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Presenting the development model of technological entrepreneurship in the banking system based on the open innovation approach

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Abstract

The purpose of this research is to present a model of technological entrepreneurship development in the banking system based on the open innovation approach. The current research has a fundamental goal and a practical approach, and the research method is mixed and content analysis. The statistical population of the qualitative section includes professors and experts in the field of technological entrepreneurship, and the sampling method in this research is a snowball sampling method, so the data collection continued until reaching the saturation point, which is 18 people. Also, the statistical population in the quantitative part includes managers and assistants of Tejarat Bank in Tehran province, and the sampling method in this research is simply random. The sample size is 313 people based on Morgan's table. The method and tools of data collection in the qualitative part are semi-structured interviews and in the quantitative part are researcher-made questionnaires. In this research, descriptive statistics and inferential statistics were used to analyze the data and achieve the aforementioned goals. Statistical methods for analysing and analysing the information available in the data set are factor analysis or factor analysis, which was used using the structural equation method (SEM) and Lisrel software. Finally, the research model was measured and fitted. The research results showed that the fit of the research model is significant for t-coefficients above ± 1.96 to ± 2.58 at the 0.05 level, and t-coefficients above ± 2.58 are significant at the 0.01 level. The path coefficients and the explained variance of the research variables and the fit indices obtained for the tested model show that the RMSEA index in the estimated model has an acceptable level with a rate of 0.064 and other fit indices such as CFI, GFI, NFI, and AGFI is equal to 0.97, 0.94, 0.95 and 0.92, respectively, and these characteristics of good fit show that the data of this research fits well with the factor structure of this model.

Keywords: pattern, development, entrepreneurship, technological entrepreneurship, open innovation, banking system, Tejarat bank
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1 Introduction

The socio-economic environment of the world is changing at a surprising speed with the new approach it has adopted, always by introducing new technologies and gradual innovations related to it, and it makes life easier but more complicated for humans. Therefore, knowing the technologies according to the needs of humans and their use in society has become one of the basic topics of scientists, engineers and policymakers, and since gaining economic value is always the main reason for the development of knowledge and technology and businesses for survival and achievement. In a highly competitive market, it is required to provide innovation and gain a competitive advantage, the importance of paying attention to its entrepreneurship in the field of technology is becoming more apparent. In this passage, the attention of scientific societies and, as a result, economic factors, to the concept of entrepreneurship as a solution to maintain and improve success indicators in businesses is shown, which is one of the most important areas related to the trend of technological entrepreneurship.

In order to create technological entrepreneurship and identify opportunities, organizations need to expand communication networks with people and institutions outside the organization because it is difficult to achieve technological entrepreneurship due to its interdisciplinary nature only through internal research and development. Organizations in today's unstable environment must apply innovation in two dimensions of inbound and outbound innovation. Inbound innovation leads to the entry of innovative ideas into the organization, and through this technological knowledge, it can improve its innovation processes and engage in entrepreneurship and the creation of new products and services. Also, outbound innovation can lead to the departure of innovative ideas and technological knowledge from the internal boundaries of the organization to the outside for financial and non-financial exploitation. Therefore, the choice of innovation approach in the organization is very important and important to the extent that the failure of some organizations happens because they only tend to one innovation approach and they are unaware of modern innovative approaches [1].

Entrepreneurial action can be known as an innovative method that is guided through an organized system of human relations and a combination of resources to achieve a specific goal [6] and providing an entrepreneurial model in the organization leads to the strategic position of an organization becomes, and by providing policies for the development of entrepreneurial activities, the competitive advantage of the organization is improved [16]. Meanwhile, technological entrepreneurship is the integration of technology and knowledge with entrepreneurial skills and is the process of creating, exploiting and developing new technological opportunities in the market. Technological entrepreneurship solves society's needs by speeding up the process of transforming new science and knowledge into technology, and by applying these technologies and applications, it leads to the creation and development and better management of the organization [20, 21].

Hijazi et al. in [11] identified the components affecting the quality to introduce technological entrepreneurship opportunities and showed that seven technology components include the main operating infrastructure, product technology, process technology, scientific and skill bases, systems and procedures. information support and the level of support and optimization in the seven working stages of the company that have a significant effect on quality have been identified. Peng et al. [19] investigated the influence of the form of governance on technological organizational entrepreneurial activities, and they showed that single control and supervision have a positive effect on technological organizational entrepreneurship and its performance, but acquisition and integration management and supervision have a negative relationship with this phenomenon. Therefore, the complex and dynamic conditions of today's environment make the importance of using new and efficient technologies in organizations undeniable. Organizations should use their internal and external resources to achieve better competitive advantages by applying effective and timely commercialization of new technologies [30]. The requirements of today's world have made technology one of the main factors in the establishment and management of most organizations. At the same time, extensive changes and increased competition along with the development of the use of technology strategy in organizations and the increase in the importance of technological cooperation have caused managers to look for new approaches to solve organizational technological problems [24]. In order to maintain the competitiveness of an organization, it is necessary to apply technological innovations. Therefore, innovation in technology is considered a necessity to improve the performance of organizations against competitors and maintain their competitive power. Therefore, a concept called organizational technological entrepreneurship is formed, which requires attention to maintain survival in a competitive environment [11]. This, along with the success of technological entrepreneurship in non-organizational fields and its undeniable role in generating wealth, has led to the creation of a new research area of technological entrepreneurship. Although technological entrepreneurship is one of the most important factors of economic value creation and development, the number of researches conducted on the role of technological entrepreneurship in organizations is very limited [24].

