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Identification and Prioritization of Factors Influencing the Selection of Financing Methods for Startup, Innovative, and Technology-Based Companies

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ABSTRACT

Financing remains one of the most critical challenges for knowledge-based, startup, and technology-oriented companies, particularly in developing innovation ecosystems such as Iran. These enterprises often face financial constraints due to their high risk, lack of tangible assets, and limited access to traditional credit channels. Consequently, selecting an appropriate financing method plays a decisive role in their survival, growth, and long-term competitiveness. This study aims to identify and prioritize the main factors influencing the choice of financing methods across three categories of knowledge-based firms-startup, innovative, and technology-based companies. Employing a mixed-method research design, the study integrates Structural Equation Modeling (SEM) to validate the conceptual model and the TOPSIS technique to prioritize alternative financing strategies. Through a comprehensive literature review and semi-structured interviews with experts and executives, eight principal dimensions and forty-six sub-factors were identified, encompassing financier-related factors, financial characteristics, macroeconomic conditions, technological features, legal and organizational factors, cultural and social factors, market dynamics, and feasibility study considerations. The results reveal that market and competitive conditions exert the greatest influence on financing decisions in startups, macroeconomic stability is most critical for innovative firms, and legal-organizational structures dominate in technology-based enterprises. The study contributes both theoretically and practically by presenting an integrated analytical framework that links financial behavior with strategic decision-making in knowledge-based firms. The findings provide actionable insights for entrepreneurs, investors, and policymakers seeking to strengthen financing infrastructures and promote innovation-driven economic growth in emerging economies such as Iran

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1. Introduction

Small and medium-sized enterprises (SMEs), particularly knowledge-based ventures, have emerged as the driving force behind economic and technological transformation. Today, the economies of developed countries revolve around SMEs to such an extent that a large share of active businesses in both developed and developing nations-such as those in Europe and Japan-are comprised of SMEs (Dastkhan, 2022). This phenomenon partly explains the accelerated pace of technological advancement over the past decade. These transformations signal a profound departure from traditional production models centered on physical goods and economies of scale. Instead, they reflect a world where adaptation, agility, and knowledge are the primary currencies of competitiveness (Bod & Raei, 2025). One of the most prominent transformations is the growing societal and economic shift toward knowledge and knowledge-based activities. Knowledge is widely recognized as a fundamental catalyst for economic and social transformation. Unlike tangible goods, knowledge is non-rivalrous-it can be shared, replicated, and reused without diminishing its intrinsic value. This unique attribute allows it to serve as a renewable driver of growth. According to the OECD, the emergence of the term "knowledge-based economy" reflects a deeper understanding of the central role that intellectual capital and technological advancement play in national development (Eskandari et al., 2022). In this context, knowledge is embodied in human capital, innovation capabilities, and technological infrastructure. Economic growth, job creation, and competitive advantage are increasingly tied to a country's ability to commercialize research, foster innovation, and cultivate knowledge-intensive enterprises. This dynamic calls for an environment in which research outcomes are continuously transformed into viable products, services, or systems through effective investment strategies (Srivastava et al., 2025). A knowledge-based economy thus thrives on a robust innovation ecosystem-one supported by financial mechanisms that enable the transition from idea to implementation. For this reason, access to finance is a vital prerequisite for the survival and scalability of knowledge-intensive businesses. However, innovation financing is often fraught with

uncertainty, particularly in early-stage enterprises where tangible assets are scarce, and risk profiles are high. Lenders and financial institutions are typically hesitant to invest in ventures lacking credit history, collateral, or proven revenue models (Hosseini et al., 2021). To bridge this gap, a diverse range of institutions-such as incubators, accelerators, science parks, venture capital firms, and public innovation agencies-have emerged to support these enterprises. These stakeholders form a complex ecosystem that must operate with synergy and strategic alignment to ensure that capital flows effectively into the knowledge-based sector (Amiri, 2022). In Iran, while no single authority currently oversees the financing of knowledge-based cooperatives, encouraging progress has been made. Supportive mechanisms have gradually taken shape, but many knowledge-intensive startups continue to struggle. The challenge is often exacerbated by a lack of managerial experience and limited financial resources among young entrepreneurs. These deficiencies frequently lead to early business failure despite the presence of viable and innovative ideas. Also, the development of knowledge-based and technology-driven enterprises has become a central pillar of the country's national innovation and economic transformation policies. Over the past decade, successive national development plans and strategic programs-such as the Knowledge-Based Economy and Innovation Development Act–have emphasized the role of these firms as engines of technological progress, job creation, and economic diversification. According to the Vice Presidency for Science, Technology, and Knowledge-Based Economy (Vice Presidency for Science, Technology, and Knowledge-Based Economy, 2024; Miraskari Jildani et al., 2024), more than 8,000 officially certified knowledge-based firms currently operate in Iran, collectively contributing approximately 3.5% of the national GDP and providing employment for over 400,000 highly skilled individuals (Eskandari et al., 2022). Their activities span a wide range of sectors, including biotechnology, information and communication technologies, nanotechnology, and advanced manufacturing (Amiri, 2022).

Despite this impressive growth, financing barriers remain one of the most persistent obstacles limiting the scalability and international competitiveness of these enterprises. Limited access to venture capital, risk-averse banking

systems, and underdeveloped financial markets for innovation have collectively constrained their capacity to commercialize research outputs and expand production. Many startups and innovative firms rely heavily on personal savings or informal credit sources, which are insufficient for sustaining large-scale innovation projects. Therefore, identifying and developing effective and context-specific financing mechanisms is not merely an economic concern but a strategic imperative for achieving sustainable national development, technological self-reliance, and global competitiveness in the knowledge economy. One potential solution lies in engaging venture capitalists and other strategic investors who are willing to assume calculated risks in exchange for high potential returns. The strategic function of venture capital is to absorb risk, offer mentorship, and stimulate high-growth enterprises. Accordingly, the venture capital industry has become an integral part of innovation systems in many advanced economies. Current studies identify several key financing mechanisms for knowledge-based companies: 1) Equity Financing: This involves capital investment by individuals or institutions who acquire ownership stakes. While this provides access to external expertise and capital, it also leads to ownership dilution and potential conflicts between entrepreneurs and investors, and 2) Debt Financing: This includes borrowing through loans or credit lines. While it avoids ownership dilution, it imposes repayment obligations and interest burdens that can be debilitating for early-stage companies. Successful firms typically utilize a balanced combination of equity and debt financing based on their revenue projections and growth trajectories. Nonetheless, each method presents unique limitations. Moreover, the valuation of knowledge-based companies is inherently difficult due to intangible assets and unpredictable returns. Information asymmetry between firms and investors exacerbates financing challenges, often leading to mispricing of risk or outright denial of funding (Godarzi et al., 2023). Given the strategic importance of financing for the growth and sustainability of knowledge-based companies-particularly in emerging economies like Iran where the innovation ecosystem is still

