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Unveiling Financial Barriers for SMEs in Iran: A Fuzzy Delphi Approach to Enhancing Production Financing

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ABSTRACT

SMEs are pivotal to Iran's economic growth. However, they face numerous financial challenges that could affect their expansion and stability. This study aims to identify and analyze the barriers to production financing for Iranian SMEs using the Fuzzy Delphi Method (FDM). A preliminary framework was initially established through a literature review and thematic analysis, identifying 10 dimensions and 57 indicators. The thematic analysis followed Braun and Clarke's six-step model, reviewing 282 research works from reputable databases within the 2014-2023 timeframe. After quality assessment using the Critical Skills Evaluation Framework, 23 articles were selected for final thematic analysis. Subsequently, experts' opinions were gathered and analyzed using the FDM. A panel of 15 experts was selected through purposive sampling. The FDM was implemented in three rounds, using triangular fuzzy numbers to quantify expert opinions. The findings confirmed that 10 principal dimensions and 71 indicators are significant barriers to production financing in Iranian SMEs. These include financial infrastructure and access, legal environment and political consequences, information asymmetry and transparency, collateral requirements and asset-based financing, loan terms and conditions, credit evaluation and risk perception, market dynamics and competition, technological advancements and digitalization, social and economic factors, regional disparities, and alternative financing mechanisms and innovations. This study can aid policymakers, managers, and decision-makers in enhancing financial access for SMEs by formulating and implementing effective supportive policies, thus promoting their growth and sustainable development.

1. Introduction

Small and Medium Enterprises (SMEs) play a crucial role in economic and social development worldwide.

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These businesses are recognized as engines of economic growth, contributing significantly to national and regional economies by creating job opportunities, increasing production, and fostering innovation (Wang et al. [56]). Financing production in these businesses is particularly important, as access to adequate financial resources paves the way for the development and expansion of production activities. However, SMEs often face significant challenges in accessing financing, which can limit their growth and development (Thekkootte [51]).

In Iran, as in many other countries, SMEs play a significant role in job creation and contribute substantially to Gross Domestic Product (GDP) and economic development. However, these businesses face considerable difficulties in securing financing. Adequate and sufficient financing is one of the key factors for the success and sustainability of businesses (Hedavand et al. [24]). Therefore, examining and analyzing the barriers to production financing in SMEs can help identify effective strategies to improve financial conditions and, thereby, promote the growth and expansion of these enterprises. This assertion is supported by numerous studies, including those by Rao et al. [49] and Gonçalves et al. [20], which emphasize the critical role of identifying financing barriers in developing targeted interventions for SME growth.

Many studies have been conducted on the financing of SMEs. Some of these studies have examined the problems and challenges associated with financing these businesses and have offered various solutions to enhance financial conditions (Zayed et al. [57]). For instance, research has looked into the use of both internal and external financial resources, the role of banks and financial institutions, and the effects of government policies on SME financing. The importance of having adequate and sufficient financial resources as a crucial factor for the success and sustainability of businesses has been emphasized in many of these studies (Gonçalves et al. [20]). Additionally, research has indicated that SMEs are more vulnerable to financial risks due to a lack of robust financial structures and need financial and credit support (Jaichandran et al. [27]).

Despite the extensive research on SME financing, there has been less focus on the specific barriers to production financing in Iran. Most studies have addressed general financing issues rather than analyzing the specific barriers to production financing for SMEs. This study seeks to fill this research gap by identifying and analyzing the barriers to production financing in Iranian SMEs.

To achieve this goal, we employ a novel hybrid approach that combines thematic analysis with the Fuzzy Delphi Method (FDM). The choice of this methodology is grounded in several key considerations. Firstly, the Delphi method is particularly well-suited for exploring complex issues where expert consensus is valuable, as it allows for iterative feedback and refinement of ideas (Linstone and Turoff [33]). In the context of SME financing, where multiple factors interact in intricate ways, this method enables a comprehensive exploration of barriers from various expert perspectives.

Secondly, the integration of fuzzy logic with the Delphi method addresses the inherent uncertainty and ambiguity often present in expert judgments, especially when dealing with linguistic variables (Hsueh [25]). By using fuzzy numbers, we can more accurately capture the nuances in expert opinions, leading to a more robust analysis of financing barriers. This approach allows for a more precise representation of the complexity and uncertainty inherent in SME financing issues, potentially leading to more nuanced and actionable insights.

Our hybrid approach begins with a thematic analysis of existing literature, following Braun and Clarke's [7] six-step model, to establish a preliminary framework of financing barriers. This initial step ensures a comprehensive foundation based on current research. Subsequently, we employ the FDM to refine and validate these barriers through expert consultation, leveraging the strengths of both qualitative and quantitative methodologies.

This study's contribution is multifaceted and significant. Firstly, it addresses a critical gap in the literature by focusing specifically on production financing barriers for SMEs in the Iranian context, an area that has received limited attention in previous research. Secondly, our novel methodological approach provides a more comprehensive and nuanced understanding of these barriers, potentially offering a new paradigm for similar studies in other contexts. This hybrid approach, combining thematic analysis with the Fuzzy Delphi Method, offers several advantages over traditional methods. It allows for the integration of existing literature with expert knowledge, while also accounting for the inherent uncertainty in expert judgments. Compared to conventional

survey methods or standalone qualitative approaches, our method offers improved reliability and validity of results, as it incorporates multiple rounds of expert feedback and uses fuzzy logic to capture the ambiguity in human opinions. Furthermore, this approach is particularly well-suited for the complex and dynamic context of SME financing in Iran, where multiple factors interact in intricate ways. Thirdly, the findings of this research have practical implications for policymakers, financial institutions, and SME managers in Iran, offering evidence-based insights to inform policy development and business strategies. By providing a more holistic and nuanced understanding of financing barriers, this study can contribute to the development of more effective and targeted interventions to support SME growth and sustainability in Iran's unique economic environment.

By identifying and analyzing the specific barriers to production financing in Iranian SMEs, this study aims to provide a foundation for developing targeted interventions and policies. These insights can assist policymakers in crafting more effective support programs, help financial institutions design more suitable products for SMEs, and guide SME managers in navigating the complex financing landscape. Ultimately, this research contributes to the broader goal of enhancing SME growth and sustainability, which is crucial for Iran's economic development.

In the following sections, we present a comprehensive review of relevant literature, detail our innovative methodology, discuss our findings, and explore their implications for theory and practice in SME financing.

2. Theoretical Framework

2.1 Small and Medium Enterprises (SMEs)

Small and Medium Enterprises (SMEs) are economic entities that play a crucial role in the global economy. The definition of SMEs varies across countries and organizations, reflecting the diverse economic structures and policy objectives worldwide. Generally, SMEs are characterized by their relatively small number of employees and lower annual turnover compared to large corporations. For instance, the European Union defines SMEs as enterprises with fewer than 250 employees and an annual turnover not exceeding €50 million (Garcia-Martinez et al. [17]). In contrast, the United States Small Business Administration sets varying standards based on industry sectors, with some definitions extending to businesses with up to 1,500 employees. In Iran, the Ministry of Industry, Mine and Trade classifies SMEs as businesses with fewer than 100 employees, further categorizing them into micro (1-9 employees), small (10-49 employees), and medium (50-99 employees) enterprises (Hedavand et al. [24]).

