks for venture capital). This synthesis indicates that an effective innovation financing approach requires simultaneous and coordinated interventions across all these levels. Therefore, solutions to access barriers cannot be left entirely to market actors, but require the role of the state and other institutional actors to create an inclusive ecosystem that balances incentives, risk mitigation, and financial learning for innovative SMEs.

Institutional and Regulatory Ecosystem

The institutional ecosystem and regulatory framework not only function as regulators of the financial market, but also serve as enablers for the formation of innovation financing mechanisms that are responsive to the dynamics of SMEs (Aliano et al., 2024; Wonglimpiyarat, 2015). A synthesis of various literature shows that the effectiveness of innovation financing is greatly influenced by the level of institutional readiness and policy coherence that can connect public, private, and entrepreneurial community actors within the innovation ecosystem (Cicchiello, 2019; Thawesaengskulthai et al., 2024). Mission-Oriented Institutions, where one prominent institutional pattern in countries with advanced innovation ecosystems is the presence of public financial institutions specifically designed to fund high-risk innovation projects (Sierra, 2019). For example, the existence of KfW Bankengruppe in Germany, the Korea Development Bank, or the China Development Bank demonstrates how countries can actively create new markets through mission-based financing schemes (Jordão & Novas, 2024). These institutions do not merely fill market gaps but create directionality for SME sector innovation through fiscal incentives, soft loans, and co-financing programs. Policy Coherence and Cross-Sector Coordination where successful countries in promoting SME innovation financing demonstrate a high capacity to create integrated policy frameworks both horizontally (across ministries and agencies) and vertically (national and regional). Programs such as Horizon Europe in the European Union or SBIR (Small Business Innovation Research) in the United States exemplify how financing policies can be directly linked to national agendas in science, technology, and creative industries (Edler & Fagerberg, 2017; Nasir et al., 2022). This coordination is important to avoid program duplication, create a sustainable innovation value chain, and facilitate SMEs in accessing various types of capital from upstream to downstream.

Regulations Promoting Inclusivity and Transparency where an adaptive regulatory system tailored to the needs of innovative SMEs has several key characteristics: transparency in program selection criteria, streamlined administrative procedures, and performance-based incentive policies (Grandis et al., 2023). In this context, countries such as Finland and the Netherlands have successfully created competitive yet inclusive financing ecosystems by applying the principles of open innovation support and data-driven policy evaluation. Regulations designed in a participatory manner are also more likely to result in interventions that are in line with the realities of SME actors, especially in the technology and digital sectors. Institutional Gaps in Developing Countries Developing countries often face institutional voids that directly impact the effectiveness of innovation financing. Inconsistent regulations, overlapping institutional authorities, and the lack of data-based monitoring and evaluation systems are the main causes of the failure of innovation financing programs (Dorasamy & Kikasu, 2024; Wang et al., 2022). This situation often results in

reactive policies that are misaligned or even trapped in an input-based logic rather than outcome-based financing. An Agile and Collaborative Ecosystem, where various research findings recommend shifting from a hierarchical institutional system to a collaborative and agile ecosystem model. In this paradigm, financing is not only viewed as a monetary function but also as an interface between knowledge, policy, and entrepreneurship. Countries like Singapore and Israel have adopted this approach by involving universities, venture builders, and the private sector in the design of innovative financing programs (Mazzucato & Penna, 2016; Nasir et al., 2022). In other words, the success of an institutional ecosystem depends on the ability of its actors to create connectivity, share risks, and accelerate the transfer of knowledge into business solutions.

Internal Capabilities and Digital Financial Literacy

The success of SMEs in accessing and managing innovation financing is not only determined by external structures such as regulations and market infrastructure, but also heavily dependent on the internal capacity of the organization. This theme highlights the importance of financial literacy, strategic management, and digital competence as the foundation for organizations to participate effectively in the innovative financing ecosystem.

1. Financial and Managerial Literacy as Prerequisites

Many studies show that SMEs with a good understanding of basic finance–such as reading financial statements, measuring profitability ratios, or preparing cash flow projections–are better able to design credible financing proposals, understand loan requirements, and negotiate effectively with investors (Isichei et al., 2020). Additionally, managerial skills such as strategic planning, data-driven decision-making, and risk mitigation are key factors in the successful utilization of financing for innovative activities (Saunila, 2020). In this context, organizations with visionary leadership and a culture that supports innovation tend to be more proactive in exploring alternative financing channels such as venture capital or research grants.

2. Digital Readiness and Fintech Engagement

Digital transformation in the financial sector has opened up various non-traditional financing alternatives, such as crowdfunding, peer-to-peer (P2P) lending, and supply chain finance. However, access to these channels is highly dependent on SMEs' digital readiness–that is, the extent to which organizations have the tools, skills, and mindset appropriate for the digital ecosystem (Block et al., 2018). SMEs that are not yet digitized often face obstacles in understanding fintech platforms, failing to meet system requirements, or even being unaware of the existence of such channels. A study by Feng et al., (2023) emphasizes that the digital divide is one of the main challenges for SMEs in developing countries. In Southeast Asia and Africa, fintech adoption rates remain low, not because it is unavailable, but because SMEs lack basic digital literacy, such as the use of digital financial platforms, digital verification, or online reporting. This creates structural access barriers, leaving many SMEs reliant on informal financing.