Today, with increasing competition and shortening of the life cycle of goods and services and rapid changes and developments in the field of technology used in them, the category of innovation is a challenging issue, and in such a

dynamic and advanced environment, innovation is only possible within the closed boundaries of the organization. It is not and you should benefit from external ideas along with the ideas inside the organization and by taking advantage of the opportunities created by the open innovation approach, design a process to use its advantages [27]. Organizational innovation is considered as the process of presenting a new idea, which turns all the activities of the organization in the form of creating a new product, service or new process and innovation is open to the concept that new ideas can come from within. and be offered to the market outside the organization, and open innovation is the purposeful use of the inward and outward flow of technical knowledge in order to accelerate the internal trends of innovation and expand the market for the external use of innovations, and it includes two dimensions of input and output.

The importance of technological entrepreneurship is due to the fact that technology-based industries are rapidly expanding and replacing traditional industries, and these changes and activities based on knowledge and skills are sometimes interpreted as the magnitude of the industrial revolution [20, 21]. Thinkers believe that technological entrepreneurship is one of the most important factors in creating economic value and development [2].

In the meantime, the banking industry has witnessed unpredictable changes in the last few years, and advanced communication and information technologies have grown widely, while the country's banking system does not have the necessary diversity, quality, and speed, and currently the biggest problem Banks is that there is no innovation in the banking system. Most bank products are almost identical copies of each other, with little difference in capabilities. Internet bank, mobile bank, ATM, point of sale, USSD-based services and various types of magnetic cards fill a large amount of innovative advertising of banks, while none of them really make a significant difference to the customer, and the customer in other competing banks is more or less the same. It will find the services. Worse, none of these products are really new and all of them are more than 30 years old in the world. Of course, this situation is not only specific to our country, and it revolves around the same heel to a large extent in the world. In other words, once bankers start using a technology, they are very loyal to it and don't let it go until they die. Therefore, in order to solve these issues and challenges and create a suitable platform for technological entrepreneurship, banks should look for new and low-cost ways and paths in order to change traditional methods and diversify services and new methods to solve customers' problems, and this leads to technological innovations. Therefore, one should seek to provide a model that can create technological entrepreneurship in the banking system and by using the innovation approach, this model can be improved. Innovation is one of the key actions in the entrepreneurial process and is a tool by which the entrepreneur creates wealth-generating resources or enriches the existing resources to increase their potential to generate wealth. According to the presented materials, the purpose of this research is to investigate the development of technological entrepreneurship development model in the banking system based on the open innovation approach.

2 Theoretical foundations of research

2.1 Entrepreneurship

Entrepreneurship is a concept that exists with human creation. The study of entrepreneurship literature shows that economists were the first to describe entrepreneurs and entrepreneurship in their economic theories. Then, due to the importance and role of entrepreneurship in shaping the evolution of societies, experts in psychology, management, sociology, and anthropology have also studied different aspects of entrepreneurship. Economists consider entrepreneurship as the engine of economic development. The study of entrepreneurship in psychology has been focused on understanding how different people's qualities are related to their motivation and entrepreneurial performance. Sociologists have made efforts to identify social groupings based on religion and race and their influence on entrepreneurial activities, and anthropologists also focus on the roles of culture and social relations in entrepreneurship. and management scientists also explain entrepreneurial management and create atmosphere and entrepreneurial environment in organizations.

Johnson and colleagues [14] believe that entrepreneurship is a complex multifaceted concept that has attracted a lot of attention today, and most experts agree that entrepreneurship and entrepreneurs contribute to the development of economy. They are sad. Therefore, entrepreneurship is an interdisciplinary subject that various disciplines such as economics, psychology, anthropology, sociology, and management have played a key role in its evolution.

The word entrepreneurship was first coined in the French language and it is derived from the French term Entreprendre meaning "intermediary and broker" or from the English term To Undertake meaning "to undertake". In Persian, this term was first translated as entrepreneurship and then as entrepreneurship, both of which are not good translations of this word. It seems that it would be better if this word was translated as the value of Afarin.

Drucker and Maciariello [9] believes that entrepreneurship is taking advantage of opportunities to create change, and an entrepreneur is someone who starts a small and new economic activity with his own capital, changes values and transforms their nature [12].

Rezaeian considers entrepreneurship as the process of hunting for opportunities by individuals, through individuals (independent entrepreneurship) or in organizations (organizational entrepreneurship), without considering the available resources at their disposal [23].

Entrepreneurship has been a growing and significant topic in the 21st century and is often seen as a way to reach a high level of organizational performance. Entrepreneurship is recognized as one of the main factors of economic prosperity that can help the growth of emerging economies and overcome the basic challenges of poverty in developing countries.

According to what has been said, it can be said that entrepreneurship never only means creating work, and if it is inferred like this, a big mistake has been made. Entrepreneurship, like any other modern phenomenon, requires culturalization, education, research, and reform of executive structures and institutions, and in addition, comprehensive development of entrepreneurship requires attention to its tools and equipment.

Entrepreneurship, in order to grow and develop in societies, requires a certain culture. Entrepreneurship, the focus and center of gravity of human work and effort and progress in the era of modernity, is considered to be the process of establishing or developing a business based on a new thought and idea. Entrepreneurial culture is influenced by the culture that dominates the society. In fact, whatever the values and beliefs in the society lead the people of the society to work, continuous production, creative thinking, learning and acquiring knowledge, the entrepreneurial culture is spread and institutionalized in that society. In other words, in this society, more people engage in creativity, innovation, and entrepreneurship, and more entrepreneurial people succeed in making their new ideas come true in the society.