These definitional differences are not merely semantic; they have significant implications for policy formulation, regulatory frameworks, and support mechanisms aimed at fostering SME growth and development. Understanding these definitions is crucial for cross-country comparisons and for designing effective, targeted interventions to support SMEs.

2.2 Importance of SMEs in the Economy

SMEs are widely recognized as the backbone of most economies, particularly in developing countries. Their significance extends beyond their sheer number to encompass various critical economic and social functions:

Employment Generation: SMEs are major contributors to job creation. According to the World Bank, SMEs account for about 90% of businesses and more than 50% of employment worldwide (Ramazanov [47]). In Iran, SMEs comprise 98% of all businesses and account for about 50% of the country's total employment (Hedavand et al. [24]).

Economic Growth and GDP Contribution: SMEs significantly contribute to Gross Domestic Product (GDP) in both developed and developing economies. In the European Union, SMEs account for 56.4% of GDP (Garcia-Martinez et al. [17]), while in Iran, they contribute approximately 35% to the GDP (Zayed et al. [57]).

Innovation and Entrepreneurship: SMEs are often at the forefront of innovation, introducing new products, services, and business models. Their smaller size and flatter hierarchies often allow for greater flexibility and faster decision-making, enabling them to adapt quickly to market changes and capitalize on new opportunities (Mabenge et al. [36]).

Economic Resilience: The diversity and flexibility of SMEs contribute to economic resilience. During

economic downturns, the presence of a strong SME sector can help mitigate the impact of crises by providing alternative employment opportunities and maintaining economic activity (Wang et al. [56]).

Regional Development: SMEs play a crucial role in regional economic development, particularly in less developed areas. They help reduce regional disparities by creating local employment opportunities and contributing to more balanced spatial economic growth (Vives [55]).

Supply Chain Integration: SMEs often serve as crucial links in the supply chains of larger corporations, providing specialized products and services. This integration enhances overall economic efficiency and competitiveness (Gonçalves et al. [20]).

Understanding the multifaceted importance of SMEs underscores the need for supportive policies and initiatives, particularly in the realm of financing, to ensure their continued growth and contribution to economic development.

2.3 SME Financing

Access to finance is a critical factor in the establishment, survival, and growth of SMEs. Adequate financing enables SMEs to invest in new technologies, expand operations, hire skilled workers, and weather economic uncertainties. The financing landscape for SMEs is diverse, encompassing both traditional and innovative funding sources.

Internal financing refers to funds generated within the business itself. This form of financing is often preferred by SMEs due to its accessibility and lower risk. Key sources include:

Retained Earnings: Profits reinvested into the business are a primary source of internal financing. This method allows for organic growth but may limit the pace of expansion (Masdupi et al. [41]).

Personal Savings and Family Funds: Particularly for startups and micro-enterprises, personal savings and funds from family members often constitute the initial capital (Effiom and Edet [13]).

Asset Sales: Selling underutilized or non-core assets can generate funds for reinvestment in more productive areas of the business.

Working Capital Management: Efficient management of inventory, accounts receivable, and accounts payable can free up cash for operational needs and small-scale investments.

External financing involves obtaining funds from sources outside the business. While potentially offering larger sums and faster growth opportunities, external financing often comes with higher costs and risks. Key sources include:

Bank Loans: Traditional bank loans remain a primary source of external financing for SMEs. However, access can be challenging due to stringent collateral requirements and risk assessment procedures (Hasseno et al. [23]).

Microfinance: Particularly relevant for micro and small enterprises, microfinance institutions provide smaller loans with more flexible terms compared to traditional banks (Chiappini et al. [12]).

Venture Capital and Angel Investors: These sources provide capital in exchange for equity, often bringing expertise and networks along with funding. They are particularly important for high-growth, innovative startups (Bellucci et al. [6]).

Crowdfunding: Online platforms that allow businesses to raise small amounts of money from a large number of people have become increasingly popular, especially for creative projects and early-stage startups (Rao et al. [49]).

Government Grants and Subsidies: Many governments offer financial support to SMEs through grants, subsidized loans, or loan guarantees, often targeted at specific sectors or policy objectives (Ceptureanu et al. [9]).

Trade Credit: Supplier financing through delayed payment terms can be a significant source of short-term financing for SMEs (Li et al. [31]).

Leasing and Factoring: These alternative financing methods allow SMEs to access equipment or improve cash flow without traditional loans (Oghosanine [43]).

Understanding this diverse financing landscape is crucial for SMEs to make informed decisions about their funding strategies and for policymakers to design effective support mechanisms.

2.4 Challenges in SME Financing

SMEs face a multitude of challenges in accessing adequate financing, which can significantly impede their growth and sustainability. A primary obstacle is the information asymmetry between SMEs and financial institutions, as many small businesses lack comprehensive financial records and credit histories, making it difficult for lenders to assess their creditworthiness (Pu et al. [46]). This information gap often leads to higher perceived risks, resulting in increased borrowing costs or loan application rejections. Additionally, stringent collateral requirements pose a significant barrier, particularly for startups and service-based SMEs that may lack substantial physical assets (Endris and Kassegn [15]). The disproportionately high transaction costs associated with processing and monitoring small loans further diminish the attractiveness of SME lending for financial institutions (Khan et al. [29]). Limited financial literacy among SME owners and managers compounds these issues, hindering their ability to navigate complex financing options and prepare compelling loan applications (Babajide et al. [5]). The regulatory environment in some countries may not adequately support alternative financing methods or may impose burdensome requirements on SMEs seeking funding (Ramazanov [47]). Economic volatility, especially in developing economies, can exacerbate these challenges by making financial institutions more risk-averse (Hai [22]). Unlike larger corporations, most SMEs cannot access public equity or bond markets, further restricting their financing options (Urbinati et al. [54]). Moreover, gender and regional disparities add another layer of complexity, with female entrepreneurs and SMEs in rural or underdeveloped areas often facing additional barriers in accessing finance (Asongu et al. [4]). These interconnected challenges create a complex landscape for SME financing, necessitating a multifaceted approach involving policy interventions, financial sector development, and capacity building within SMEs themselves to ensure their continued growth and contribution to economic development.

3. Literature Review

Small and Medium Enterprises (SMEs) play a crucial role in economic growth and development worldwide. However, access to adequate financing remains a significant challenge for SMEs, particularly in developing economies. This literature review examines recent studies on financing barriers faced by SMEs and potential solutions. Several studies have investigated the specific financing challenges faced by SMEs. Ibitomi et al. [26] conducted an empirical study on access to finance for micro, small, and medium enterprises (MSMEs) in Kosovo. Their findings revealed a heavy reliance on internal funds among most SMEs, with high interest rates and stringent collateral requirements identified as the main barriers to accessing external financing. This aligns with earlier research by Serrasqueiro et al. [50], which found that SMEs prefer internal financing to external financing due to severe constraints such as high interest rates, complex administrative requirements, and high collateral demands.