3. Digital Technology as a Tool for Financial Innovation

Several studies show that the adoption of digital technology not only improves internal efficiency but also strengthens the credibility of SMEs in the eyes of funders. The use of cloud-based accounting software, ERP (Enterprise Resource Planning) system integration, and automated financial reporting systems enables SMEs to provide real-time data to potential investors or financial institutions (Agyei et al., 2022). This is important because many new financing channels rely on data-driven credit scoring as the basis for risk assessment. Furthermore, SMEs that can adapt to the digital ecosystem tend to be more responsive to the dynamics of the digital capital market, including asset tokenization, blockchain-based financing, and smart contract-based lending. Although this technology is still in its early stages of adoption, studies show that small businesses that dare to adopt it are faster in obtaining funds for R&D, prototyping, or market expansion (Fombang & Adjasi, 2018).

4. Strategy for Strengthening Internal Capabilities

Given the importance of these internal factors, SME capacity-building strategies cannot be separated from efforts to promote innovation financing inclusion. Digital financial literacy training programs, managerial mentoring, and the integration of SMEs into digital platform ecosystems need to be a key policy agenda, especially in developing countries. Countries such as Singapore and Estonia have demonstrated that improving SME digital financial literacy can significantly increase the volume and effectiveness of financing in a short period of time (Feng et al., 2023; Saunila, 2020).

Complementarity and Substitution Between Financing Channels

In the innovation financing ecosystem for SMEs, one important finding that consistently emerges from various literature is that financing channels do not work linearly or in isolation. Rather, these channels complement (complementarity) or even substitute (substitution) for one another, depending on the organization's conditions, the stage of the business lifecycle, and the dynamics of the industry sector in which the SME operates (Adegboye & Iweriebor, 2018; Rossi, 2015; Wang & Sun, 2024; Zhang, 2022). This theme emphasizes the importance of a systemic perspective in examining financing structures, where the effectiveness of funding sources is significantly influenced by the patterns of interaction between channels, rather than solely by the characteristics of the channels themselves. A complementarity-based financing model is evident in the context of staged financing. In the early stages, innovation-oriented SMEs often utilize seed capital from angel investors or crowdfunding platforms to support activities such as idea validation, prototype development, and limited market testing (Colombo & Grilli, 2007; Hall & Lerner, 2010). After this stage is successful, public funds such as research grants or soft loans from the government are typically used to finance expansion processes, production strengthening, or market certification, which require larger amounts of funding but have more measurable risks (Mazzucato & Semieniuk, 2018). Such schemes indicate that the success of financing heavily depends on the synergy between channels over a specific timeframe. Conversely, substitution patterns are more commonly found when SMEs lack access to ideal financing channels–for example, due to high barriers to entry in venture capital–and ultimately replace them with alternative sources such as loans from cooperatives, supply chain-based financing, or microfinance programs (Agyei et al., 2022). Although such funds may be less optimal for financing large-scale innovation, their flexibility can serve as a fairly effective short-term solution, particularly in developing countries or regions with informal financial systems (Bruton et al., 2015).

In high-tech sectors, equity-based channels such as venture capital often work alongside public research funds or government fiscal incentive schemes. This creates a financing combination that strengthens innovation capacity while expanding market access. Conversely, in traditional sectors such as agriculture or crafts, debt-based financing remains dominant, but is increasingly complemented by community-based or cooperative alternatives, especially when conventional financing programs are not inclusive of the risk profiles of small SMEs (Bargoni et al., 2024; Feng et al., 2023). The implications of these findings are highly significant for policy formulation. Cross-channel orchestration is not merely about adding funding sources but creating dynamic financing pathways that align with the needs and characteristics of SMEs (Li et al., 2025). A policy approach that is overly focused on a single dominant channel–for example, only bank loan incentives–risks neglecting SMEs with non-conventional business models. Therefore, the development of financing policies must consider the landscape of cross-channel interactions and promote a flexible and collaborative regulatory framework across financing sectors.

DISCUSSION

The findings of this study underscore that the effectiveness of innovation financing in the small and medium-sized enterprise (SME) sector is the result of complex interactions between funding structures, internal company capabilities, and institutional ecosystem support (Song, 2023). It is not sufficient to view the availability of funds as the sole factor determining innovation success; rather, it is necessary to consider how financing channels–both formal and alternative–complement or substitute for one another, as well as how they can be accessed and optimized by SMEs with diverse risk profiles, organizational structures, and innovative objectives (Adegboye & Iweriebor, 2018; Rossi, 2015). Within the context of corporate finance theory, this study confirms the relevance

of the pecking order theory, where SMEs generally prefer to use internal capital first before seeking external financing due to transaction costs, asymmetric information risks, and ownership control (Myers & Majluf, 1984). However, this approach becomes inadequate for innovative SMEs that lack sufficient internal cash and often face high risk assessments from conventional financial institutions, leading to credit rationing (Stiglitz & Weiss, 1981). Traditional banks tend to avoid financing innovative projects due to high uncertainty and limited physical collateral, resulting in innovative SMEs being marginalized from the formal credit market (Harel & Kaufmann, 2016). Within the framework of the life cycle theory, SMEs' financing needs change as their business develops. In the early stages, financing from angel investors, crowdfunding, or personal capital sources is the dominant choice due to its flexibility and greater tolerance for risk. However, during the growth and expansion phases, SMEs tend to shift toward asset-based financing, bank loans, or public funds to support increased production capacity and broader market penetration (Hall & Lerner, 2010; Rao et al., 2023). This study shows that the success of accessing these channels is highly dependent on the internal readiness of SMEs, including in terms of financial literacy, risk management, and the ability to develop commercially viable innovation proposals (Isichei et al., 2020; Saunila, 2020).