2.2 Technological entrepreneurship

Technological or technological entrepreneurship is a new field that is rooted in entrepreneurship. The purpose of technological entrepreneurship is to study the characteristics of entrepreneurial behaviors in environments focused on technology and new technologies. The study of technological entrepreneurship is important because it includes a combination of risk factors associated with entrepreneurship; In recent years, technopreneurship has been proposed in Europe as one of the most important sources of economic value creation and development. Technological entrepreneurship is at a higher level than entrepreneurship and consists of delivering a new product or providing innovation in services in the field of new technologies. An interpretation is a process of engineering the future of an individual, organization or nation. Technopreneur is an entrepreneur who has technological understanding, creativity, innovation, dynamism and the courage to be different are his characteristics. Technological entrepreneurs usually have different knowledge, skills and characteristics from other entrepreneurs. They generally have enough technical knowledge but lack skills. Generally related to business, Scott Sheen and Nektaraman call technological entrepreneurship the process by which entrepreneurs integrate organizational resources and technology systems and strategies used by entrepreneurial companies to pursue opportunities.

Technological entrepreneurship consists of two concepts of entrepreneurship and technology. "Technology" means theoretical and practical knowledge, skills and tools that can be used in the creation and development of products and services, where entrepreneurship can also be used to identify and exploit inactive opportunities through the creation of new resources or the combination of existing resources to Defined new ways to develop and commercialize new products, obtain new markets or provide service to new customers. Based on these two concepts, Petty defines technological entrepreneurship as identifying, discovering and even creating entrepreneurial opportunities based on technological developments.

Burgelman and Rosenbloom [7] proposed technological entrepreneurship as a combination of commercialization and technology and considered it as the foundation of the technological innovation process. A comparison was also made between the traditional entrepreneur and the technological entrepreneur. The traditional entrepreneur is a person who can identify opportunities. and have the commercial use of a new product or service, and a technological entrepreneur is a person who has the ability to identify the market for the technology used, which ultimately leads to technological innovations and new product development.

2.3 Open innovation

The theory of open innovation is related to Henry Chesbrough, a professor at the University of California, Berkeley. Henry Chesbrough opened the paradigm (open innovation) for the first time in 2003 AD and created a great movement that today has spread to all industries and universities in most countries of the world [8]. He defined open innovation as the new imperative to create and profit from technology and explained how companies in the 20th century invested

heavily in research and development, hired the best people, they They enable They developed their innovative ideas, supported them with intellectual property strategies, and reinvested the profit in research and development.

Open innovation is a set of activities to benefit from innovation and also a cognitive model to create, interpret and investigate those activities. Open innovation responds to two issues in the past research on innovation. This model treats spillovers as an explicit consequence of the business model (rather than avoiding it) and intellectual property rights as a new class of assets (rather than a means to be protected). They can add additional income to the business model [8].

Open innovation has gained popularity in recent years due to numerous studies in the literature that believe this construct can be classified as one of the most important drivers of performance for many companies [10]. The term "open innovation" was coined by [8]. To date, he has been one of the main researchers in this field. His first definition of open innovation was as follows: "Open innovation is a model that assumes that companies can and should use external ideas as well as internal ideas and internal and external routes to business." In his later work, this concept was expanded: "Open innovation is the use of input and output flows of knowledge to accelerate internal innovation and expand markets for external use of innovation".

Open innovation is a process during which the internal ideas of the organization are combined with external ideas, which makes it possible to use the ideas and opinions of experts outside the organization along with the purposeful use of internal ideas. The goal of open innovation is to create opportunities for cooperation with partners, customers and producers of the organization in order to achieve innovation processes that ultimately end in the exploitation of ideas in the business process [12]. Based on the importance of open innovation and the recognition that there are capable and intelligent minds outside the company, it has attracted the attention of many companies, venture capitalists and governments around the world, which subsequently provided additional investment opportunities. Open innovation is recognized as an essential part of one of the United Nations Sustainable Development Goals in 2030 [18].

2.4 Research background

Zhang et al. [31] in a research entitled open innovation and sustainable competitive advantage: the role of organizational learning. Due to intensifying competition and increasing dependence on foreign investors, open innovation has become an inevitable and common strategy to achieve sustainable competitive advantage. A lot of research has been done on the open innovation advantage, the innovation advantage is the mechanism through which open innovation becomes a sustainable competitive advantage. Relying on the framework of strategic strength-competitive advantage and knowledge-based perspective, this study examines the role of the mediator of ambidextrous organizational learning in the relationship between open innovation and sustainable competitive advantage, as well as the moderating role of knowledge management capacity. Based on data collected from 269 Chinese hi-tech companies in 2021, we found that open innovation contributes to sustainable competitive advantage by enhancing organizational learning, including exploratory and extractive learning, as well as the balance between them. In addition, knowledge management capacity positively moderates open innovation relationships with exploratory and extractive learning as well as their combination. At the end, research and practical implications are discussed.

Soluk et al. [28] in a research entitled Digital entrepreneurship in developing countries: the role of organizational gaps, how to use the support of different stakeholders - especially family, community and business partners - in overcoming organizational gaps and strengthening entrepreneurship in micro-enterprises India was studied. They also explored how the adoption of digital technologies—for example, in the form of smartphone apps—could strengthen these relationships. The results of a survey of more than 1000 micro-entrepreneurs in rural India showed that both families and communities (especially self-help groups) of entrepreneurs have a positive and significant impact on entrepreneurship that is enhanced by the use of digital technologies. However, support from business partners has been negatively related to entrepreneurship.

Yang et al. [29] conducted a study on the effects of input open innovation, output open innovation and team role diversity on open source software project performance. This research maps two open innovation strategies, inbound and outbound, to examine how their mutual effects on open source software project performance are influenced by project team role diversity. In this research, the opportunity-motivation-ability (OMA) theory has been used to explain that open innovation provides opportunities to access external knowledge in open innovation social networks. But whether a project can absorb and use such external knowledge depends on external open innovation and the role diversity of the project team, which affects the motivation and ability of team members to do so. Using a large sample of open source software projects, empirical findings show that project performance should be differentiated internally (technical performance) and external (market performance) to understand the effects of an open innovation strategy. Technical performance is enhanced by a combined open innovation strategy that utilizes both high-output open innovation and

high-input open innovation, associated with low team role diversity. However, an open innovation strategy is optimal for market performance, especially when team role diversity is high. Thus, project team role diversity explained the trade-off effects of inbound and outbound open innovation strategies on project technical performance and market performance.