Technological advancements and digital transformation have been recognized as both opportunities and challenges for SME financing. Hai [22] discussed the barriers to digital transformation for SMEs in Vietnam, noting that while digital transformation offers significant opportunities, many SMEs face challenges in adopting new technologies due to financial constraints. This is particularly relevant in the context of emerging fintech solutions for SME financing, as explored by Łasak [35], who examined the role of financial technology and entrepreneurial finance practices in SME financing. The role of banks and traditional financial institutions in SME financing remains significant but evolving. Garcia-Posada-Gomez [18] analyzed SME financing in transition economies, identifying factors creating financing obstacles and examining how bank regulatory practices affect SMEs' access to bank loans. Their study contributes to understanding the impact of specific bank supervisory practices on credit lending to SMEs in transition economies.

Innovation financing for SMEs has been a focus of several studies. Khan et al. [43] investigated the role of financial frictions as barriers to the likelihood of introducing both technological and soft innovations (e.g., organizational-managerial and marketing innovations) in developing markets. Their findings highlight the

importance of bank-based finance in promoting various types of innovation in developing countries. Alternative financing methods have gained attention as potential solutions to SME financing challenges. Abdeldayem and Aldulaimi [1] explored the development of an Islamic crowdfunding model with an innovative new mechanism for financing SMEs in the Middle East. Their study presents a Sharia-compliant crowdfunding model as an alternative form of financing for SMEs in Islamic business environments.

The impact of financial constraints on SME growth and performance has been extensively studied. Chiappini et al. [12] examined whether direct innovation subsidies can relax SMEs' financial constraints. Their research found significant improvements in access to bank financing for firms, particularly for small and very small companies that have been operating for about six years. Sectoral differences in SME financing have also been explored. Li et al. [31] investigated the effects of monetary policy on corporate financing across different industries, finding heterogeneous effects of monetary policies among various industries. Their study revealed that tight monetary policies significantly curbed the financing scale of manufacturing companies in terms of both bank loans and trade credit but had no impact on real estate companies.

The role of education and financial literacy in SME financing decisions has been highlighted by several researchers. Eldesouky et al. [14] studied the impact of education levels of SME owners on financing priorities, finding that education influences financing priorities, although the level of education does not affect other forms of financing. Gender disparities in SME financing have also been a subject of research. Liñares-Zegarra and Wilson [32] examined access to finance for UK social enterprises, including those led by women and minority ethnic groups (MEG). Their study found that women-led social enterprises are more likely to apply for bank loans but less likely to receive funding from banks compared to male-led enterprises. The COVID-19 pandemic has added new dimensions to SME financing challenges. Oyewole et al. [44] discussed future directions for enhancing global competitiveness of U.S. SMEs through sustainable finance, emphasizing the importance of integrating Environmental, Social, and Governance (ESG) criteria into financial decision-making processes in the post-pandemic context.

In conclusion, the literature reveals that SME financing remains a complex challenge influenced by various factors including government policies, technological advancements, banking practices, innovation requirements, and global economic conditions. While traditional banking continues to play a crucial role, alternative financing methods and fintech solutions are emerging as important complements. The research also highlights the need for tailored approaches considering the specific contexts of different countries, sectors, and types of SMEs. Future research directions could include more in-depth studies on the impact of fintech and sustainable finance practices on SME financing, as well as comparative analyses across different economic contexts.

4. Methodology

This research employs a mixed-method approach, combining qualitative thematic analysis with the quantitative Fuzzy Delphi Method (FDM). The study was conducted in two main phases: (1) thematic analysis of existing literature, and (2) application of the FDM to refine and validate the findings.

4.1 Thematic Analysis

The thematic analysis was conducted based on Braun and Clarke's [7] six-step model. We reviewed 282 research works from reputable external databases such as Emerald, Springer, ScienceDirect, and Google Scholar, as well as internal databases such as Civilica, Magiran, and SID. These works were identified and reviewed within the time frame of 2014 to 2023 using keywords relevant to the research topic.

After assessing the relevance of the articles to the study topic, we evaluated the quality of the initial articles using the Critical Skills Evaluation Framework. Criteria such as objectives, logic, research design and sampling, data collection methods, reflexivity, ethical considerations, analytical accuracy, presentation of findings, and research value were examined and scored for each article. The scoring system used in this study was as follows: Excellent (41-50), Very Good (31-40), Good (21-30), Fair (11-20), and Poor (0-10). Research scoring less than 30 were excluded, and ultimately, after selection and refinement, 23 articles were chosen for final thematic

analysis.

4.2 Fuzzy Delphi Method (FDM)

The FDM was employed to identify specific factors influencing the barriers to production financing in SMEs in Iran. This method combines the traditional Delphi technique with fuzzy set theory to handle the vagueness of human opinions (Hsueh [25]).

4.2.1 Expert Selection

Experts in finance, business management, and economic development were selected through purposive sampling. A total of 15 experts were chosen based on their experience, active participation in the relevant field, and thorough understanding of different dimensions of SME financing.

4.2.2 Fuzzy Set Theory and Triangular Fuzzy Numbers

In the FDM, linguistic variables are represented as triangular fuzzy numbers. A triangular fuzzy number \tilde{A} is defined as a triplet (l, m, u) , where $l \leq m \leq u$. Here, l and u represent the lower and upper bounds of the fuzzy number \tilde{A} , respectively, and m is the modal value (Kaufmann and Gupta [28]). The membership function of a triangular fuzzy number \tilde{A} is defined as:

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x < l \\ \frac{x-l}{m-l}, & l \leq x \leq m \\ \frac{u-x}{u-m}, & m \leq x \leq u \\ 0, & x > u \end{cases} \tag{1}$$

Table 1 shows the relationship between linguistic terms and fuzzy numbers used in this study (adapted from Hsueh [25]):

Table 1. Relationship between linguistic terms and fuzzy numbers [25]

Linguistic Variable	Fuzzy Number	l	m	u
Very Low	(0, 0, 0.25)	0	0	0.25
Low	(0, 0.25, 0.5)	0	0.25	0.5
Medium	(0.25, 0.5, 0.75)	0.25	0.5	0.75
High	(0.5, 0.75, 1)	0.5	0.75	1
Very High	(0.75, 1, 1)	0.75	1	1

4.2.3 FDM Process

The FDM was implemented through the following steps:

Step 1: Fuzzification of expert opinions. Each expert's opinion was quantified using triangular fuzzy numbers. The fuzzy set \tilde{A}_i for the i th expert was determined using Equation 2 (Chang et al. [10]):

$$\tilde{A}_i = (l_i, m_i, u_i) \tag{2}$$

where l_i , m_i , and u_i represent the minimum, most likely, and maximum values of the fuzzy number, respectively.