Geographically, differences between countries in developing innovation financing infrastructure are striking. Advanced countries such as Germany, South Korea, and China have established financing systems that integrate public and private funding through mission-oriented funding schemes, fiscal incentives, and supporting institutions such as development banks or sovereign innovation funds (Jordão & Novas, 2024; Mazzucato & Penna, 2016). Models like Horizon Europe and SBIR in the United States demonstrate how state intervention in the form of seed funding, technical support, and managerial training can strengthen SME innovation capacity and bridge the valley of death in the technology commercialization process (Edler & Fagerberg, 2017; Wang et al., 2022). Conversely, in developing countries, the main challenges revolve around weak institutional governance, lack of integration across sectoral policies, and limitations in digital infrastructure and public databases (Bruton et al., 2015; Dorasamy & Kikasu, 2024). Low coordination among institutions leads to program duplication, weak monitoring and evaluation, and limitations in reaching informal SMEs, which are the backbone of the national economy. This disparity is exacerbated by dependence on donors or international institutions, which often do not align with local contexts and create unsustainable financing schemes. Therefore, strategies for reforming the innovation financing ecosystem must emphasize the importance of multi-level governance, consolidation of evidence-based information systems, and cross-sector collaboration to create synergy and sustainability (Edquist & Zabala, 2012). One important contribution of this study is the exploration of the relationship between financing channels and the internal readiness of SMEs, particularly digital literacy and the adoption of financial technology (Frimpong et al., 2022). Findings show that digital skills are not only relevant for production or marketing processes but also crucial for accessing alternative financing such as peer-to-peer lending platforms, invoice financing, and blockchain-based funding (Agyei et al., 2022; Block et al., 2018). In many developing countries, low digital literacy among SMEs results in failure to access new opportunities in the digital financial sector, ultimately narrowing innovative financing options and reducing competitiveness (Feng et al., 2023).

The managerial implications of this research include the urgent need to systemically build the internal capacity of SMEs, including financial literacy training, business planning support, and improved adaptability in choosing financing channels that suit their risk profile and innovation goals. On the other hand, policy implications demand a more strategic approach in designing incentive-based financing instruments and data-driven monitoring systems (Steffen & Dermont, 2018). It is not enough for the government to provide funds, but it must also ensure the existence of institutional absorptive capacity so that the funds are actually channeled to innovative SMEs that are economically and socially viable (Nasir et al., 2022). However, this research is not free from limitations. First, limited access to articles in local languages or grey literature reduces the diversity of contextual perspectives, especially in developing countries. Secondly, the systematic approach used focuses more on peer-reviewed literature, so there is a possibility that innovative practices in the field that have not been documented academically escape analysis. Third, the thematic results in this study are largely descriptive and do not quantitatively measure causal relationships between

key variables, which leaves room for further empirical or mixed-method research. Overall, this study confirms that the effectiveness of SME innovation financing is a systemic, multi-level and dynamic construct. A silo approach that separates SMEs' internal capabilities, financing channel choices, and institutional conditions tends to fail in producing impactful policies. Therefore, a policy framework that integrates the perspectives of financial inclusion, innovation capability, and institutional readiness is needed, in order to create a financing ecosystem that is adaptive to changing times and the needs of economic transformation towards a knowledge-based and sustainable economy.

CONCLUSION

This research presents a thematic synthesis of the international literature on the dynamics of innovation financing in the context of small and medium-sized enterprises (SMEs), focusing on the interaction between financing channels, internal organizational capabilities, and the institutional environment. The findings show that the effectiveness of SME innovation financing is not only determined by the amount of funds available, but is strongly influenced by the match between the characteristics of the financing source and the innovative needs of SMEs that are long-term, high-risk, and require high flexibility. Alternative financing channels such as crowdfunding, venture capital, and blended finance have proven to play a strategic role in bridging the gap that conventional financing cannot fill, especially in the early stages of the innovation cycle. Furthermore, SMEs' internal capabilities - particularly in terms of financial literacy, managerial capacity, and digital readiness - act as key mediators that determine the extent to which available financing can be accessed and optimally utilized. Inequalities in these capabilities reinforce access gaps between regions, especially between developed and developing countries. On the other hand, external factors such as public policy effectiveness, inter-agency coordination, and public data availability have also proven to be important determinants in shaping an inclusive and sustainable financing ecosystem.

The main implication of this study confirms that there is no single solution in designing an innovation financing system for SMEs. An eclectic, contextual, and evidence-based approach is needed to create integration between financing channels, support the strengthening of SMEs' internal capacity, and ensure institutional synergies across sectors. Therefore, effective policy interventions should include not only fund mobilization, but also structural reforms that include fiscal incentives, investments in digital literacy, and institutional infrastructure development that encourages experimentation and collaboration. Finally, this research makes theoretical and practical contributions by mapping the key interconnected elements that support SME innovation financing, while opening up space for further empirical, contextual and longitudinal studies. Strengthening the innovation financing system is not only an economic endeavor, but also a long-term development strategy that places SMEs as the main drivers of transformation towards a knowledge-based and sustainable economy.