maturing-this study seeks to identify, analyze, and prioritize the factors that shape financing method selection. Through a combination of structural equation modeling (SEM) and the TOPSIS method, the study aims to provide a data-driven foundation for financing strategy in startup, innovative, and technology-based firms. Compared with previous Iranian studies such as Zakernia et al. (2016), Golailizadeh (2021), Jahan Tigh & Taftiyan (2023), and Hooshmand et al. (2025), this research makes several distinct contributions. First, it simultaneously analyzes three categories of knowledge-based enterprises-startup, innovative, and technology-based firms-whereas earlier works focused on a single group. Second, it integrates SEM and TOPSIS in a hybrid analytical framework, providing both explanatory and prescriptive insights. Finally, it offers a comparative prioritization of financing methods tailored to each firm type, thus extending the domestic literature on financial strategy for innovation-driven firms.

Recent national strategies, as outlined by Miraskari et al. (2024), emphasize the transition toward a knowledge-based economy through innovation-driven growth and technological self-reliance. Aligning with these policies, this research contributes by providing an evidence-based framework to enhance financing mechanisms for knowledge-based firms in Iran.

2. Literature Review

From a theoretical standpoint, the financing behavior of firms has been widely analyzed through the lenses of both Pecking Order Theory and Signaling Theory, which together provide a comprehensive conceptual foundation for understanding how firms determine their optimal financing structure. According to the Pecking Order Theory proposed by Myers and Majluf (1984), firms follow a hierarchical order of financing preferences: they primarily rely on internal funds such as retained earnings, then turn to debt financing, and finally consider issuing new equity only as a last resort. This preference is largely explained by the problem of information asymmetry between managers and external investors, as managers possess superior

knowledge of firm value and project risks. Issuing new equity may signal overvaluation to the market, potentially leading to a decline in share price and dilution of ownership (Myers & Majluf, 1984; Frank & Goyal, 2003; Brealey, Myers, & Allen, 2020). Consequently, firms operating in environments characterized by high uncertainty-such as innovation-driven or technology-based sectors-tend to avoid equity issuance and instead depend on internal financing or debt instruments. Complementing this perspective, the Signaling Theory introduced by Spence (1973) and further developed by Ross (1977) emphasizes that financing decisions themselves act as strategic signals to external investors. In this framework, the choice of financing method communicates information about a firm's confidence, risk tolerance, and future performance expectations. For example, established knowledge-based companies that undertake high-risk R&D investments might deliberately select equity or venture capital financing to signal their technological strength and growth potential, whereas early-stage startups may rely on personal funds or short-term debt to preserve flexibility and ownership control (Ross, 1977; Frank & Goyal, 2003). Together, these theoretical perspectives explain why financing behavior among knowledge-based firms varies according to organizational maturity, innovation intensity, and perceived market risk. Integrating the Pecking Order and Signaling frameworks allows researchers to interpret the complex motivations and constraints shaping capital structure decisions in high-tech and knowledge-intensive enterprises-offering a deeper understanding of how financial strategy aligns with innovation dynamics in emerging economies (Brealey et al., 2020)

Numerous researchers have investigated various financing methods that knowledge-based companies can utilize, as well as the factors influencing the selection of these methods and their impact on company performance. Below is a review of the most significant studies in this field:

Zakernia et al. (2016) employed a fuzzy TOPSIS approach to prioritize factors influencing the selection of financing methods in Iran, using linguistic variables to capture uncertainty in expert judgment. Their results highlighted

the importance of market stability and investor confidence but did not differentiate among various categories of knowledge-based firms. Narimani (2017) examined the issues and challenges of financing knowledge-based companies and stated that completing the financial system of innovation and a knowledge-based economy requires developing a range of financial tools for companies—from early innovation stages in the form of products, processes, or business models to company growth and maturity in international markets. Motavasseli et al. (2017) prioritized financing methods using the Analytic Hierarchy Process (AHP). Their findings showed that personal financing by the entrepreneur is the most common self-startup method, followed by deferred payments, suspension of receivables, minimizing investment costs, and finally, resource sharing. Naeej Haghighi & Saeidi (2020) studied the effects of internal and external factors on the selection of financing strategies by new technology ventures. Statistical society of the present research includes start-up companies. Research results indicate a positive and significant effect of internal variables of companies concerning the role of intermediary variables on traditional and new financing methods. Golailizadeh (2021) conducted a comprehensive classification of financing challenges faced by Iranian knowledge-based companies, emphasizing regulatory barriers, limited investor networks, and weak commercialization capabilities. Although this study provided a detailed taxonomy of challenges, it did not offer a systematic prioritization or modeling of influencing factors. Bezerra Borges et al. (2021) conducted a comparative analysis of six Brazilian federal programs aimed at fostering technological entrepreneurship in small companies. The study examined objectives, target profiles, funding, and collaboration mechanisms, revealing strategic improvements over time. Notably, newer programs increasingly emphasized partnerships within the innovation ecosystem to enhance cooperation and innovation outcomes.Nigam et al. (2021) collected random data from 204 startups that obtained funding during the 2014–2017 period and used signaling theory to examine the factors that impact access to external financing for Indian health