Step 2: Aggregation of fuzzy opinions. To convert the opinions of all experts on a particular indicator into a single fuzzy number, the average of the fuzzy sets was calculated using Equation (3) (Hsueh [25]), where n is the number of experts.

$$\hat{A} = (l, m, u) = \left(\frac{1}{n} \sum_{i=1}^n l_i, \frac{1}{n} \sum_{i=1}^n m_i, \frac{1}{n} \sum_{i=1}^n u_i \right) \tag{3}$$

Step 3: Defuzzification. To defuzzify the final values for each indicator, the simple center of gravity method was applied, as described by Equation (4) (Hsueh[25]), Where S is the defuzzified (crisp) value.

$$S = \frac{l + m + u}{3} \quad (4)$$

4.2.4 Consensus and Indicator Selection

The Delphi process was repeated until the absolute mean difference in expert opinions between two rounds of the survey dropped below 0.2 (Cheng and Lin [11]). Once consensus was reached, indicators with a defuzzified value of 0.7 or higher were accepted, while those below this threshold were removed (Kosmidou [30]). The implementation steps of the FDM are shown in Figure 1.

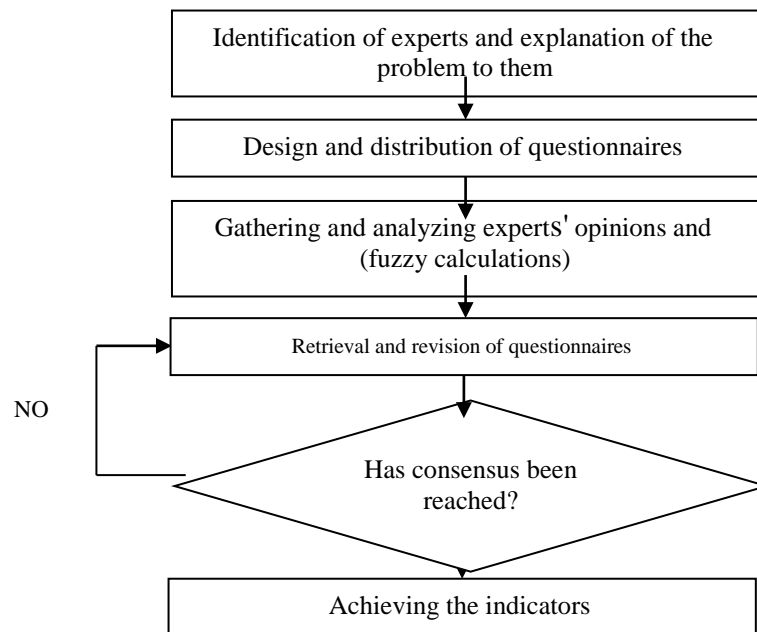


Figure 1. Steps for implementing the FDM (Hsueh, [25])

4.3 Validation

Content validity in the Delphi section was established through content validity methods. Initially, indicators affecting the barriers to production financing in SMEs were identified through a thematic analysis of previous studies and refined based on expert opinions. Subsequently, questions were designed based on the validated indicators, and approval was received from experts, demonstrating the validity of the content of the questionnaire. For reliability assessment, Cronbach's alpha of the questionnaire was calculated. Since the alpha value was above 0.7, the reliability of the questionnaire was confirmed. This comprehensive methodology allows for a rigorous and nuanced analysis of the barriers to production financing in Iranian SMEs, combining the strengths of both qualitative and quantitative approaches.

4.4 Advantages of the Proposed Method

The proposed hybrid approach combining thematic analysis and FDM offers several advantages over other methods used in similar studies:

1. **Comprehensive analysis:** By integrating literature review with expert opinions, this method provides a more holistic understanding of the financing barriers faced by SMEs.
2. **Handling uncertainty:** The use of fuzzy logic allows for better representation of the vagueness and

ambiguity inherent in expert judgments, leading to more reliable results compared to traditional Delphi methods (Habibi et al. [21]).

3. Iterative refinement: The multi-round nature of the Delphi process allows for continuous refinement of ideas, leading to more robust findings compared to one-time surveys or interviews (Linstone and Turoff [33]).

4. Flexibility: This method can be easily adapted to different contexts and can incorporate a wide range of expert opinions, making it suitable for studying complex phenomena like SME financing (Hsueh [25]).

In terms of computational cost and efficiency, the proposed method strikes a balance between depth of analysis and resource requirements. While it may require more time and effort compared to simple survey methods due to its iterative nature, it is more efficient than conducting extensive case studies or large-scale quantitative analyses. The use of fuzzy logic does add some computational complexity, but modern software tools make this manageable. Moreover, the improved reliability and validity of results justify the additional computational cost. Compared to other approaches like Analytic Hierarchy Process (AHP) or purely quantitative methods, our approach is more suitable for exploring and defining the initial set of barriers, especially in contexts where quantitative data may be limited or unreliable. It also allows for the emergence of new factors that may not have been considered in previous literature, making it particularly valuable for studying evolving phenomena like SME financing in developing economies.

5. Research Findings

This research utilized the six-phase model by Braun and Clarke [7] for thematic analysis, which offers a systematic and advanced approach. The steps taken in this study for data analysis and theme extraction were as follows:

Initially, a thorough understanding of the existing data was gained by extensively reviewing relevant studies and research work. The data coding process then began with all data summaries being coded and categorized. Next, similar codes were identified and grouped into preliminary themes. These preliminary themes were reviewed, redundant themes were eliminated, and similar ones were merged, resulting in the extraction of 57 final themes. Each of these 57 themes was then defined and clarified, and an assessment was made of which parts of the data each theme covered. Finally, the final report, including definitions and concepts for each of the 57 extracted themes, was prepared.

The thematic analysis revealed 57 indicators identified as significant barriers to production financing in SMEs, grouped into 10 main dimensions. These main dimensions represent a set of barriers drawn from various sources to provide a comprehensive and structured view of the challenges SMEs face in financing.

Figure 2 shows these dimensions and indicators, as well as their interrelationships.

Using the identified factors and defined verbal variables, a Delphi questionnaire was designed for expert review. The results from the first round of the Delphi questionnaire are shown in Table 2.