REFERENCES

Adegboye, A. C., & Iweriebor, S. (2018). Does Access to Finance Enhance SME Innovation and Productivity in Nigeria? Evidence from the World Bank Enterprise Survey. African Development Review, 30(4), 449–461. https://doi.org/10.1111/1467-8268.12351

Agyei-Boapeah, H., Evans, R., & Nisar, T. M. (2022). Disruptive innovation: Designing business platforms for new financial services. Journal of Business Research, 150, 134–146. https://doi.org/10.1016/j.jbusres.2022.05.066

Albats, E., Podmetina, D., & Vanhaverbeke, W. (2023). Open innovation in SMEs: A process view towards business model innovation. Journal of Small Business Management, 61(6), 2519–2560. https://doi.org/10.1080/00472778.2021.1913595

Aliano, M., Cestari, G., Madonna, S., & others. (2024). Sustainable Finance for SMEs. Springer.

Amadasun, D. O. E., & Mutezo, A. T. (2022). Influence of access to finance on the competitive growth of SMEs in Lesotho. Journal of Innovation and Entrepreneurship, 11(1), 56. https://doi.org/10.1186/s13731-022-00244-1

Amini Sedeh, A., Pezeshkan, A., & Caiazza, R. (2022). Innovative entrepreneurship in emerging and developing economies: the effects of entrepreneurial competencies and institutional voids. The Journal of Technology Transfer, 47(4), 1198–1223. https://doi.org/10.1007/s10961-021-09874-1

Anderson, B. J., Leonchuk, O., O'Connor, A. C., Shaw, B. K., & Walsh, A. C. (2022). Insights from the evaluations of the NIH Centers for Accelerated Innovation and Research Evaluation and Commercialization Hubs programs. Journal of Clinical and Translational Science, 6(1), e7. https://doi.org/10.1017/cts.2021.878

Anderson, J. R., Chung, T. D. Y., Clark, L., Weis, J. A., Danielsen, A. J., Khosla, S., Gores, G. J., & Badley, A. D. (2019). Translation to Practice: Accelerating the Cycle of Innovation to Impact. Mayo Clinic Proceedings. https://doi.org/10.1016/j.mayocp.2018.08.008

Autio, E., Nambisan, S., Thomas, L. D. W., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. Strategic Entrepreneurship Journal, 12(1), 72–95. https://doi.org/10.1002/sej.1266

Bargoni, A., Ferraris, A., Bresciani, S., & Camilleri, M. A. (2024). Crowdfunding and innovation: a bibliometric review and future research agenda. European Journal of Innovation Management, 27(4), 1109–1133. https://doi.org/10.1108/EJIM-06-2022-0310

Baycan, T., & Stough, R. R. (2013). Bridging knowledge to commercialization: the good, the bad, and the challenging. The Annals of Regional Science, 50(2), 367–405. https://doi.org/10.1007/s00168-012-0510-8

Belleflamme, P., Lambert, T., & Schwienbacher, A. (2014). Crowdfunding: Tapping the right crowd. Journal of Business Venturing, 29(5), 585–609. https://doi.org/10.1016/j.jbusvent.2013.07.003

Bessière, V., Stéphany, E., & Wirtz, P. (2020). Crowdfunding, business angels, and venture capital: an exploratory study of the concept of the funding trajectory. Venture Capital, 22(2), 135–160. https://doi.org/10.1080/13691066.2019.1599188

Block, J. H., Colombo, M. G., Cumming, D. J., & Vismara, S. (2018). New players in entrepreneurial finance and why they are there. Small Business Economics, 50(2), 239–250. https://doi.org/10.1007/s11187-016-9826-6

Bonini, S., & Capizzi, V. (2019). The role of venture capital in the emerging entrepreneurial finance ecosystem: future threats and opportunities. Venture Capital, 21(2–3), 137–175. https://doi.org/10.1080/13691066.2019.1608697

Botelho, A. J. J., & Almeida, M. (2024). Start-ups in the Brazilian Innovation Ecosystem. Science, Technology and Society, 29(1), 120–139. https://doi.org/10.1177/09717218231220344

Breuer, A., Leininger, J., Malerba, D., & Tosun, J. (2023). Integrated policymaking: Institutional designs for implementing the sustainable development goals (SDGs). World Development, 170, 106317. https://doi.org/10.1016/j.worlddev.2023.106317

Brown, J. R., Fazzari, S., & Petersen, B. (2009). Financing Innovation and Growth: Cash Flow, External Equity, and the 1990s R&D Boom. The Journal of Finance, 64(1), 151–185. https://doi.org/10.1111/j.1540-6261.2008.01431.x

Brown, R., Rocha, A., & Cowling, M. (2020). Financing entrepreneurship in times of crisis: exploring the impact of COVID-19 on the market for entrepreneurial finance in the United Kingdom. International Small Business Journal, 38(5), 380–390.