Hutton et al. [13] in a research entitled How does open innovation contribute to the dynamic capabilities of the company? they performed Our study aims to expand knowledge in this field by elucidating the underlying mechanisms of open innovation that contribute to a firm's dynamic capabilities. For this purpose, adopting a micro-foundation perspective, three separate new product development projects in a British manufacturing company were examined over two years. The findings showed that manufacturing companies can exploit technological and market-based knowledge sources during open innovation activities. Also, in this research, a process model was presented to reflect these findings. In the following, three basic mechanisms of open innovation were identified: realization, participation and allocation, which help to build firm resources and firm dynamic capabilities. This study showed that each mechanism links the open innovation process to a firm's dynamic capabilities by sequentially and reciprocally changing the firm's abilities to sense and exploit opportunities.

Martin-Rojas et al. [16], in a research titled the antecedents of technological entrepreneurship and its consequences for organizational performance. In this research, they analyzed how senior management support of technology and technology skills and technology acquisition, integration and infrastructure in companies is possible and affects organizational performance through corporate entrepreneurship. The analysis was carried out using the structural equation model with a sample of 201 Spanish technology companies. The results showed that awareness of technological issues enables technological entrepreneurship in the company.

Shan et al. [26] in a research titled Assessing the Relationship and Contribution of China's Technological Entrepreneurship to Economic and Social Development stated that China has adopted technological entrepreneurship as a national strategy for future economic development. In this research, the contribution of technological entrepreneurship in national development was evaluated. The results showed: (1) The number of technology companies is increasing and their share in the country's production value, exports, employment and taxes is increasing. (2) From 2010 to 2014, the industrial production value of technological entrepreneurship accounted for a large share of the average GDP growth. There is a high correlation between technological entrepreneurship and economic growth. (3) Technological entrepreneurship has played an important role in promoting the advancement of technology and foreign trade. The total export value of high-tech products accounted for approximately 22.6%. (4) Technological entrepreneurship did not have a clear effect on employment and accounted for only 2.79% of employment. (5) The contribution of technological entrepreneurship to the tax revenue of the state was approximately 8.49%.

Azar and Ciabuschi [5] in a research titled organizational innovation, technological innovations and export performance: the effects of innovation radicality and extent focused on the relationship of different types of innovation for the company's export performance. Despite extensive research on the relationship between innovation and performance, previous studies have mainly focused on technological innovations, and the effects of organizational innovation were relatively unknown. Hypotheses related to the relationship between organizational and technological innovations and firm export performance have been tested using structural equation modeling using data from 218 Swedish export firms. The results show that organizational innovation increases export performance directly and indirectly by supporting technological innovations. In addition, the analysis on the mediating role of technological innovation, with regard to its radicality and extent for organizational innovation, showed how transformation increases the radicality and extent of technological innovation, although, only its extent is beneficial for export performance.

Khavari et al. [15] in a research entitled the characteristics of technological entrepreneurship curriculum in elementary school. The research was conducted with a qualitative approach and a systematic review method. Using specialized keywords related to technological entrepreneurship curriculum until March 2021, articles and books were reviewed and 44 reliable sources were reviewed and analyzed. The results showed that the technological entrepreneurship curriculum in the target component is aimed at developing students' technological entrepreneurship skills; in the content component on theoretical and practical content; in the component of learning activities to practical and problem-based activities; In the component of learning strategies based on action-oriented and original education; And also in the field of evaluation, it emphasizes on "evaluation for learning". In the end, it is concluded that the curriculum of technological entrepreneurship will be the main need of elementary school students to create employment and develop knowledge-based and technological businesses.

Saber Kohneh Gourabi et al. [25] in a research titled "Presenting a technological entrepreneurship model with an open innovation approach in Iran's knowledge-based oil and gas companies." Therefore, a mixed exploratory approach including content analysis in the qualitative part and survey in the quantitative part was used. Qualitative

part by selecting 87 articles from among 336 articles in ISA and Scopus databases and quantitative part in Delphi stage with targeted distribution of 15 questionnaires among key informants and in path analysis stage with simple random distribution of 230 questionnaires among managers of knowledge-based companies. Done. The validity and reliability of the qualitative part was confirmed through the inclusion criteria, review by an expert coder, multi-coder agreement, and the quantitative part by experts and Cronbach's alpha. Data analysis of the qualitative part was done with open and axial coding and the quantitative part was done with fuzzy Delphi and path analysis. The results showed that open innovation is effective in discovering and developing new technologies, creating product or process innovations, and ultimately creating value and gaining competitive advantage, and while facilitating the process of technological entrepreneurship, it causes profitability and increases the market share of companies. Also, organizational and environmental factors have the greatest impact on technological entrepreneurship and the success of companies through open innovation. Therefore, this research can solve the challenges of these companies in order to achieve success and help the policy makers of this field in technological entrepreneurship and sustainable development.

Asadullah et al. [4] conducted a study titled Designing an open banking business model in the light of open innovation. For this purpose, this research has used the mixed research method (qualitative-quantitative). At first, by reviewing the background and surveying 44 experts using the Delphi technique, the conceptual model of the research was identified, and then to validate the model, a researcher-made questionnaire of 44 questions was used among the statistical sample consisting of 481 employees and managers of the country's banking network. which were selected from the cluster probability method is distributed. Smart PLS software was used for data analysis. Cronbach's alpha coefficient and composite reliability were used for reliability tests, and Fornell and Larcker tests were used to measure divergent validity. The goodness of fit test has also shown the predictive power of the model. The results showed that the structure of financial institutions, developers of financial technologies and the systemic model of the business environment have a positive effect on the open banking model, but customer segmentation has no effect on the open banking model. Also, the open banking business model has an impact on improving the business environment and organizational performance, but it has no effect on the acceptance of virtual banking.