Table 2. Results of the first round of the FDM

Dimensions	Row	Indicators	Ref.	Expert Opinion Aggregation			Defuzzified Value
				<i>l</i>	<i>m</i>	<i>u</i>	<i>S</i>
Financial Infrastructure and Access	1	Availability of financial institutions	[2], [16], [19]	0.600	0.650	0.700	0.650
	2	Access to banking services	[58], [42]	0.678	0.883	0.700	0.754
	3	Depth of financial markets	[8]	0.711	0.917	0.733	0.787
	4	Government support programs	[48]	0.600	0.650	0.700	0.650
	5	Venture capital	[6]	0.689	0.917	0.700	0.769
	6	Access to microfinance	[12], [43], [9]	0.711	0.917	0.733	0.787
Legal Environment and Political Implications	7	Transparency of legal framework	[43]	0.811	0.983	0.850	0.881
	8	Compliance and administrative ease	[22], [37]	0.750	0.933	0.783	0.822
	9	Tax policies	[31], [47], [38]	0.694	0.900	0.717	0.770
	10	Government support programs	[9], [54]	0.639	0.867	0.650	0.719
	11	Financial inclusion initiatives	[4], [6], [12]	0.383	0.617	0.367	0.456
Information Asymmetry and Transparency	12	Availability of information	[52], [59]	0.667	0.883	0.683	0.744
	13	Transparency in lending practices	[6], [39], [47]	0.694	0.900	0.717	0.770
	14	Credit reporting mechanisms	[9]	0.711	0.917	0.733	0.787
	15	Disclosure requirements	[6]	0.533	0.783	0.533	0.616
	16	Access to information	[45], [18], [22]	0.678	0.883	0.700	0.754
	17	Risk assessment transparency	[12], [54]	0.689	0.917	0.700	0.769
	18	Data security measures	[43], [9]	0.644	0.883	0.650	0.726
Collateral Requirements and Asset-Based Financing	19	Collateral policies	[12], [39], [47]	0.639	0.867	0.650	0.719
	20	Asset valuation methods	[12], [39], [47]	0.772	0.967	0.800	0.846
	21	Loan-to-Value Ratios (LTV)	[12], [39], [47]	0.667	0.883	0.683	0.744
	22	Asset-liability mismatch	[12], [39], [47]	0.761	0.933	0.800	0.831
	23	Non-traditional collateral acceptance criteria	[12], [39], [47]	0.383	0.417	0.367	0.389
Loan Terms and Conditions	24	Interest rates and fees	[2], [16], [19]	0.811	0.983	0.850	0.881
	25	Loan duration and repayment schedule	[58], [42]	0.644	0.883	0.650	0.726
	26	Flexibility of repayment terms	[8]	0.711	0.917	0.733	0.787
	27	Prepayment penalties	[48]	0.706	0.900	0.733	0.780
	28	Loan contracts and terms	[6]	0.570	0.604	0.638	0.604
	29	Default and delinquency resolution	[12], [43], [9]	0.711	0.917	0.733	0.787
	30	Loan guarantees and collateral	[22], [37]	0.728	0.933	0.750	0.804
Credit Assessment and Risk Perception	31	Credit scoring and credit history evaluation	[31], [47], [38]	0.644	0.883	0.650	0.726
	32	Financial statement analysis	[9], [54]	0.694	0.900	0.717	0.770
	33	Business and industry survival risk assessment	[4], [6], [12]	0.750	0.933	0.783	0.822
	34	Collateral and asset-based risk assessment	[52], [59]	0.811	0.983	0.850	0.881
	35	Market perception and economic conditions	[6], [39], [47]	0.411	0.633	0.383	0.476

Table 2. Continued

Dimensions	Row	Indicators	Ref.	Expert Opinion Aggregation			Defuzzified Value
				l	m	u	S1
Market Dynamics and Competition	36	Market structure	[45], [18], [22]	0.678	0.883	0.700	0.754
	37	Competitive landscape	[9], [54]	0.772	0.967	0.800	0.846
	38	Industry concentration	[31], [47], [38]	0.656	0.883	0.667	0.735
	39	Entry barriers	[9], [54]	0.650	0.867	0.667	0.728
	40	Substitutes and complements	[4], [6], [12]	0.678	0.883	0.700	0.754
	41	Pricing strategies	[52], [59]	0.678	0.883	0.700	0.754
	42	Technological disruption	[6], [39], [47]	0.761	0.933	0.800	0.831
Technological Advancements and Digitalization	43	Digital infrastructure	[37], [22], [52]	0.711	0.917	0.733	0.787
	44	Fintech adoption	[4]	0.644	0.883	0.650	0.726
	45	Digital platform integration	[47], [9], [54]	0.650	0.850	0.667	0.722
	46	Cybersecurity measures	[6]	0.650	0.867	0.667	0.728
Socioeconomic Factors and Regional Disparities	47	Economic development levels	[22], [37]	0.678	0.883	0.700	0.754
	48	Income inequality	[31],[47], [38]	0.639	0.867	0.650	0.719
	49	Access to education	[9], [54]	0.650	0.867	0.667	0.728
	50	Infrastructure development	[4], [6], [12]	0.672	0.900	0.683	0.752
	51	Regional economic disparities	[52], [59]	0.694	0.900	0.717	0.770
	52	Government support policies	[6], [39], [47]	0.694	0.900	0.717	0.770
Alternative Financing Mechanisms and Innovations	53	Peer-to-peer lending	[45], [18], [22]	0.650	0.850	0.667	0.722
	54	Crowdfunding platforms	[6], [39]	0.700	0.917	0.717	0.778
	55	Invoice financing	[31], [47], [38]	0.761	0.933	0.800	0.831
	56	Supply chain financing	[9], [54]	0.711	0.917	0.733	0.787
	57	Revenue-based financing	[4], [6], [12]	0.728	0.933	0.750	0.804

Following the initial Delphi round, experts not only commented on the provided indicators but also added new indicators for some components, as detailed in Table 3.

Table 3. Indicators proposed in the first round of the FDM based on expert opinions

Dimensions	Indicators
Financial Infrastructure and Access	Lack of liquidity
	Fixed capital allocation (need for long-term financing for production units, as opposed to short-term working capital)
	Short-term working capital (production units' need for working capital for daily operations and production)
Legal Environment and Political Implications	Issuance of multiple circulars and problems arising from complexity and constant changes in laws and regulations
	Streamlining the licensing process for setting up new production units
Information Asymmetry and Transparency	Issues related to the calculation of bank interest and profit, which can impose a significant financial burden on production units
Collateral Requirements and Asset-Based Financing	Capital lockup (unused capital in incomplete and stagnant units)
	Sale of incomplete units (production units abandoned due to financial problems and put up for sale)
	Need for supportive and incentive policies for small production units.
	Stagnant production units that have ceased operations due to financial problems and other obstacles
Loan Terms and Conditions	Loan repayment methods and problems related to loan repayment terms and conditions
	Various production costs that affect the profitability and competitiveness of production units
Credit Assessment and Risk Perception	Selection and support of qualified producers who can operate with high efficiency
Market Dynamics and Competition	Structural problems in policy-making and management of production units
Socioeconomic Factors and Regional Disparities	Difficulty in accessing suitable land for developing production units
	Allocation of subsidized resources to small and medium-sized production units to support them
Alternative Financing Mechanisms and Innovations	Measures to dispossess opportunists who have acquired land and resources without productive use
	Licensing policies accompanied by free land can help encourage investment.

In the second round, a revised questionnaire was prepared that included both the initial indicators and the new suggestions. This questionnaire, along with each expert's previous responses and the degree of discrepancy with other experts' views, was sent back to the group. Experts responded to the questions once more, taking into account feedback from their peers. To evaluate the level of consensus, the absolute mean difference in expert opinions between the first and second rounds was calculated, with results shown in Table 4.