care technology startups. The results show that some business models show a negative impact on financing implying that investors are reluctant to invest in new technologies that carry more uncertainty and take a longer time to become profitable. Bertoni et al. (2022) provided a general overview of digitization in the market for entrepreneurial finance, illustrate how the different articles in the special issue contribute to advance our knowledge, and identify promising avenues for research. Rannikko et al. (2022) studied investigates a mediational model between legitimated elements, financial resource mobilisation and subsequent early firm growth among New Technology-Based Firms using conformity and control perspectives of legitimacy. The results show that based on the conformity principle, two out of three legitimated elements (business plan and incubator relationship, but not start-up experience) have an impact on financial resource mobilisation, which in turn, is associated with early growth in NTBFs based on the control principle. Jahan Tigh and Taftiyan (2023) analyzed the determinants of financing for startups through Iran's capital market, identifying risk aversion and regulatory inefficiencies as major constraints. Their work focused exclusively on capital market mechanisms and did not integrate broader macroeconomic or organizational dimensions. Godarzi et al. (2023) examined the key qualitative and quantitative factors of venture capital influencing the optimal capital structure of knowledge-based companies. Using factor analysis and the ANP method, they found managerial, corporate, and financial factors most critical, with managerial elements like communication skills and leadership experience ranked highest. Technological factors were ranked lowest, highlighting the priority of human and organizational capabilities in venture capital effectiveness. Song et al. (2024) investigated key factors influencing open innovation in high-tech firms using the SER-M framework (subject, environment, resource, mechanism). Based on expert input and AHP analysis, the "subject" dimension-especially executive leadership and decision-making-was identified as most critical. The study emphasizes that while external factors matter, strong internal leadership drives successful open innovation.Latifpour et al. (2024) aimed to identify and

prioritize key factors behind startup failures using a literature review and AHP analysis. The study found poor management, lack of financial resources, and technical/team deficiencies as the top contributors to failure. Market and legal issues ranked lower, and targeted strategies were proposed to address the most critical challenges. In the broader context of Iran's innovation ecosystem, Miraskari Jildani et al. (2024) examined the strategic roadmap for developing a knowledge-based economy. Their study demonstrated that sustainable innovation and technological independence require coordinated financial and institutional policies. This macro-level insight provides a contextual foundation for analyzing firm-level financing decisions, as undertaken in the present study.

Bod & Raei (2025) used the fuzzy Delphi method to identify 9 key dimensions and 29 components of investor risk and financing in IT-based startups. Using BWM and DEMATEL techniques, they prioritized these dimensions and analyzed their interrelationships. The study highlights underexplored factors such as governmental, geographical, and scientific aspects in the startup financing literature. Hu et al. (2025) explored financing decisions of tech-driven SMEs in China amid digitalization, using panel regression and machine learning on data from 41 firms. Key factors like capital structure were identified, and the random forest model showed strong predictive performance (F1 score: 0.814). The study uniquely combines traditional econometric analysis with ML, offering practical insights for policymakers and financial institutions. Hooshmand et al. (2025) explored the determinants of financing in defense-related startups and emphasized the influence of institutional support, risk absorption, and government funding mechanisms. While their findings are sector-specific, they underscore the relevance of institutional and policy frameworks in financing innovative firms. Jafari et al. (2025) investigated the relationship between the components of the knowledge-based economy and the growth of Qard al-Hasan (interest-free) deposits in public banks. Their results indicate that technological progress and innovation directly influence the volume of such

deposits, suggesting that Islamic financial instruments can play an important complementary role in supporting knowledge-based companies

The experiences of Southeast Asian economies provide valuable insights into how emerging countries can develop robust financing ecosystems for knowledge-based and technology-oriented enterprises. Over the past two decades, nations such as Singapore, Malaysia, and South Korea have strategically integrated financial innovation with national development policies to support entrepreneurship and technological upgrading (World Bank, 2023; OECD, 2022). In Singapore, the government has implemented multiple initiatives under the Startup SG framework, including Startup SG Equity and Startup SG Tech, which provide co-investment funds, tax incentives, and early-stage grants. These programs have mobilized more than USD 1.5 billion in venture funding and helped establish Singapore as a regional innovation hub (Enterprise Singapore, 2023). Malaysia has also made significant progress through institutions such as Cradle Fund and Malaysia Venture Capital Management (MAVCAP), which collectively manage several public-private funds exceeding USD 500 million (ASEAN Secretariat, 2023). The Cradle CIP300 program alone has supported over 1,000 startups through seed funding and mentoring initiatives. Similarly, South Korea's experience demonstrates the transformative potential of state-backed venture capital and R&D-oriented financing. The Korea Fund of Funds and Tech Incubator Program for Startups (TIPS) have been instrumental in linking private venture capital with government support, resulting in an innovation-driven SME sector that contributes nearly 30% of national R&D investment (Korea Institute of S&T Evaluation and Planning [KISTEP], 2023). Across the ASEAN region, knowledge-based and technology-intensive firms now account for approximately 12% of regional GDP and employ nearly 9 million skilled workers (ASEAN Secretariat, 2024). The common denominator among these successful economies is the creation of multi-channel financing systems-combining public venture capital, private equity, innovation grants, and incubator networks-which collectively reduce risk and improve capital accessibility for early-stage firms.

For emerging economies such as Iran, these cases demonstrate the importance of designing hybrid financing models that align government incentives with private-sector participation. Adapting such integrative financial frameworks could enhance the scalability, resilience, and competitiveness of Iran's knowledge-based enterprises, especially in high-technology sectors where capital intensity and uncertainty are both high. Based on this extensive literature review, various financing methods have been categorized into different types, as shown in Table 1, which includes conventional domestic financing methods and those common in non-Islamic foreign countries.

Table 1. Common Financing Methods

Type of Financing Method	Financing Instruments	Financing Approach
Domestic Financing Methods	Internal Financing	Personal resources, pledging owner assets, funding from friends/relatives, family funds – retained earnings (profit distribution) – asset sales
	Traditional Debt-Based Financing (Banks, Financial Institutions, Credit Companies)	Short-term loans – overdrafts – credit lines and cards – long-term loans
	Government-Backed Financing	Grants and subsidies – low-interest or long-term loans – government venture capital funds – public-private venture capital – guarantee schemes – sovereign wealth funds
Traditional Debt-Based Financing (Banks, Financial Institutions, Credit Companies	Asset-Based Financing	Asset-backed loans – receivables discounting – purchase financing – warehouse receipt financing – leasing
	Alternative Debt Financing	Corporate bonds – debt purchasing by financial intermediaries – covered bonds – private alternatives – crowdfunding – debt sale (Bay' al-Dayn) – Ijara (leasing) – Murabaha –