Mazidi et al. [17] in a research entitled "Presenting the model of technological entrepreneurship in schools of Golestan province". The descriptive research method is of the correlational type and the statistical population of the research was entrepreneurship teachers of schools in Golestan province, whose number was 711, and based on Cochran's formula, 203 people were selected by stratified random method and school teachers were used to collect data. The data collection tool included a researcher-made questionnaire, whose validity was confirmed using content validity of face validity and its reliability was confirmed using Cronbach's alpha coefficient ($Alpha > 0.7$), the data was analyzed using Smart-Pls software. The processing is placed. To analyze the data, statistical methods were used according to the level of measurement of the variables and the main concepts of the research. The research results showed that there is a positive and significant relationship between causal conditions and technological entrepreneurship, between technological entrepreneurship and strategies, between intervening conditions and strategies, between contextual conditions and strategies, and between strategies and outcomes, and all hypotheses were confirmed.

Ahari Lahagh et al. [1] in a research titled presenting the model of open innovation in small and medium-sized businesses based on the approach of the level of social interactions with the medium of innovation (case study: small and medium-sized businesses of information technology and banking communication). Therefore, by adopting a qualitative approach, interviews were conducted with the senior managers of small and medium-sized businesses of information technology and banking communications that have cooperated with Innovation Media, senior managers of Innovation Media as well as representatives of the governing body in this field, and a model in this regard. Provided. This study has led to the identification of actors including small and medium businesses, innovation intermediaries and the legislative body, which, with the adoption of strategies by small and medium companies, has resulted in the emergence of specific outputs for small and medium businesses that have cooperated with innovation intermediaries.

Akbari et al. [3] in a research entitled the effect of inbound and outbound innovation on innovation performance in information and communication technology companies stated that today innovation is considered as a vital principle for organizations. So that one of the key factors in the survival of companies is the continuous improvement of the organization's innovation performance. The statistical population of the research was the companies active in the field of information and communication technology in Tehran, from which 116 companies were selected. A questionnaire was used to collect data and the data was analyzed with the help of SPSS and PLS software. The results showed that there is a positive and significant relationship between inbound and outbound innovation. The two variables of outgoing and incoming open innovation have a positive and significant effect on the performance of the organization. This is while outbound open innovation, inbound open innovation and combined organizational performance explained changes in innovation performance, but the share of inbound open innovation is less than the other two variables.

Rezaei [22] carried out a research titled investigating the relationship between knowledge management system,

innovation capacity and open innovation (case study: Kermanshah National Bank). This research is applied in terms of purpose, descriptive-survey in terms of nature, and correlational in terms of method. The study related to the literature of the subject was through library study such as books, magazines, theses, articles, etc., and the required data were collected through a questionnaire, then the desired data were analyzed by performing statistical methods. According to the topic of this research, the studied community in this research is the managers and employees of National Bank in Kermanshah city, whose number is 485 people. The sample size was obtained using Cochran's formula of 215 people and simple random sampling was done. After analyzing the data with correlation methods, it has been determined that there is a positive and significant relationship between the knowledge management system and innovation capacity. Also, there was a significant relationship between knowledge management system and open innovation and between innovation capacity and open innovation. The results showed that there is a positive and significant relationship between the knowledge management system, innovation capacity and open innovation in Kermanshah National Bank.

3 Research Method

The current research has a fundamental goal and a practical approach, and the research method is mixed (qualitative-quantitative) and the content analysis model was used to identify indicators. In this research, the foundation data method was used to identify the components; and to determine the structural relationships of model variables and model fit from structural equation modeling (SEM); The statistical population of the qualitative section includes all professors and experts who are in the field of technology entrepreneurship development with management and educational experience of more than 5 years, and the sampling method in this research is the snowball sampling method, so that data collection It continued to reach the saturation point, which number is 18 people and also the statistical population in the quantitative section includes all the managers and assistants of Tejarat Bank in Tehran province with management experience of more than 5 years and the sampling method in this research is random. It is simple that the sample size is 313 people based on Morgan's table.

$$n = \frac{NZ^2pq}{(N-1)d^2 + Z^2pq} \tag{3.1}$$

The method and tools of data collection in the qualitative part are semi-structured interviews and in the quantitative part are researcher-made questionnaires. In this research, descriptive statistics and inferential statistics were used to analyze the data and achieve the aforementioned goals. Statistical methods for analyzing and analyzing the information in the data set are factor analysis or factor analysis, so confirmatory factor analysis has been used to measure the relationships between hidden variables and their measurement items. Confirmatory factor analysis examines the relationship between items (questionnaire questions) and constructs. In fact, until it is proven that the questions of the questionnaire have measured the hidden variables well, the research hypotheses based on the questionnaire data cannot be used. Therefore, confirmatory factor analysis is used to prove that the data have been measured correctly. The strength of the relationship between the factor (latent variable) and the observable variable is represented by the factor loading. The factor loading is a value between zero and one. It was used using structural equation method (SEM) and Lisrel software, finally the research model was measured and fitted.

3.1 Research questionnaire and interview

The questionnaire created by the research researcher has been prepared with the aim of presenting a model of technological entrepreneurship development in the banking system based on the open innovation approach, which aims to familiarize and gain awareness and knowledge of the research categories, as well as more coordination and identification of research variables with professors and experts related to Technological entrepreneurship interviews were conducted, which includes 13 main categories and 68 items. The scoring of the questionnaire is in the form of a 5-point Likert scale, with 5, 4, 3, 2, 1 points respectively for the options "very high", "high", "moderate", "low", "very low". It was considered, which is based on table 1.