Table 4. Results of the second round of the FDM

Dimensions	Row	Indicators	Expert Opinion Aggregation			Defuzzified value, the second phase	S2- S1
			l	m	u	S2	
Financial Infrastructure and Access	1	Availability of financial institutions	0.811	0.983	0.850	0.881	0.231
	2	Access to banking services	0.689	0.917	0.700	0.769	0.015
	3	Depth of financial markets	0.711	0.917	0.733	0.787	0.000
	4	Government support programs	0.850	0.881	0.912	0.881	0.231
	5	Venture capital	0.694	0.900	0.717	0.770	0.001
	6	Access to microfinance	0.811	0.983	0.850	0.881	0.094
	7	Lack of liquidity	0.689	0.917	0.700	0.769	0.769
	8	Fixed capital allocation (need for long-term financing for production units versus short-term working capital)	0.711	0.917	0.733	0.787	0.787
	9	Short-term working capital (production units' need for working capital for daily operations and production)	0.678	0.883	0.700	0.754	0.754
Legal Environment and Political Implications	10	Transparency of legal framework	0.694	0.900	0.717	0.770	0.111
	11	Compliance and administrative ease	0.772	0.967	0.800	0.846	0.024
	12	Tax policies	0.678	0.883	0.700	0.754	0.016
	13	Government support programs	0.639	0.867	0.650	0.719	0.000
	14	Financial inclusion initiatives	0.383	0.417	0.367	0.389	0.067
	15	Issuance of multiple circulars and problems arising from complexity and constant changes in laws and regulations	0.750	0.933	0.783	0.822	0.822
	16	Facilitating the licensing process for establishing new production units	0.689	0.917	0.700	0.769	0.769
Information Asymmetry and Transparency	17	Availability of information	0.711	0.917	0.733	0.787	0.043
	18	Transparency in lending practices	0.667	0.883	0.683	0.744	0.026
	19	Credit reporting mechanisms	0.689	0.917	0.700	0.769	0.018
	20	Disclosure requirements	0.383	0.617	0.367	0.456	0.160
	21	Access to information	0.644	0.883	0.650	0.726	0.028
	22	Transparency of risk assessment	0.639	0.867	0.650	0.719	0.050
	23	Data security measures	0.667	0.883	0.683	0.744	0.018
	24	Problems arising from the method of calculating bank interest and profit, which can impose a heavy financial burden on production units	0.761	0.933	0.800	0.831	0.831
Collateral Requirements and Asset-Based Financing	25	Collateral policies	0.711	0.917	0.733	0.787	0.068
	26	Asset valuation methods	0.706	0.900	0.733	0.780	0.066
	27	Loan-to-value ratio	0.711	0.917	0.733	0.787	0.043
	28	Asset-liability mismatch	0.728	0.933	0.750	0.804	0.027
	29	Non-traditional collateral acceptance criteria	0.411	0.633	0.383	0.476	0.087
	30	Capital lockup (unused capital in unfinished and stagnant units)	0.811	0.983	0.850	0.881	0.881
	31	Sale of unfinished units (production units abandoned due to financial problems and put up for sale)	0.678	0.883	0.700	0.754	0.754
	32	Need for supportive and incentive policies for small production units.	0.644	0.883	0.650	0.726	0.726
	33	Stagnant production units that have ceased operations due to financial problems and other obstacles	0.644	0.883	0.650	0.726	0.726

Table 4. Continued

Dimensions	Row	Indicators	Expert Opinion Aggregation			Defuzzified value, the second phase	S2- S1
			l	m	u	S2	
Loan Terms and Conditions	34	Interest rates and fees	0.750	0.933	0.783	0.822	0.059
	35	Loan duration and repayment schedule	0.694	0.900	0.717	0.770	0.044
	36	Flexibility of repayment terms	0.811	0.983	0.850	0.881	0.094
	37	Prepayment penalties	0.678	0.883	0.700	0.754	0.026
	38	Loan contracts and conditions	0.772	0.967	0.800	0.846	0.242
	39	Default and violation resolution	0.656	0.883	0.667	0.735	0.052
	40	Loan guarantees and collateral	0.650	0.867	0.667	0.728	0.076
	41	Method of loan repayment and problems related to loan repayment terms and conditions	0.678	0.883	0.700	0.754	0.754
42	Various production costs that affect the profitability and competitiveness of production units	0.650	0.867	0.667	0.728	0.728	
Credit Assessment and Risk Perception	43	Credit scoring and credit history assessment	0.639	0.867	0.650	0.719	0.007
	44	Financial statement analysis	0.678	0.883	0.700	0.754	0.016
	45	Business and industry survival risk assessment	0.650	0.867	0.667	0.728	0.094
	46	Collateral assessment and asset-based risk	0.761	0.933	0.800	0.831	0.050
	47	Market perception and economic conditions	0.383	0.417	0.367	0.389	0.087
	48	Selection and support of qualified producers who can operate with high productivity	0.678	0.883	0.700	0.754	0.754
Market Dynamics and Competition	49	Market structure	0.650	0.850	0.667	0.722	0.032
	50	Competitive landscape	0.644	0.883	0.650	0.726	0.120
	51	Industry concentration	0.711	0.917	0.733	0.787	0.052
	52	Entry barriers	0.700	0.917	0.717	0.778	0.050
	53	Substitutes and complements	0.694	0.900	0.717	0.770	0.016
	54	Pricing strategies	0.672	0.900	0.683	0.752	0.002
	55	Technological disruption	0.711	0.917	0.733	0.787	0.044
	56	Structural problems in policy-making and management of production units	0.694	0.900	0.717	0.770	0.770
Technological Advancements and Digitalization	57	Digital infrastructure	0.522	0.767	0.517	0.602	0.185
	58	Adoption of financial technologies	0.694	0.900	0.717	0.770	0.044
	59	Integration of digital platforms	0.728	0.933	0.750	0.804	0.082
	60	Cybersecurity measures	0.761	0.933	0.800	0.831	0.103
Social and Economic Factors and Regional Inequalities	61	Levels of economic development	0.650	0.850	0.667	0.722	0.032
	62	Income inequality	0.811	0.983	0.850	0.881	0.162
	63	Access to education	0.761	0.933	0.800	0.831	0.103
	64	Infrastructure development	0.689	0.917	0.700	0.769	0.017
	65	Regional economic inequalities	0.678	0.883	0.700	0.754	0.016
	66	Government support policies	0.750	0.933	0.783	0.822	0.052
	67	The problem of access to suitable land for the development of production units	0.811	0.983	0.850	0.881	0.881
	68	Allocation of subsidized resources to small and medium-sized production units to support them	0.689	0.917	0.700	0.769	0.769

Table 4. Continued

Dimensions	Row	Indicators	Expert Opinion Aggregation			Defuzzified value, the second phase	S2- S1
			l	m	u	S2	
Alternative Financing Mechanisms and Innovations	69	Peer-to-peer lending	0.761	0.933	0.800	0.831	0.109
	70	Crowdfunding platforms	0.678	0.883	0.700	0.754	0.024
	71	Factor financing	0.761	0.933	0.800	0.831	0.000
	72	Supply chain financing	0.678	0.883	0.700	0.754	0.024
	73	Revenue-based financing	0.672	0.900	0.683	0.752	0.052
	74	Measures to dispossess opportunistic individuals who have acquired land and resources without productive use	0.678	0.883	0.700	0.754	0.754
	75	Licensing policies accompanied by free land can help encourage investment.	0.678	0.883	0.700	0.754	0.754

The Delphi process is repeated until the absolute mean difference in expert opinions between two rounds of the survey drops below 0.2, at which point the survey process concludes (Cheng and Lin [11]). Since the absolute mean difference in opinions for all indicators in the second round did not fall below 0.2, the Delphi survey continued into the third round. In this round, the survey was conducted only for indicators where the mean difference between the first and second rounds was greater than 0.2. Results from this round are presented in Table 5, along with the absolute mean difference in opinions between the second and third rounds, as shown in the same table.