Type of Financing Method	Financing Instruments	Financing Approach
		Spot sale – Deferred payment sale – Salam – Tawarruq
	Hybrid Financing Instruments	Subordinated debt – mezzanine loans – silent partnerships – convertible debt and warrants – mezzanine financing
	Equity-Based Instruments	Business angels – venture capital – initial public offerings (IPOs) – special new equity markets
	Partnership-Based Instruments (Startups)	Time-bound participation certificates – Istisna' – Mudarabah
Conventional Financing Methods in Non-Islamic Countries	International Funds and Financial Institutions	National funds – regional funds – EU funds – regional development banks – integrated funds
	Public-Private Partnerships (PPP)	Model A (construction with tolls levied by the government) – Model F (construction and tolls by private sector) – BOT – BOO – BLT – BLO – DBOM – ROT – ROO
	Borrowing	Category 129 loans – State Infrastructure Banks (SIBs)
	Support-Based Models	New equipment (DB partnerships) – concession model – consortium model

Note: Domestic Financing Methods" refers to financing instruments available within the national financial system, including both internal company funds and external debt instruments such as bank loans. In contrast, Conventional Financing Methods in Non-Islamic Countries" represent international or foreign sources outside Iran.

Although the present study focuses on domestic and conventional international financing models, future research may extend the analysis to Islamic financing mechanisms such as Sukuk, Mudarabah, and Murabaha, which are increasingly relevant in Muslim-majority economies. Previous research indicates that the financing methods of knowledge-based companies have not been comprehensively examined based on the influencing factors. Therefore, one of the novel aspects of this study is the development of a

comprehensive model of factors affecting the choice of financing methods across different types of knowledge-based companies, which can contribute to enriching previous research. Additionally, the prioritization of various financing methods for different types of knowledge-based companies based on this comprehensive model represents another innovative contribution of this article.

3. Research Methodology

This study adopts an applied research design, aiming to generate practical insights for knowledge-based enterprises in Iran. The findings are intended to guide these firms in revising their financial sourcing strategies and selecting appropriate financing instruments. Methodologically, the study employs a mixed-method approach-integrating both qualitative and quantitative techniques-to provide a comprehensive understanding of the research problem. The qualitative phase involves purposive sampling of knowledge-based company managers with diverse backgrounds, ensuring maximum variation. Interviews continue until theoretical saturation is achieved. The objective of this phase is to identify underlying factors that influence financing decisions. For the quantitative phase, a structured survey is distributed using simple random sampling. The sample size is determined based on the complexity of the structural model and is sufficient for performing confirmatory factor analysis (CFA). The experts and managers interviewed were selected from key innovation hubs across Iran, including Tehran, Isfahan, Shiraz, Mashhad, and Tabriz, ensuring national coverage and representation of diverse regional ecosystems. In the qualitative phase, 15 participants were interviewed, including executives, financial officers, and innovation managers. Their responses were analyzed using thematic coding. In the quantitative phase, a large-scale survey was administered to validate the conceptual model and assess the relative importance of each factor across different company types. Although a small portion (approximately 5%) of respondents possessed only a diploma degree, their responses were retained as they held administrative positions in knowledge-based firms and had direct exposure to financial decision-making.

However, the main analysis was dominated by respondents with bachelor's degrees or higher (over 95%), ensuring data validity.

3.1. Validity, Reliability, and Trustworthiness

Validity pertains to the appropriateness of measurement tools and how accurately they capture the intended constructs. Reliability refers to the consistency of measurements under similar conditions. To ensure construct validity, expert reviews were conducted during instrument development. Feedback from academic advisors and industry professionals informed multiple iterations of the questionnaire, resulting in a refined and contextually relevant instrument. Reliability was assessed using Cronbach's alpha, a standard measure of internal consistency. All alpha values exceeded 0.7, indicating satisfactory reliability. Composite Reliability (CR) and Average Variance Extracted (AVE) metrics were also calculated. All constructs achieved CR > 0.7 and AVE > 0.5, confirming both convergent validity and internal cohesion of the model.

3.2. Data Collection Tools and Methods

Data were gathered through a triangulated approach that included literature review, semi-structured interviews, and a standardized questionnaire. The first phase focused on identifying influential factors through expert elicitation and document analysis. The second phase involved the quantitative evaluation of these factors using a five-point Likert scale. The questionnaire was pre-tested and adjusted based on pilot results to improve clarity and relevance.

3.3. Data Analysis Method

The qualitative data were analyzed using thematic analysis, categorizing expert insights into subthemes and main themes relevant to financing decisions. This informed the development of the conceptual model. For the quantitative phase, first-order and second-order confirmatory factor analyses were performed using AMOS software to validate the structural relationships.

Subsequently, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) was used to prioritize financing methods. This multicriteria decision-making tool facilitated a systematic ranking of financing alternatives based on the importance weights derived from the SEM model. By applying this combined approach, the study delivers both explanatory and prescriptive insights for financial decision-making in the knowledge-based sector.

Although alternative techniques such as Delphi and meta-analysis could have been employed, this study adopted a mixed SEM–TOPSIS framework to ensure both rigorous statistical validation and practical prioritization of alternatives. While the Delphi method is typically suitable for developing expert consensus and gathering qualitative judgments, it does not directly test causal relationships or provide quantitative ranking among multiple options. Similarly, meta-analysis is effective for synthesizing findings from previous studies but is limited in generating context-specific prioritizations for decision-making. In contrast, the Structural Equation Modeling (SEM) component of our framework allows for robust testing of hypothesized causal relationships between variables, providing statistical evidence of direct and indirect effects. Simultaneously, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) enables the practical ranking of alternatives based on multiple criteria, facilitating decision-making in real-world contexts. By integrating SEM and TOPSIS, the study achieves a balanced approach that combines theoretical rigor with actionable insights, making it particularly suitable for addressing complex research questions that require both explanation and prioritization

4. Research Findings

This section outlines the results from both the qualitative and quantitative phases of the study. Initially, interview data were subjected to thematic analysis to derive critical themes influencing financing method selection. These findings informed the development of the survey instrument. Subsequently, data collected through questionnaires were analyzed using

descriptive statistics, confirmatory factor analysis (CFA), and the TOPSIS method to prioritize financing strategies.