3.2 Validity and reliability of the questionnaire

In this research, the opinions of professors and experts have been used to check the validity of research questionnaires, and for this purpose, at first 30 questionnaires were distributed and collected among the respondents, and after obtaining the opinion of experts, they have been approved and the research questionnaires have been validated. has

Table 1: Questionnaire items

Component	**Number of items**
Customer orientation	1–7
Resource Management	8–11
Financial resources	12–14
Social factors	15–17
Technological factors	18–21
Government policy making	22–25
Introducing organizational entrepreneurship	26–33
Characteristics of the entrepreneurial enterprise organization	34–39
Characteristic of entrepreneurial company employees	40–46
Characteristics of entrepreneurial company managers	47–57
Internal capabilities	58–61
Organization performance	62–66
Employment	67–68
Total items	68

Also, the reliability of the research was done through Cronbach's alpha coefficient and the number of items related to the variables of the questionnaire. Since the value of Cronbach's alpha is greater than 0.7, the questionnaire has acceptable reliability, which is based on table 2.

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum S_i^2}{S_t^2}\right) \tag{3.2}$$

S_i^2: i question variance; S_t^2: Total test variance; N: Number of questionnaire questions

Table 2: The results of the reliability test of the questionnaire

Component	**Cronbach's alpha coefficients**
Customer orientation	0.76
Resource management	0.84
Financial resources	0.79
Social factors	0.91
Technological factors	0.88
Government policy	0.82
Introducing of organizational entrepreneurship	0.94
characteristic of the entrepreneur's organization	0.91
Characteristic of entrepreneurial company employees	0.93
Characteristics of entrepreneurial company managers	0.89
Internal capabilities	0.77
Organization performance	0.85
Employment	0.87

4 Research findings

In the qualitative stage of model presentation, the method of qualitative content analysis and theoretical coding has been used. To collect data for the qualitative part, 18 professors and experts were interviewed in the field of technological entrepreneurship development in the banking system based on the open innovation approach. In the open coding phase, the interviews were implemented and the summaries of the documents were re-read, and 100 concepts were extracted.

In the axial coding section, the codes obtained in the free coding section are examined and studied, and related and similar codes are grouped together in larger categories. The categories and concepts extracted from the interviews, which are classified under 13 categories, are presented separately in Table 3:

In the next step, similar and symmetrical categories were tried to be placed in the main themes. Based on the conceptual commonality that the categories had with each other, the themes were extracted in the form of more abstract concepts. Establishing a relationship between the different identified categories is shown in the form of a paradigm model in Figure 1:

Table 3: Categories and concepts extracted from the interviews

Category 1: customer orientation	
Having knowledge about the customer	Concepts
Customer satisfaction	
Focus on customer needs	
Understanding customer needs and demands	
Proximity and building personal relationships with customers	
Continuous contacts with the customer	
Providing and improving the product with the customer's opinion	
Category 2: Resource management	
Organization of resources	Concepts
Resource efficiency	
Resource control	
Quality improvement of human resources	
Category 3: Financial resources	
Available capital	Concepts
Budget allocation	
Access to foreign exchange resources	
Category 4: Social factors	
Social acceptability	Concepts
Satisfaction of related groups	
Increasing social benefits	
Category 5: Technological factors	
Ability to obtain technology	Concepts
Technical infrastructure	
Existence of technology training centers	
Technology update	
Category 6: Government policy making	
Macro policies of the government	Concepts
Providing stable environmental conditions	
Supportive policies	
Providing infrastructure	
Category 7: Introduction of organizational entrepreneurship	
Gathering organization information	Concepts
Monitoring of marketing performance	
Distribution channels	
Presence in social networks	
Creating value through social networks	
Attending specialized exhibitions	
Ability to penetrate the market	
Attending international exhibitions	
Category 8: Organizational characteristics of the entrepreneurial company	
Organizational reputation	Concepts
Company size	
Corporate branding	
Company goals	
Knowledge absorption capacity	
Entrepreneurial organizational culture	
Category 9: characteristics of the employees of the entrepreneurial company	
Staff education	Concepts
teamwork	
Knowledge-oriented employees	
Production skills of employees	
Employee self-efficacy	
Ability to solve problems	
tolerance of ambiguity	
Category 10: Characteristics of entrepreneurial company managers	
having a reputation	Concepts
Good reputation and acceptability	
Create events	
Developing planning, monitoring and control strategies	
Entrepreneurial mindset	
Entrepreneurial attitude	
Riskiness	
Creating value	
Identifying entrepreneurial opportunities	
Being creative and innovative	
Having business intelligence	

Independence	
Category 11: Intra-organizational capabilities	
Proximity and building personal relationships with employees	Concepts
Personal relationships among employees	
Friendly meetings with staff	
Non-official communications	
Category 12: Organization performance	
Responsiveness to competitors	Concepts
Increasing the share of the organization	
Expansion of the organization	
Ability to compete	
ability to choose	
Category 13: Employment	
Increase employment	Concepts
Production and employment	