Table 5. Results of the third round of the FDM

Dimensions	Row	Indicators	Expert Opinion Aggregation			Defuzzified value, the second phase	S3- S2
			l	m	u	S3	
Financial Infrastructure and Access	1	Availability of financial institutions	0.761	0.933	0.800	0.831	0.050
	2	Government support programs	0.750	0.933	0.783	0.822	0.059
	3	Lack of liquidity	0.811	0.983	0.850	0.881	0.112
	4	Fixed capital allocation (need for long-term financing for production units versus short-term working capital)	0.644	0.883	0.650	0.726	0.061
	5	Short-term working capital (production units' need for working capital for daily operations and production)	0.689	0.917	0.700	0.769	0.015
Legal Environment and Political Implications	6	Issuance of multiple circulars and problems arising from complexity and constant changes in laws and regulations	0.750	0.933	0.783	0.822	0.000
	7	Facilitating the licensing process for establishing new production units	0.678	0.883	0.700	0.754	0.015
Information Asymmetry and Transparency	8	Problems arising from the method of calculating bank interest and profit, which can impose a heavy financial burden on production units	0.678	0.883	0.700	0.754	0.077
Collateral Requirements and Asset-Based Financing	9	Capital lockup (unused capital in unfinished and stagnant units)	0.850	0.881	0.912	0.881	0.000
	10	Sale of unfinished units (production units abandoned due to financial problems and put up for sale)	0.689	0.917	0.700	0.769	0.015
	11	Need for supportive and incentive policies for small production units.	0.811	0.983	0.850	0.881	0.155
	12	Stagnant production units that have ceased operations due to financial problems and other obstacles	0.678	0.883	0.700	0.754	0.028

Table 5. Continued

Dimensions	Row	Indicators	Expert Opinion Aggregation			Defuzzified value, the second phase	S3- S2
			l	m	u	S3	
Loan Terms and Conditions	13	Method of loan repayment and problems related to loan repayment terms and conditions	0.711	0.917	0.733	0.787	0.033
	14	Various production costs that affect the profitability and competitiveness of production units	0.678	0.883	0.700	0.754	0.026
Credit Assessment and Risk Perception	15	Selection and support of qualified producers who can operate with high productivity	0.650	0.867	0.667	0.728	0.026
Market Dynamics and Competition	16	Structural problems in policy-making and management of production units	0.689	0.917	0.700	0.769	0.001
Social and Economic Factors and Regional Inequalities	17	The problem of access to suitable land for the development of production units	0.811	0.983	0.850	0.881	0.000
	18	Allocation of subsidized resources to small and medium-sized production units to support them	0.678	0.883	0.700	0.754	0.015
Alternative Financing Mechanisms and Innovations	19	Measures to dispossess opportunistic individuals who have acquired land and resources without productive use	0.644	0.883	0.650	0.726	0.028
	20	Licensing policies accompanied by free land can help encourage investment.	0.678	0.883	0.700	0.754	0.000

According to Table 5, the mean differences in expert opinions for all indicators have fallen below 0.2, indicating that consensus has been reached. Once consensus on the indicators was achieved, the next step was to screen these indicators. In this phase, any indicator with a value below the predetermined threshold was removed, while the remaining indicators were considered effective. Some researchers have established a threshold value of 0.7 for accepting indicators. This means that if the non-fuzzy value of an indicator in the final round is 0.7 or higher, it is accepted; otherwise, it is rejected and removed. Since 4 indicators fell below the 0.7 threshold, these indicators were removed, as shown in Table 6.

Table 6. Indicators eliminated in the final round of Delphi based on expert opinions

Row	Indicators
1	Financial inclusion initiatives
2	Non-traditional collateral acceptance criteria
3	Disclosure requirements
4	Market perception and economic conditions

Based on the results, the analysis of the barriers to production financing in SMEs in Iran using the fuzzy Delphi approach identified 10 dimensions and 71 indicators, as presented in Table 7.

Table 7. Barriers to production financing in Iranian SMEs identified using FDM

Dimensions	Row	Indicators
Financial Infrastructure and Access	1	Availability of financial institutions
	2	Access to banking services
	3	Depth of financial markets
	4	Government support programs
	5	Venture capital
	6	Access to microfinance
	7	Liquidity shortage
	8	Fixed capital allocation (need for long-term financing for production units as opposed to short-term working capital)
	9	Short-term working capital (production units' need for working capital for daily operations and production)
Legal Environment and Political Implications	10	Transparency of legal framework
	11	Compliance and administrative ease
	12	Tax policies
	13	Government support programs
	14	Issuance of multiple circulars and problems arising from complexity and constant changes in laws and regulations
Information Asymmetry and Transparency	15	Facilitating the licensing process for establishing new production units
	16	Availability of information
	17	Transparency in lending practices
	18	Credit reporting mechanisms
	19	Access to information
	20	Transparency in risk assessment
	21	Data security measures
22	Problems arising from the method of calculating bank interest and profit, which can impose a heavy financial burden on production units	
Collateral Requirements and Asset-Based Financing	23	Collateral policies
	24	Asset valuation methods
	25	Loan-to-value ratio
	26	Asset-liability mismatch
	27	Capital lockup (unused capital in unfinished and stagnant units)
	28	Sale of unfinished units (production units abandoned due to financial problems and put up for sale)
	29	Need for supportive and incentive policies for small production units.
	30	Stagnant production units that have ceased operations due to financial problems and other obstacles
Loan Terms and Conditions	31	Interest rate and fees
	32	Loan duration and repayment schedule
	33	Flexibility of repayment terms
	34	Prepayment penalties
	35	Loan contracts and conditions
	36	Default and violation resolution
	37	Loan guarantee and collateral
	38	Method of loan repayment and problems related to loan repayment terms and conditions
	39	Various production costs that affect the profitability and competitiveness of production units
Credit Assessment and Risk Understanding	40	Credit scoring and credit history assessment
	41	Financial statement analysis
	42	Business and industry survival risk assessment
	43	Collateral assessment and asset-based risk
	44	Selection and support of qualified producers who can operate with high efficiency
Market Dynamics and Competition	45	Market structure
	46	Competitive landscape
	47	Industry concentration
	48	Entry barriers
	49	Substitutes and complements

Table 7. Continued

	50	Pricing strategies
	51	Technological disruption
	52	Structural problems in policy-making and management of production units
Dimensions	Row	Indicators
Technological Advancements and Digitalization	53	Digital infrastructure
	54	Adoption of financial technologies
	55	Integration of digital platforms
	56	Cybersecurity measures
Social and Economic Factors and Regional Inequalities	57	Levels of economic development
	58	Income inequality
	59	Access to education
	60	Infrastructure development
	61	Regional economic inequalities
	62	Government support policies
	63	The problem of access to suitable land for developing production units
	64	Allocation of subsidized resources to small and medium production units to support them
Alternative Financing Mechanisms and Innovations	65	Peer-to-peer lending
	66	Crowdfunding platforms
	67	Factoring finance
	68	Supply chain finance
	69	Revenue-based financing
	70	Measures to dispossess profiteers who have acquired land and resources without productive use

6. Discussion and Conclusion

This study aimed to identify and analyze the barriers to production financing in SMEs in Iran using the Fuzzy Delphi Method (FDM). The results revealed 10 principal dimensions and 71 indicators as significant barriers to production financing in Iranian SMEs. These findings not only confirm existing knowledge about SME financing challenges but also introduce new insights specific to the Iranian context.