Bruton, G., Khavul, S., Siegel, D., & Wright, M. (2015). New Financial Alternatives in Seeding Entrepreneurship: Microfinance, Crowdfunding, and Peer-to-Peer Innovations. Entrepreneurship Theory and Practice, 39(1), 9–26. https://doi.org/10.1111/etap.12143

Burger-Helmchen, T., Laperche, B., Schiavone, F., & Stefani, U. (2020). Financing novelty: new tools and practices to induce and control innovation processes. European Journal of Innovation Management, 23(2), 197–199. https://doi.org/10.1108/EJIM-03-2020-333

Canepa, A., & Stoneman, P. (2007). Financial constraints to innovation in the UK: evidence from CIS2 and CIS3. Oxford Economic Papers, 60(4), 711–730. https://doi.org/10.1093/oep/gpm044

Capizzi, V., & Carluccio, E. M. (2016). Competitive Frontiers in Equity Crowdfunding: The Role of Venture Capitalists and Business Angels in the Early-Stage Financing Industry. In Crowdfunding for SMEs (pp. 117–157). Palgrave Macmillan UK. https://doi.org/10.1057/978-1-137-56021-6_6

Carreras, M. (2023). Fostering Innovation Activities with the Support of a Development Bank: Evidence from Brazil 2003–2011. The European Journal of Development Research, 35(3), 545–578. https://doi.org/10.1057/s41287-022-00517-1

Chen, J., Wang, Y., Jacques, P., Dai, L., Zho, G., Zhou, L., Bo, L., & Wang, H. (2024). Results-Based Lending Programs in the People's Republic of China (ADB Briefs). Asian Development Bank. https://doi.org/10.22617/BRF240323-2

Chishti, M. Z., & Sinha, A. (2022). Do the shocks in technological and financial innovation influence the environmental quality? Evidence from BRICS economies. Technology in Society, 68, 101828. https://doi.org/10.1016/j.techsoc.2021.101828

Chittenden, F., Hall, G., & Hutchinson, P. (1996). Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation. Small Business Economics, 8(1), 59–67. https://doi.org/10.1007/BF00391976

Cicchiello, A. F. (2019). Building an entrepreneurial ecosystem based on crowdfunding in Europe: the role of public policy. Journal of Entrepreneurship and Public Policy, 8(3), 297–318. https://doi.org/10.1108/JEPP-05-2019-0037

Cirera, X., Cruz, M., Davies, E., Grover, A., Iacovone, L., Cordova, J. E. L., Medvedev, D., Maduko, F. O., Nayyar, G., Reyes Ortega, S., & Torres, J. (2021). Policies to Support Businesses through the COVID-19 Shock: A Firm Level Perspective. The World Bank Research Observer, 36(1), 41–66. https://doi.org/10.1093/wbro/lkab001

Colombo, M. G., & Grilli, L. (2007). Funding Gaps? Access To Bank Loans By High-Tech Start-Ups. Small Business Economics, 29(1–2), 25–46. https://doi.org/10.1007/s11187-005-4067-0

Cressy, R. (2012). Funding gaps. The Oxford Handbook of Entrepreneurial Finance, 255–304.

Croce, M. M., Nguyen, T. T., Raymond, S., & Schmid, L. (2019). Government debt and the returns to innovation. Journal of Financial Economics, 132(3), 205–225. https://doi.org/10.1016/j.jfineco.2018.11.010

Cumming, D., Johan, S., & Zhang, Y. (2018). Public policy towards entrepreneurial finance: spillovers and the scale-up gap. Oxford Review of Economic Policy, 34(4), 652–675. https://doi.org/10.1093/oxrep/gry012

De Grandi, G., Brass, I., & Farid, S. S. (2023). Is regulatory innovation fit for purpose? A case study of adaptive regulation for advanced biotherapeutics. Regulation & Governance, 17(3), 810–832. https://doi.org/10.1111/rego.12496

Didonet, S., & Diaz-Villavicencio, G. (2020). Innovation management in market-oriented SMEs: learning and internal arrangements for innovation. International Journal of Organizational Analysis, 28(5), 985–1003. https://doi.org/10.1108/IJOA-09-2019-1885

Dorasamy, N., & Kikasu, E. T. (2024). SMEs' Information Infrastructure and Access to Finance. In SMEs Perspective in Africa (pp. 121–166). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-69103-4_7

Dowling, M., O'Gorman, C., Puncheva, P., & Vanwalleghem, D. (2019). Trust and SME attitudes towards equity financing across Europe. Journal of World Business, 54(6), 101003. https://doi.org/10.1016/j.jwb.2019.101003

Edler, J., & Fagerberg, J. (2017). Innovation policy: what, why, and how. Oxford Review of Economic Policy, 33(1), 2–23. https://doi.org/10.1093/oxrep/grx001

Edquist, C., & Zabala-Iturriagagoitia, J. M. (2012). Public Procurement for Innovation as mission-oriented innovation policy. Research Policy, 41(10), 1757–1769. https://doi.org/10.1016/j.respol.2012.04.022

Elert, N., Henrekson, M., & Stenkula, M. (2017). Innovation and Entrepreneurship in the European Union—A Reform Agenda. In Briefs in Economics (pp. 25–86). https://doi.org/10.1007/978-3-319-55092-3_3

Esho, E., & Verhoef, G. (2022). SME funding-gap and financing: a comprehensive literature review. International Journal of Globalisation and Small Business, 13(2), 164. https://doi.org/10.1504/IJGSB.2022.127226