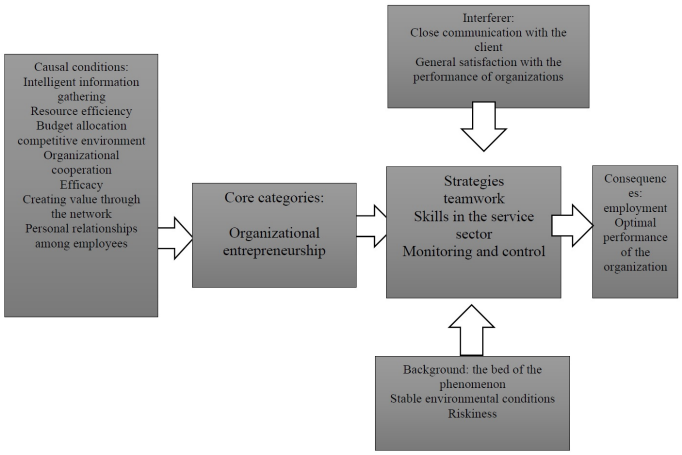

Figure 1: Axial coding based on the research paradigm model

4.1 Confirmatory factor analysis of data

First, to enter the structural equations, the research tools must be subjected to confirmatory analysis to determine the validity of the structure. Confirmatory factor analysis was used to confirm each of the variables as well as the items related to each of them. In fact, confirmatory factor analysis is used to determine the appropriateness of the measurement model. Confirmatory factor analysis is actually a theory test model, in which the researcher starts his analysis with a previous hypothesis. This model, which is based on a strong theoretical and experimental foundation, specifies which variables should be correlated with which factors. It also offers a reliable method to the researcher to evaluate the validity of the structure, so that in this way he can clearly test the hypotheses about the factorial structure of the data, which is caused by a predetermined model with a specific number and combination of factors.

4.2 Confirmatory factor analysis of variables of causal conditions

In order to determine the validity of variables of causal conditions, confirmatory factor analysis method was used. The output of Lisrel software shows that all factor loadings are higher than 0.3.

According to Lisrel's output in Table, the calculated χ^2/df value is 2.07, the presence of χ^2/df smaller than 5 indicates the appropriate fit of the model, and the root mean square error estimate (RMSEA) should be less than 0.80, which in the presented model is equal to 0.066. The amount of GFI, AGFI, CFI and NFI indicators should be more than 0.9, which is higher than the determined amount in the model under study. Therefore, the data of this research fits well with the factor structure of this scale, and this indicates the alignment of the questions with the variables of the causal conditions.

$$Y = \widetilde{XB} + \widetilde{B0}$$

In order to determine the validity of the strategies, confirmatory factor analysis method was used. All factor loadings are higher than 0.3 as shown in Figures 3 and 4.

According to Lisrel's output in Table, the calculated χ^2/df value is 1.80, the presence of χ^2/df smaller than 5 indicates the appropriate fit of the model, and the root mean square error estimate (RMSEA) should be less than 08

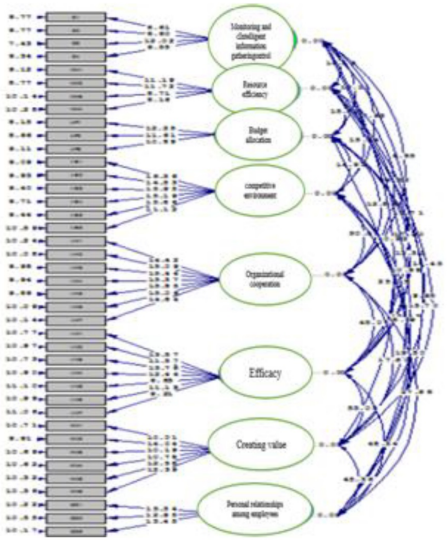

Figure 2: Lisrel output for causal condition variables

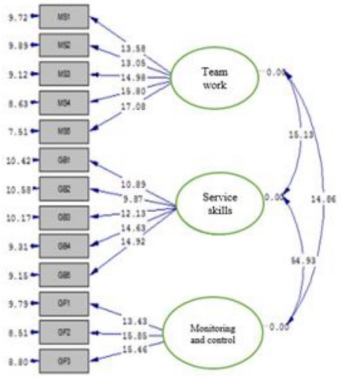

Figure 3: Laserl output for strategies

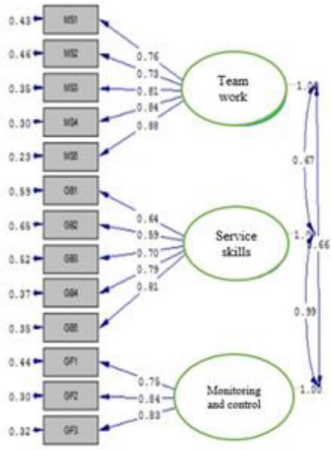

Figure 4: T-coefficients for strategies variables

be 0.057, which in the presented model is equal to 0.057. The amount of GFI, AGFI, CFI and NFI indicators should be more than 0.9, which is higher than the determined amount in the model under investigation. Therefore, the data of this research fits well with the factor structure of this scale and this indicates the alignment of the questions with the variables of the strategies.

4.3 Confirmatory factor analysis of background variables

In order to determine the validity of background variables, confirmatory factor analysis method was used. The numbers on the paths are factor loadings. All factor loadings are higher than 0.3 as shown in Figures 5 and 6.

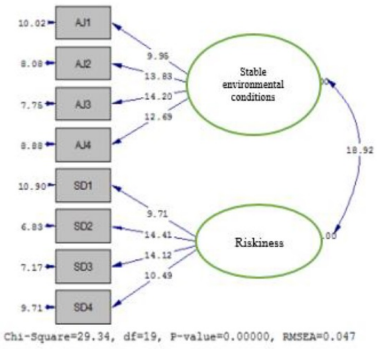

Figure 5: Laserl output for background variables

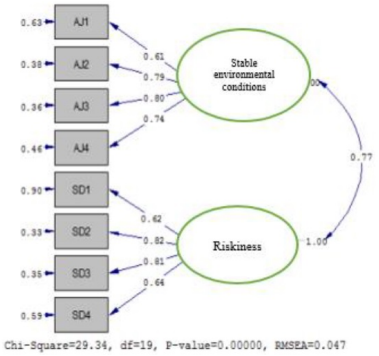

Figure 6: T coefficients for background variables

According to Lisrel's output in Table, the calculated χ^2/df value is 1.54, the presence of χ^2/df smaller than 5 indicates the appropriate fit of the model, and the root mean square error estimate (RMSEA) should be less than 08 be 0.047, which in the presented model is equal to 0.047. The amount of GFI, AGFI, CFI and NFI indicators should be more than 0.9, which is higher than the determined amount in the model under investigation. Therefore, the data of this research fits well with the factor structure of this scale, and this indicates the alignment of the questions with the background variables of the phenomenon.