4.1. Qualitative Research Findings

To meet the study's objectives, 15 semi-structured interviews were conducted with domain experts, company managers, and financial officers. Transcripts were coded to extract meaningful units and were grouped into sub-themes and overarching categories. This analysis yielded eight key thematic dimensions, aligned with conceptual frameworks in the literature. Expert validation (interpretive validity) was employed to ensure the thematic structure aligned with theoretical and practical expectations. Based on the table, in terms of demographic characteristics, 9 participants (60%) were male and 6 participants (40%) were female. Regarding education, 6 participants (40%) held a Master's degree, 3 participants (20%) were PhD students, and 6 participants (40%) had a PhD degree.

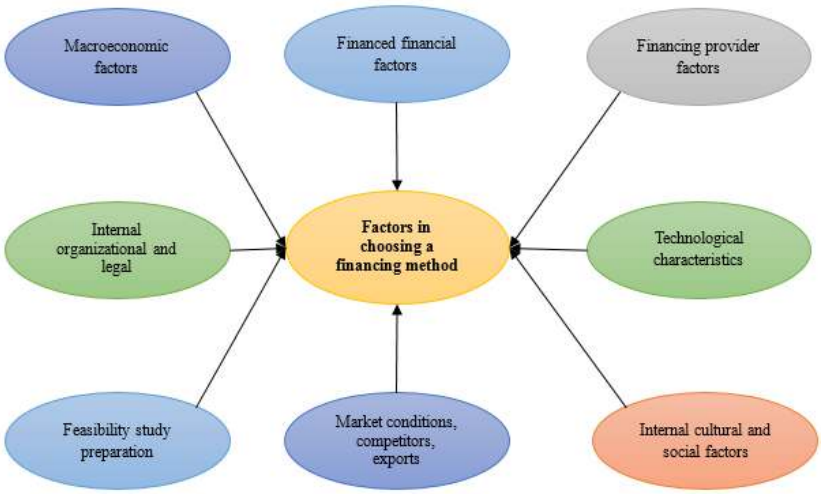

Fig. 1. Thematic Analysis Model of Factors Influencing the Choice of Financing Methods
Source: Research findings

4.2. Descriptive and Inferential Statistics

This section presents the descriptive statistics of the survey respondents from the statistical sample. Based on the sample size and Cochran's formula, the number of completed questionnaires was: 187 for startup companies, 330 for innovative companies, and 278 for technology-based companies**.** Fig 2 to 4 display bar charts illustrating the percentage distribution of respondents to the questionnaire based on: Age of respondents, Educational background, and Work experience.

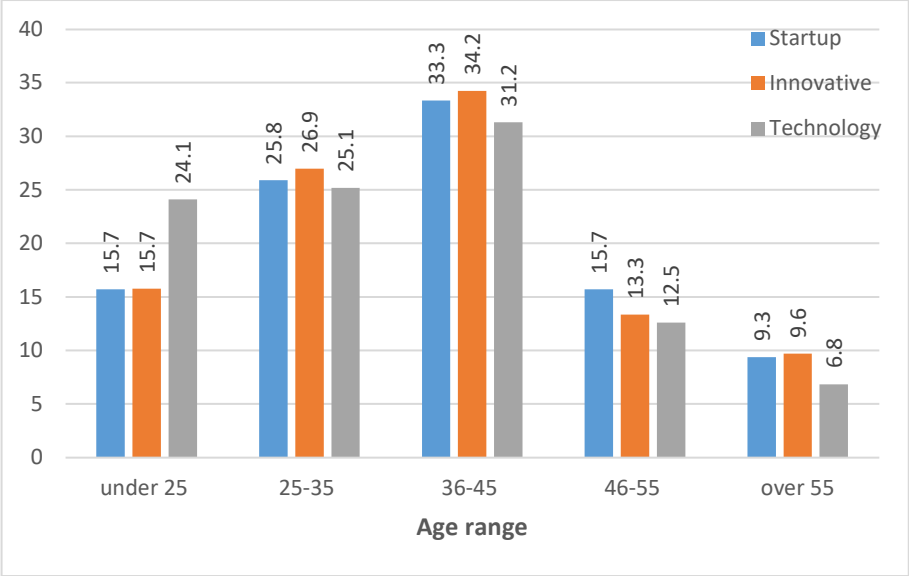

Fig. 2. Percentage Frequency of Respondents Based on Respondents' Age
Source: Research findings

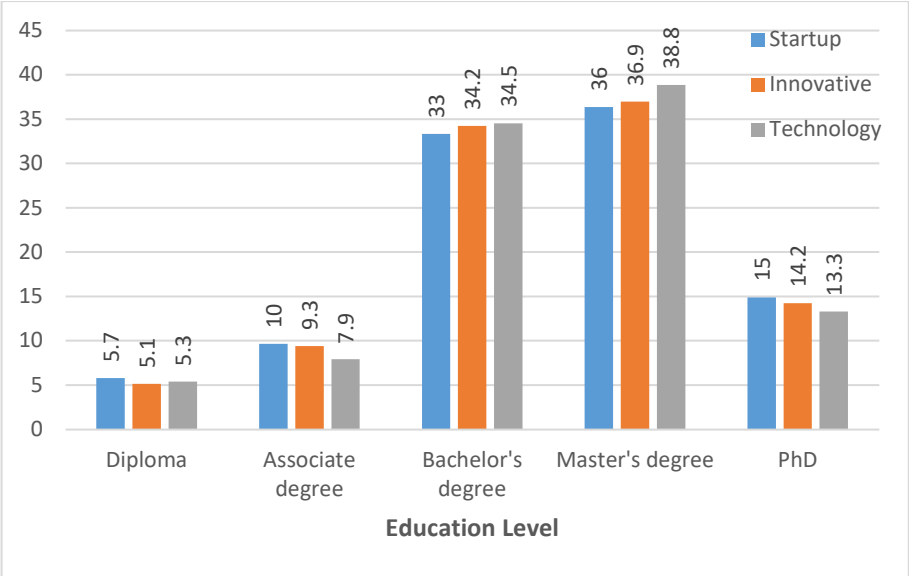

Fig. 3. Percentage Frequency of Respondents Based on Respondents' Education Level
Source: Research findings