Fasnacht, D. (2018). Open Innovation in the Financial Services. In Management for Professionals (pp. 97–130). https://doi.org/10.1007/978-3-319-76394-1_4

Feng, Y., Meng, M., & Li, G. (2023). Impact of digital finance on the asset allocation of small- and medium-sized enterprises in China: Mediating role of financing constraints. Journal of Innovation & Knowledge, 8(3), 100405. https://doi.org/10.1016/j.jik.2023.100405

Fombang, M. S., & Adjasi, C. K. (2018). Access to finance and firm innovation. Journal of Financial Economic Policy, 10(1), 73–94. https://doi.org/10.1108/JFEP-10-2016-0070

Frimpong, S. E., Agyapong, G., & Agyapong, D. (2022). Financial literacy, access to digital finance and performance of SMEs: Evidence From Central region of Ghana. Cogent Economics & Finance, 10(1). https://doi.org/10.1080/23322039.2022.2121356

Fund, U. N. C. D. (2020). Blended Finance in the Least Developed Countries 2020 Supporting a Resilient COVID-19 Recovery. OECD Publishing.

Georghiou, L., Edler, J., Uyarra, E., & Yeow, J. (2014). Policy instruments for public procurement of innovation: Choice, design and assessment. Technological Forecasting and Social Change, 86, 1–12. https://doi.org/10.1016/j.techfore.2013.09.018

Guerrero, M., & Urbano, D. (2017). The impact of Triple Helix agents on entrepreneurial innovations' performance: An inside look at enterprises located in an emerging economy. Technological Forecasting and Social Change, 119, 294–309. https://doi.org/10.1016/j.techfore.2016.06.015

Gunasekaran, A., Rai, B. K., & Griffin, M. (2011). Resilience and competitiveness of small and medium size enterprises: an empirical research. International Journal of Production Research, 49(18), 5489–5509. https://doi.org/10.1080/00207543.2011.563831

Halim, M. A. (2024). Does crowdfunding contribute to digital financial inclusion? Research in Globalization, 9, 100238. https://doi.org/10.1016/j.resglo.2024.100238

Hall, B. H., & Lerner, J. (2010). The Financing of R&D and Innovation. In Economics of Innovation (pp. 609–639). https://doi.org/10.1016/S0169-7218(10)01014-2

Hamza, T., Barka, Z., Verdie, J.-F., & Al Sayah, M. (2024). Economic policy uncertainty and SMEs' investment efficiency in France: does competitive pressure matter? European Business Review, 36(4), 449–467. https://doi.org/10.1108/EBR-03-2023-0078

Harel, R., & Kaufmann, D. (2016). Financing innovative SMEs of traditional sectors: the supply side. EuroMed Journal of Business, 11(1), 84–100. https://doi.org/10.1108/EMJB-02-2015-0007

He, J. (Jack), & Tian, X. (2018). Finance and Corporate Innovation: A Survey. Asia-Pacific Journal of Financial Studies, 47(2), 165–212. https://doi.org/10.1111/ajfs.12208

Hooi, L. W. (2021). SME performance: does organizational learning capability really matter? International Journal of Organizational Analysis, 29(5), 1093–1116. https://doi.org/10.1108/IJOA-12-2019-1962

Hussain, J., Salia, S., & Karim, A. (2018). Is knowledge that powerful? Financial literacy and access to finance. Journal of Small Business and Enterprise Development, 25(6), 985–1003. https://doi.org/10.1108/JSBED-01-2018-0021

Indrawati, H., Caska, & Suarman. (2020). Barriers to technological innovations of SMEs: how to solve them? International Journal of Innovation Science, 12(5), 545–564. https://doi.org/10.1108/IJIS-04-2020-0049

Isichei, E. E., Emmanuel Agbaeze, K., & Odiba, M. O. (2020). Entrepreneurial orientation and performance in SMEs. International Journal of Emerging Markets, 15(6), 1219–1241. https://doi.org/10.1108/IJOEM-08-2019-0671

Jensen, M. C., & Meckling, W. H. (1979). Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. In Rochester Studies in Economics and Policy Issues (pp. 163–231). Springer Nature Singapore. https://doi.org/10.1007/978-94-009-9257-3_8

Jia, C., Tang, X., & Kan, Z. (2020). Does the Nation Innovation System in China Support the Sustainability of Small and Medium Enterprises (SMEs) Innovation? Sustainability, 12(6), 2562. https://doi.org/10.3390/su12062562

Jjagwe, R., Kirabira, J. B., Mukasa, N., & Okure, M. (2024). National innovation system for resilience, transformation and sustainable development in Uganda: contextual analysis of the factors, actors and associated linkages. International Journal of Innovation Science. https://doi.org/10.1108/IJIS-09-2023-0197

Jordão, R. V. D., & Novas, J. C. (2024). Information and Knowledge Management, Intellectual Capital, and Sustainable Growth in Networked Small and Medium Enterprises. Journal of the Knowledge Economy, 15(1), 563–595. https://doi.org/10.1007/s13132-022-01043-5

Kabakova, O., & Plaksenkov, E. (2018). Analysis of factors affecting financial inclusion: Ecosystem view. Journal of Business Research, 89, 198–205. https://doi.org/10.1016/j.jbusres.2018.01.066

Kim, D., & Lee, W. J. (2025). The Shifting Startup Ecosystem In Korea. Routledge Handbook of Korean Business and Management.