6.1 Key Findings and Contributions

Our research provides a comprehensive understanding of financing barriers specific to Iranian SMEs, an area previously underexplored in the literature. The study's findings align with previous research in several aspects while also offering unique contributions. For instance, the importance of financial infrastructure and access, as highlighted by Chiappini et al. [12] and Oghosanine [43], is reinforced in our study. Similarly, the significance of the legal environment and political implications, emphasized by Khan et al. [43], is also confirmed in the Iranian context.

However, this study makes several unique contributions. We have identified several new indicators not commonly discussed in previous literature. For example, "capital lockup in unfinished and stagnant units" and "sale of unfinished units due to financial problems" are unique findings that reflect the specific challenges in the Iranian SME sector. By identifying 10 interconnected dimensions, our study provides a more holistic view of SME financing barriers than many previous studies that focus on a narrower range of factors.

The "Financial Infrastructure and Access" dimension emerges as one of the most critical challenges in financing SMEs in Iran. Experts have highlighted a shortage of liquidity as a primary barrier within this dimension. SMEs often struggle with insufficient liquidity to maintain daily operations and pursue new investments. Additionally, limited access to fixed capital for long-term investments in production units and short-term working capital for everyday needs are significant challenges. These constraints can hinder the growth and development of SMEs, putting them at a disadvantage compared to larger enterprises.

In the "Legal Environment and Political Implications" dimension, the findings show that legal frameworks

and government policies are significant barriers to the financing process for SMEs in Iran. Experts pointed to the issuance of numerous directives and the challenges arising from the complexity and frequent changes in laws and regulations. This creates uncertainty and ambiguity for businesses, complicating the financing process. Additionally, experts emphasized the need to streamline the licensing process for launching new production units.

The "Lack of Information Symmetry and Transparency" dimension is identified as a major barrier in the financing process for SMEs in Iran. Key challenges include the absence of transparency and limited access to reliable and up-to-date information regarding lending methods, credit reporting mechanisms, risk assessment, and data security measures. These results align with previous studies (e.g., Mangla et al. [39], and Ramazanov [47]), which emphasize the crucial role of information transparency in facilitating financing.

The "Collateral Requirements and Asset-Based Financing" dimension reveals issues such as capital being locked in unfinished and idle units, the sale of unfinished units due to financial constraints, and the need for supportive and incentivizing policies for small production units as key barriers. These findings highlight the importance of more flexible collateral and asset-based financing policies, as also emphasized in previous studies (e.g., Ramazanov [47] and Chiappini et al. [12]).

The "Loan Conditions and Terms" dimension is identified as a major barrier to SME financing in Iran. Challenges in this dimension include issues with repayment methods, high interest rates and fees, inappropriate repayment durations and schedules, inflexibility in repayment terms, heavy prepayment penalties, strict contracts, and problems related to loan guarantees and collateral. These findings align with previous studies (e.g., Asongu et al. [4], Bellucci et al. [6]), which emphasize the critical role of loan conditions and terms in either facilitating or hindering financing.

In the "Credit Evaluation and Risk Perception" dimension, a significant challenge is selecting and supporting qualified producers who can operate efficiently. Issues such as inappropriate scoring and credit history evaluation processes, inadequate financial statement analysis, and incomplete assessment of business and industry survival risks are key barriers in this dimension.

The "Market Dynamics and Competition" dimension emerges as another significant barrier in the financing process for SMEs in Iran. Structural issues in policy-making and the management of production units are among the primary challenges in this dimension, negatively impacting market dynamics and the financing process. These findings align with previous studies (e.g., Garcia-Posada-Gomez [18], and Hai [22]), which emphasize the role of market structure and competitive dynamics in the financing process for businesses.

The "Technological Advancements and Digitalization" dimension highlights challenges such as inadequate development of digital infrastructure, restricted adoption of new financial technologies, incomplete integration of digital platforms, and concerns about cybersecurity in SMEs in Iran. These barriers can limit businesses' access to modern technology-based financial tools and services.

The "Social and Economic Factors and Regional Inequality" dimension reveals prominent challenges, such as the limited availability of suitable land for production unit growth and the demand for subsidized resources to support SMEs. Additional major factors affecting the financing process include differing levels of economic development across various regions, income disparities, unequal access to education, uneven infrastructure development, and regional economic inequalities.

In the "Alternative Financing Mechanisms and Innovations" dimension, key challenges include the need to eliminate opportunistic individuals who control land and resources without productive use and the requirement for policies that offer licenses and free land to encourage investment. Additionally, limited access to modern financing methods, such as peer-to-peer lending, crowdfunding, factoring, supply chain finance, and income-based financing, presents further barriers for SMEs in Iran.

6.2 Implications for Practice

Based on these findings, several recommendations are proposed to overcome the financial barriers faced by SMEs in Iran. The government should focus on developing financial infrastructure, reforming legal frameworks

and administrative procedures, reviewing tax policies, implementing expanded support programs, and developing integrated information systems. Collateral policies and asset valuation methods should be reevaluated, loan conditions should be updated, and credit evaluation and scoring processes should be enhanced. Efforts should be made to enhance healthy competition in the market, expand information technology infrastructure, and mitigate regional economic disparities.

The findings of this study have important implications for SME managers, policymakers, and financial institutions. SME managers should explore alternative financing mechanisms, enhance their financial literacy, and embrace digital technologies. Policymakers should focus on regulatory reform, infrastructure development, and designing targeted support programs. Financial institutions should innovate their products and refine their risk assessment models to better meet the needs of SMEs.

6.3 Limitations and Future Research Directions

While this study provides valuable insights, it has several limitations. The geographical scope is limited to Iran, which may limit the generalizability of findings to other contexts. The expert panel composition, despite efforts to ensure diversity, may not represent all perspectives on SME financing in Iran. The dynamic nature of the business environment, especially in a developing economy like Iran, means that the identified barriers may change over time. Additionally, the study did not quantitatively prioritize the identified barriers, which could have provided additional practical value.

Future research could address these limitations by conducting comparative studies across different countries or regions, incorporating a larger and more diverse panel of experts, conducting longitudinal studies to track changes in financing barriers over time, and employing quantitative methods to prioritize the identified barriers. Additionally, future studies could explore the impact of rapidly developing financial technologies on SMEs' access to financial resources and conduct comparative international research to identify best practices and successful strategies used in other countries.

In conclusion, this study provides a comprehensive framework for understanding the barriers to production financing for SMEs in Iran. By offering context-specific insights and identifying new indicators, it contributes to both academic knowledge and practical decision-making in the field of SME financing. The findings can serve as a foundation for developing more effective policies and strategies to support SME growth and sustainability in Iran.

Conflict of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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