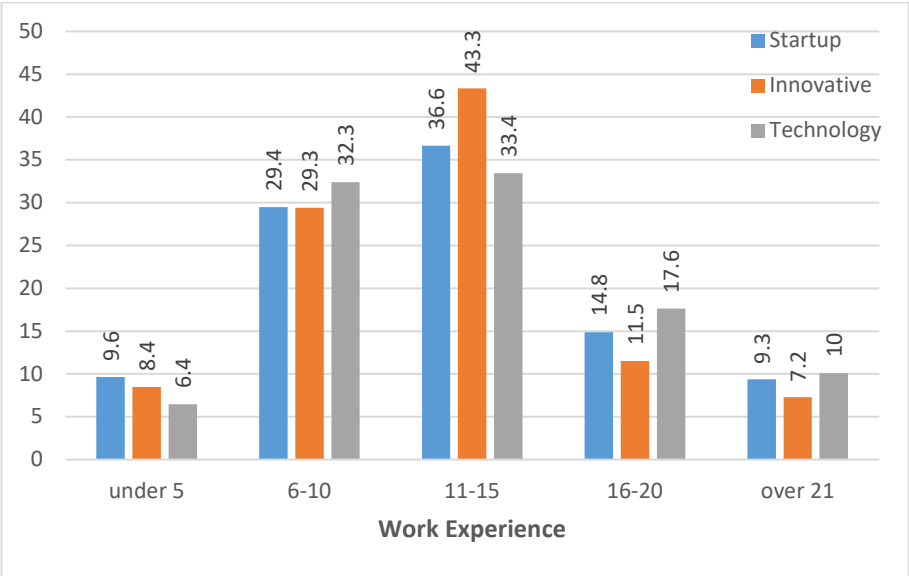

Fig. 4. Percentage Frequency of Respondents Based on Respondents' Work Experience
Source: Research findings

Based on the data, in startup companies, 87 participants (23.97%) were female and 276 participants (76.03%) were male, totaling 363 participants. In innovative companies, 95 participants (28.79%) were female and 235 participants (71.21%) were male, totaling 330 participants. In technology companies, 68 participants (24.46%) were female and 210 participants (75.54%) were male, totaling 278 participants. The descriptive statistical results for factors influencing the choice of financing methods in startup, innovative, and technology-based companies indicate that for most indicators, the mean value is above 3.

However, in startup companies, the mean ratings for the factors "Expected Return," "Financing Time Horizon," "Financial Instrument Risk," "Financial Process Cost," "Company Size," "Profitability," "Software Infrastructure," "Team Status," "Qualitative Development of Knowledge-based Companies," "Distribution Channel," "Weak Sales Infrastructure," "Limitations of Domestic Market for Knowledge-based Products," "Customer Loyalty," "Technical Feasibility Study," and "Market Feasibility Study" are below 3, indicating unfavorable status. For innovative companies, the mean ratings for "Expected Return," "Financial Resource Risk," "Financing Time Horizon," "Financial Instrument Risk," "Company Size," "Profitability," "Improvement of Social Status of Knowledge-based Companies," and "Number of Competitors" are below 3, indicating an unfavorable condition. For technology-based companies, the mean ratings for "Credit Status of Companies," "Company Liquidity," "Investment Attractiveness," "AI-Based Infrastructure," "Improvement of Business Cultural Environment," "Qualitative Development of Knowledge-based Companies," "Weak Sales Infrastructure," and "Infrastructure for Export and Import Control of Knowledge-based Products" are below 3, indicating an unfavorable condition.

4.3. Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM)

In this section, confirmatory factor analysis was conducted for factors

influencing the choice of financing methods. The primary goal of CFA is to determine how well the predefined factor model fits a set of observed data. In other words, CFA examines whether the number of factors and the factor loadings of variables measured on these factors conform to theoretical expectations and the hypothesized model.

CFA tests the goodness-of-fit and consistency between the theoretical constructs and the empirical constructs of the study. Figures (5) to (7) illustrate the results of CFA for factors influencing the choice of financing methods in startup, innovative, and technology-based companies, respectively.

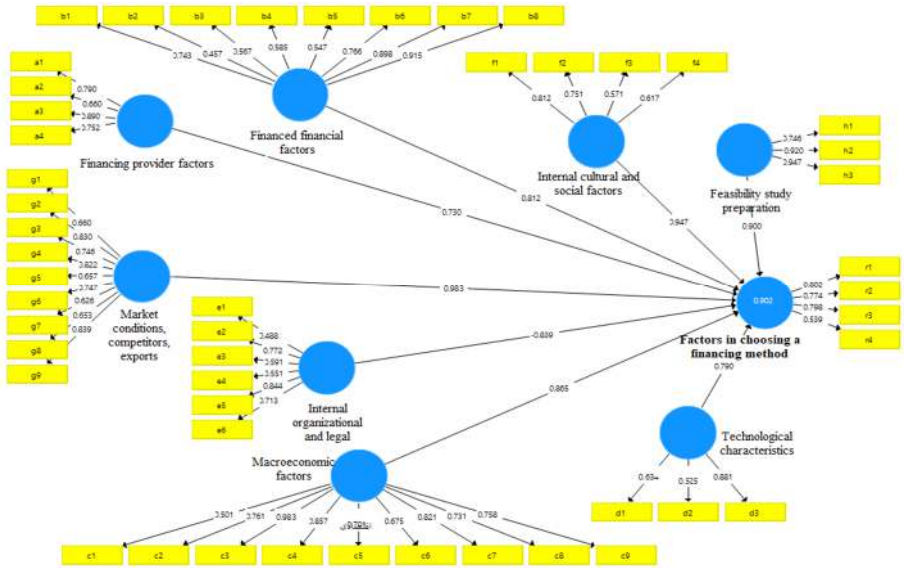

Fig. 5. Confirmatory Factor Analysis of Factors Influencing the Choice of Financing Methods for Startup Companies