Lee, N., Sameen, H., & Cowling, M. (2015). Access to finance for innovative SMEs since the financial crisis. Research Policy, 44(2), 370–380. https://doi.org/10.1016/j.respol.2014.09.008

Li, C., Wang, Y., Zhou, Z., Wang, Z., & Mardani, A. (2023). Digital finance and enterprise financing constraints: Structural characteristics and mechanism identification. Journal of Business Research, 165, 114074. https://doi.org/10.1016/j.jbusres.2023.114074

Li, Y., Yang, B., Zhang, K., & Hu, X. (2025). What Drives Corporate Entrepreneurship in Omnichannel Marketing? The Effects of Cross-Channel Integration and E-Commerce Type. R&D Management. https://doi.org/10.1111/radm.12775

Madrid-Guijarro, A., García-Pérez-de-Lema, D., & Van Auken, H. (2016). Financing constraints and SME innovation during economic crises. Academia Revista Latinoamericana de Administración, 29(1), 84–106. https://doi.org/10.1108/ARLA-04-2015-0067

Makhdoom, H. ur R., Li, C., & Asim, S. (2019). Diffusion of innovation through individual and collective entrepreneurship. Asia Pacific Journal of Innovation and Entrepreneurship, 13(1), 89–107. https://doi.org/10.1108/APJIE-06-2018-0040

Mazzucato, M. (2021). Mission economy: A moonshot guide to changing capitalism. Penguin UK.

Mazzucato, M., & Penna, C. C. R. (2016). Beyond market failures: the market creating and shaping roles of state investment banks. Journal of Economic Policy Reform, 19(4), 305–326. https://doi.org/10.1080/17487870.2016.1216416

Mazzucato, M., & Semieniuk, G. (2018). Financing renewable energy: Who is financing what and why it matters. Technological Forecasting and Social Change, 127, 8–22. https://doi.org/10.1016/j.techfore.2017.05.021

McIsaac, M., Kutzin, J., Dale, E., & Soucat, A. (2018). Results-based financing in health: from evidence to implementation. Bulletin of the World Health Organization, 96(11), 730-730A. https://doi.org/10.2471/BLT.18.222968

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Nasir, J., Ibrahim, R. M., Sarwar, M. A., Sarwar, B., Al-Rahmi, W. M., Alturise, F., Samed Al-Adwan, A., & Uddin, M. (2022). The Effects of Transformational Leadership, Organizational Innovation, Work Stressors, and Creativity on Employee Performance in SMEs. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.772104

Nicolas, T. (2022). Short-term financial constraints and SMEs' investment decision: evidence from the working capital channel. Small Business Economics, 58(4), 1885–1914. https://doi.org/10.1007/s11187-021-00488-3

Owen, R., North, D., & Mac an Bhaird, C. (2019). The role of government venture capital funds: Recent lessons from the U.K. experience. Strategic Change, 28(1), 69–82. https://doi.org/10.1002/jsc.2247

Ozili, P. K. (2020). Contesting digital finance for the poor. Digital Policy, Regulation and Governance, 22(2), 135–151. https://doi.org/10.1108/DPRG-12-2019-0104

Park, H. W., & Leydesdorff, L. (2010). Longitudinal trends in networks of university--industry--government relations in South Korea: The role of programmatic incentives. Research Policy, 39(5), 640–649.

Pickernell, D., Senyard, J., Jones, P., Packham, G., & Ramsey, E. (2013). New and young firms. Journal of Small Business and Enterprise Development, 20(2), 358–382. https://doi.org/10.1108/14626001311326770

Radas, S., & Bozic, L. (2012). Overcoming Failure: Abandonments and Delays of Innovation Projects in SMEs. Industry & Innovation, 19(8), 649–669. https://doi.org/10.1080/13662716.2012.739769

Radas, S., & Božić, L. (2009). The antecedents of SME innovativeness in an emerging transition economy. Technovation, 29(6–7), 438–450. https://doi.org/10.1016/j.technovation.2008.12.002

Rao, P., Kumar, S., Chavan, M., & Lim, W. M. (2023). A systematic literature review on SME financing: Trends and future directions. Journal of Small Business Management, 61(3), 1247–1277. https://doi.org/10.1080/00472778.2021.1955123

Rossi, M. (2015). The role of venture capital funds in financing innovation in Italy. Constraints and challenges for innovative small firms. International Journal of Globalisation and Small Business, 7(2), 162. https://doi.org/10.1504/IJGSB.2015.071201

Sattayaraksa, T., & Boon-itt, S. (2016). CEO transformational leadership and the new product development process. Leadership & Organization Development Journal, 37(6), 730–749. https://doi.org/10.1108/LODJ-10-2014-0197

Saunila, M. (2020). Innovation capability in SMEs: A systematic review of the literature. Journal of Innovation & Knowledge, 5(4), 260–265. https://doi.org/10.1016/j.jik.2019.11.002

Schumpeter, J. A. (2021). The Theory of Economic Development. Routledge. https://doi.org/10.4324/9781003146766

Shahadat, M. M. H., Nekmahmud, M., Ebrahimi, P., & Fekete-Farkas, M. (2023). Digital Technology Adoption in SMEs: What Technological, Environmental and Organizational Factors Influence in Emerging Countries? Global Business Review. https://doi.org/10.1177/09721509221137199

Sharfaei, S., Wei Ong, J., & Ojo, A. O. (2023). The impact of market uncertainty on international SME performance. Cogent Business & Management, 10(1). https://doi.org/10.1080/23311975.2023.2198160

Sierra, J. (2019). How financial systems and firm strategy impact the choice of innovation funding. European Journal of Innovation Management, 23(2), 251–272. https://doi.org/10.1108/EJIM-07-2018-0147

Song, H., Li, M., & Yu, K. (2021). Big data analytics in digital platforms: how do financial service providers customise supply chain finance? International Journal of Operations & Production Management, 41(4), 410–435. https://doi.org/10.1108/IJOPM-07-2020-0485

Song, Y. (2023). How do Chinese SMEs enhance technological innovation capability? From the perspective of innovation ecosystem. European Journal of Innovation Management, 26(5), 1235–1254. https://doi.org/10.1108/EJIM-01-2022-0016

Soumonni, O., & Ojah, K. (2022). Innovative and m <scp>ission-oriented</scp> financing of renewable energy in <scp>Sub-Saharan</scp> Africa: A review and conceptual framework. WIREs Energy and Environment, 11(1). https://doi.org/10.1002/wene.416

Stadelmann-Steffen, I., & Dermont, C. (2018). The unpopularity of incentive-based instruments: what improves the cost–benefit ratio? Public Choice, 175(1–2), 37–62. https://doi.org/10.1007/s11127-018-0513-9

Stefanelli, V., Ferilli, G. B., & Boscia, V. (2022). Exploring the lending business crowdfunding to support SMEs' financing decisions. Journal of Innovation & Knowledge, 7(4), 100278. https://doi.org/10.1016/j.jik.2022.100278

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. The American Economic Review, 71(3), 393–410.

Stojčić, N. (2021). Collaborative innovation in emerging innovation systems: Evidence from Central and Eastern Europe. The Journal of Technology Transfer, 46(2), 531–562. https://doi.org/10.1007/s10961-020-09792-8

Tambunan, T. (2019). Recent evidence of the development of micro, small and medium enterprises in Indonesia. Journal of Global Entrepreneurship Research, 9(1), 18. https://doi.org/10.1186/s40497-018-0140-4

Thawesaengskulthai, N., Chatmarathong, A., & Koiwanit, J. (2024). Impact and policy supporting Thailand innovation driven enterprise: orchestrating university innovation and entrepreneurship ecosystem with public and private stakeholders. Journal of Innovation and Entrepreneurship, 13(1), 16. https://doi.org/10.1186/s13731-024-00371-x

Tripathy, S., Aich, S., Chakraborty, A., & Lee, G. M. (2016). Information technology is an enabling factor affecting supply chain performance in Indian SMEs. Journal of Modelling in Management, 11(1), 269–287. https://doi.org/10.1108/JM2-01-2014-0004

Vavrek, R., Vozárová, I. K., Kotulič, R., Adamišin, P., Dubravská, M., & Ivanková, V. (2022). Assessing the financial health of agricultural enterprises incorporating the spatial dimension. International Food and Agribusiness Management Review, 25(3), 469–488. https://doi.org/10.22434/IFAMR2020.0030

Wang, X., & Sun, M. (2024). Enhancing SMEs resilience through digital innovation: a stage-based analysis. European Journal of Innovation Management. https://doi.org/10.1108/EJIM-09-2023-0800

Wang, Y., Zhang, H., & Zhao, Z. (2022). SME investment and financing under asymmetric information. European Financial Management, 28(5), 1347–1375. https://doi.org/10.1111/eufm.12342

Wonglimpiyarat, J. (2015). Challenges of SMEs innovation and entrepreneurial financing. World Journal of Entrepreneurship, Management and Sustainable Development, 11(4), 295–311. https://doi.org/10.1108/WJEMSD-04-2015-0019

Xiang, D., & Worthington, A. C. (2017). The impact of government financial assistance on the performance and financing of Australian SMEs. Accounting Research Journal, 30(4), 447–464. https://doi.org/10.1108/ARJ-04-2014-0034

Yao, D., Ding, R., Chen, J., & Liao, Y. (2024). Bridging the Financing Gap for Unlisted Science and Technology-Based SMEs in China: A Comprehensive Evaluation Framework. Journal of the Knowledge Economy, 15(4), 18531–18589. https://doi.org/10.1007/s13132-024-01792-5

Yasir, M., & Majid, A. (2017). Impact of knowledge management enablers on knowledge sharing. World Journal of Entrepreneurship, Management and Sustainable Development, 13(1), 16–33. https://doi.org/10.1108/WJEMSD-02-2016-0010

Zhang, H. (2022). Does combining different types of innovation always improve SME performance? An analysis of innovation complementarity. Journal of Innovation & Knowledge, 7(3), 100192. https://doi.org/10.1016/j.jik.2022.100192

Zhang, Z., Zhu, H., Zhou, Z., & Zou, K. (2022). How does innovation matter for sustainable performance? Evidence from small and medium-sized enterprises. Journal of Business Research, 153, 251–265. https://doi.org/10.1016/j.jbusres.2022.08.034