Source: Research findings

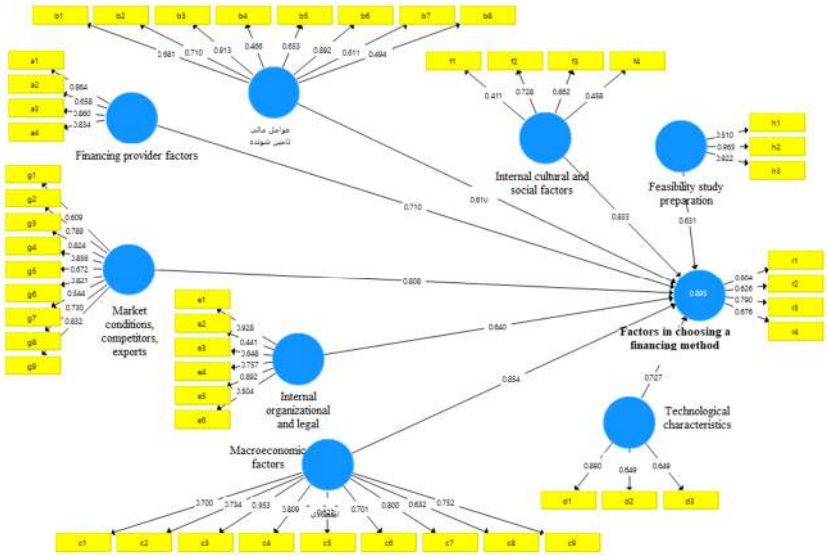

Fig. 6. Confirmatory Factor Analysis of Factors Influencing the Choice of Financing Methods for Innovative Companies
Source: Research findings

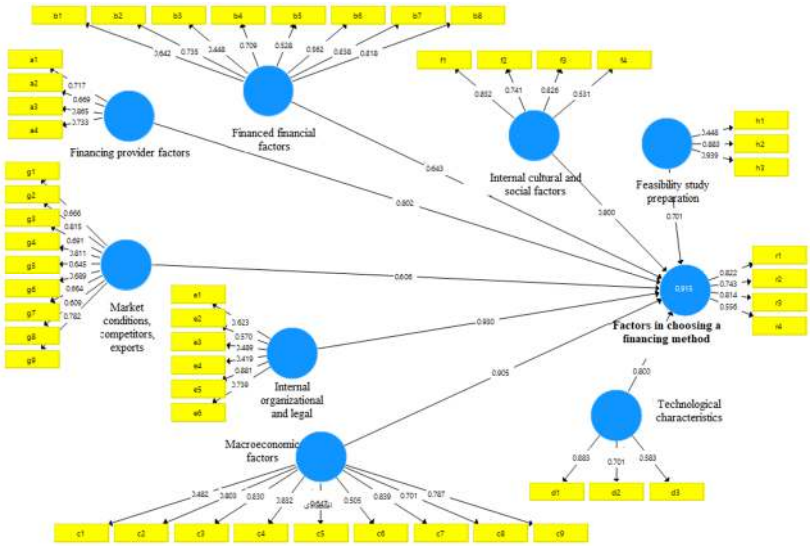

Fig. 7. Confirmatory Factor Analysis of Factors Influencing the Choice of Financing Methods for Technology Companies
Source: Research findings

For startup companies, market conditions, competitors, and exports have the highest standardized coefficient of 0.983, while the financed financial factor has the lowest standardized coefficient of 0.730 among the base indicators. For innovative companies, macroeconomic factors have the highest standardized coefficient of 0.854, and the financed financial factor has the lowest standardized coefficient of 0.610 among the base indicators. For technology companies, internal organizational and legal factors have the highest standardized coefficient of 0.930, and feasibility study preparation has the lowest standardized coefficient of 0.606 among the base indicators. Additionally, according to the obtained t-value for the factors influencing the choice of financing methods and factor loadings, since the numerical values for all indicators and variables are greater than 1.96, this indicates that all components are statistically significant at the 95% confidence level.

4.4. Model Fit Indices

Model fit criteria indicate that a significance level less than 0.05 for relative indices is an appropriate estimated value (GOF index). It is worth noting that after determining the model fit in structural equation modeling, the reliability of each dimension, construct, or model must be evaluated. For this purpose, the Composite Reliability (CR) index is used. Also, to measure the internal consistency and cohesion of observed variables, Cronbach's alpha was used. Cronbach's alpha for all variables is above 0.7, and composite reliability for all variables is also above 0.7. Finally, to examine the degree of correlation between a construct and its indicators, the AVE index (Average Variance Extracted) is used, which represents the average shared variance between each construct and its indicators. Simply put, AVE shows the average shared variance, where the higher this correlation, the better the fit. Convergent validity exists when AVE is greater than 0.5. Therefore, the presented model for measuring factors influencing the choice of financing method has a desirable fit.

Table 2. Composite Reliability (CR), Cronbach's Alpha, and Average Variance Extracted (AVE)

Company Type	Variables	CR	Cronbach's Alpha	AVE
Startup	Financing provider factors	0.907	0.852	0.767
	Financed financial factors	0.913	0.897	0.541
	Macroeconomic factors	0.823	0.717	0.542
	Technological characteristics	0.826	0.797	0.551
	Internal organizational and legal	0.909	0.760	0.647
	Internal cultural and social factors	0.868	0.851	0.670
	Market conditions, competitors, exports	0.858	0.799	0.604
	Feasibility study preparation	0.894	0.866	0.595
Innovative	Financing provider factors	0.857	0.801	0.681
	Financed financial factors	0.919	0.901	0.561
	Macroeconomic factors	0.817	0.701	0.530
	Technological characteristics	0.779	0.774	0.598
	Internal organizational and legal	0.734	0.729	0.511
	Internal cultural and social factors	0.746	0.805	0.600
	Market conditions, competitors, exports	0.882	0.824	0.654
	Feasibility study preparation	0.861	0.819	0.640
Technology	Financing provider factors	0.820	0.879	0.621
	Financed financial factors	0.901	0.882	0.506
	Macroeconomic factors	0.827	0.724	0.550
	Technological characteristics	0.759	0.801	0.565
	Internal organizational and legal	0.795	0.718	0.536
	Internal cultural and social factors	0.724	0.869	0.585
	Market conditions, competitors, exports	0.836	0.758	0.562
	Feasibility study preparation	0.879	0.842	0.663

Source: Research findings

Table 3. Ideal Solutions for Selecting Financing Methods

Alternative	Technology Company	Innovative Company	Startup Company
Personal funds	0.569	0.507	0.713
Retained earnings (profit distribution)	0.523	0.466	0.274
Sale of assets	0.506	0.463	0.499
Short-term loans	0.445	0.462	0.61
Overdrafts	0.403	0.438	0.518
Credit cards	0.463	0.405	0.564
Long-term loans	0.642	0.606	0.424
Subsidies, grants, and low-interest facilities	0.44	0.471	0.651
Government venture capital funds	0.572	0.621	0.631
Guarantee schemes	0.641	0.611	0.42
Fund of funds	0.39	0.448	0.581
Asset-based loans	0.618	0.418	0.296
Factoring / Discounting receivables	0.5	0.554	0.471
Purchase financing	0.569	0.303	0.466
Inventory financing	0.395	0.436	0.575
Leasing	0.511	0.507	0.423
Corporate bonds	0.428	0.487	0.54
Debt purchase by financial intermediaries	0.484	0.538	0.556
Covered bonds	0.351	0.4	0.521
Private placements	0.507	0.492	0.426
Crowdfunding	0.508	0.589	0.613
Subordinated debt	0.574	0.37	0.391
Participatory loans	0.641	0.574	0.552
Silent partnership	0.363	0.528	0.448
Convertible debt	0.381	0.47	0.356
Mezzanine financing	0.466	0.494	0.292
Business angels	0.555	0.511	0.638
Venture capital	0.461	0.442	0.503
Initial public offerings (IPOs)	0.504	0.546	0.421
New stock markets	0.376	0.348	0.358
Participation term certificates	0.502	0.359	0.427
Istisna (manufacturing contract)	0.313	0.544	0.475
Mudarabah (profit-sharing contract)	0.47	0.455	0.55

Note: The closer the ideal solution value is to 1, the more suitable the financing method is for selection.

Source: Research findings

A comparison with recent national data (Vice Presidency for Science and Technology, 2024) confirms partial alignment between empirical findings and real-world financing practices. For instance, venture capital funds indeed represent a leading financing source for innovative firms, while startups predominantly rely on personal savings and informal financing. However, for technology-based firms, long-term loans remain less accessible in practice, highlighting a financing gap that policymakers should address. The top five financing method priorities vary by company type. For startup companies, the primary methods include personal resources, pledging owners' assets, and resources from friends, relatives, or family, followed by subsidies, grants, and the provision of low-interest or long-term repayment facilities. Business angels rank third, followed by crowdfunding and short-term loans. Innovative companies prioritize government venture capital funds or venture capital, guarantee schemes, long-term loans, crowdfunding, and participatory loans. Technology companies, on the other hand, focus first on long-term loans, followed by participatory loans, guarantee schemes, asset-based loans, and non-preferred debts.

5. Conclusion

This research rigorously examined the critical factors influencing the selection of financing methods for startup, innovative, and technology-oriented firms. Employing a hybrid methodology that combined structural equation modeling (SEM) with multi-criteria decision-making (MCDM) techniques such as TOPSIS, the study provided a nuanced understanding of the decision-making process surrounding financing in dynamic, high-potential sectors. By integrating a literature review with expert insights gathered through semi-structured interviews, the study identified eight main categories of factors and 46 detailed sub-factors that shape financing strategies, including financing provider factors, financed financial factors, macroeconomic factors, technological characteristics, internal organizational and legal factors, internal cultural and social factors, market conditions, competitors, and exports, and

feasibility study preparation. Using data collected from three distinct groups—startups, innovative companies, and technology-based firms—the study revealed significant differences in the weight and influence of these factors across company types. For startups, the most influential factor was market conditions, competitors, and exports (standardized coefficient = 0.983), while financed financial factors had the least influence (0.730). For innovative companies, macroeconomic factors were the most impactful (0.854), with financed financial factors remaining the least significant (0.610). For technology companies, internal organizational and legal factors had the strongest effect (0.930), whereas feasibility study preparation was the weakest (0.606). All identified factors were statistically significant, with t-values exceeding 1.96, confirming their robust explanatory power, and model reliability and validity were well-supported through Cronbach's alpha, composite reliability, and average variance extracted (AVE) indices. The application of the TOPSIS method further enabled the ranking and prioritization of 33 financing methods in relation to the identified factors, showing that the most preferred financing methods were personal resources and pledging owners' assets for startups, government venture capital funds for innovative companies, and long-term loans for technology companies.

The findings provide vital implications for entrepreneurs, financial managers, policymakers, and investors involved in knowledge-based and innovation-driven industries. First, managers must recognize that financing needs and priorities are not universal, as startups require agile financing aligned with market dynamics, innovative firms benefit from macroeconomic stability, and technology companies prioritize organizational structure and legal clarity, highlighting the importance of customized financing strategies. Second, policymakers can leverage these insights to design targeted financial instruments and support mechanisms, such as enhancing access to venture capital for innovative firms or streamlining legal frameworks for technology enterprises, thereby catalyzing growth. Third, investors should consider these domain-specific influences when structuring funding offers, as understanding

the drivers of financing decisions can improve alignment between funders and recipients. Finally, capacity building is essential, particularly for entrepreneurs in startups, who should be trained to better assess external market conditions and effectively leverage personal and tangible assets to access early-stage financing. Furthermore, comparative evidence from Southeast Asian countries demonstrates that hybrid financing systems—combining public venture capital, angel investors, and private equity—can significantly enhance innovation outcomes. These integrated approaches not only provide startups and knowledge-based enterprises with the necessary financial resources but also bring valuable strategic guidance, industry networks, and managerial expertise. By leveraging a mix of public and private funding, firms are better positioned to navigate market uncertainties, scale rapidly, and accelerate research and development activities.

Adopting similar integrated financing approaches in Iran could substantially strengthen the resilience and scalability of knowledge-based enterprises. For instance, structured public support programs could reduce initial investment risks, encouraging greater participation from private investors and venture capitalists. In addition, fostering collaboration between different financing actors could facilitate knowledge transfer, improve governance structures, and increase the likelihood of commercializing high-impact innovations. Overall, a well-coordinated hybrid financing ecosystem could serve as a critical driver for Iran's innovation-led economic growth, enhancing both competitiveness and sustainability in the long term

Given the inherent uncertainty and complexity in financing decisions, future studies should consider incorporating advanced decision-making and uncertainty-handling frameworks. These may include fuzzy logic-based models to better capture real-world ambiguity in expert assessments, D-numbers theory for more flexible and realistic weighting of criteria under uncertainty, and grey theory or the MARCOS method to enhance robustness in ranking and prioritizing financing options. Additionally, longitudinal studies tracking the evolution of financing preferences over time and their

impact on firm performance would provide valuable insights. Cross-country comparative analyses could further deepen understanding by revealing how regional and cultural factors influence and mediate financing decisions.

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All authors had contribution in preparing this paper.

Conflicts of interest

The authors declare no conflict of interest

Resources

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