4.4 Confirmatory factor analysis of intervening factors

In order to determine the validity of intervening factors, the method of confirmatory factor analysis was used. The numbers on the tracks are factor loads. All factor loads are higher than 0.3 as shown in Figures 7 and 8.

The findings related to the fit indices of the intervening factors indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these good fit characteristics show that the data of this research with the factor structure This scale has a good fit and it shows the alignment of the questions with the structure of intervening factors.

4.5 Confirmatory factor analysis of results

In order to determine the validity of the results, the method of confirmatory factor analysis was used. All factor loadings are higher than 0.3 as shown in Figures 9 and 10.

The findings related to the outcome fit indices indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these good fit characteristics show that the data of this research fits the factor structure of this scale. It is appropriate and this indicates the alignment of the questions with the constructs of the results.

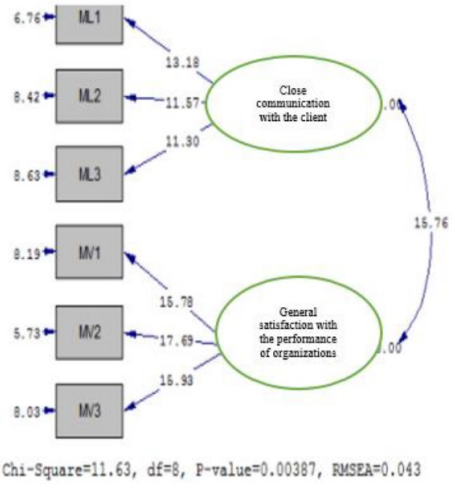

Figure 7: Lisrel output for intervention factors

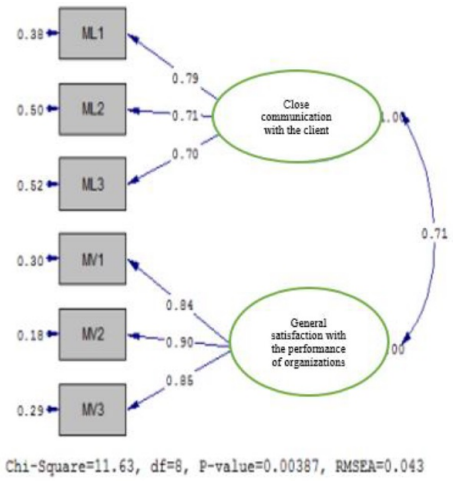

Figure 8: T coefficients for variables of intervening factors

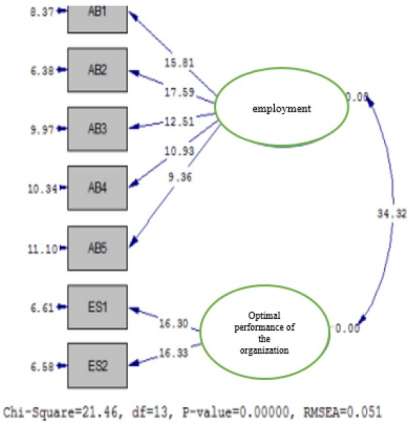

Figure 9: Laserl output for outcome variables

4.6 Confirmatory factor analysis of organizational entrepreneurship

In order to determine the validity of the model, the method of confirmatory factor analysis was used. All factor loadings are higher than 0.3 as shown in Figures 11 and 12.

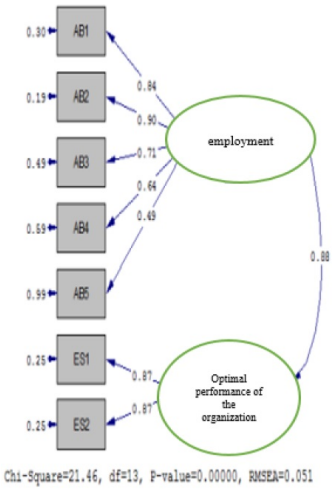

Figure 10: T coefficients for outcome variables

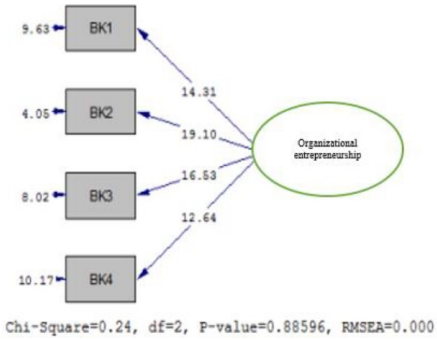

Figure 11: Lisrel output for organizational entrepreneurship variable

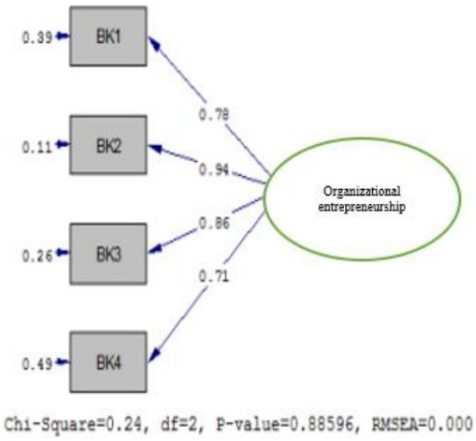

Figure 12: T coefficients for the organizational entrepreneurship variable

The findings related to the fit indices of communication with the client indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these good fit characteristics show that the data of this research with the structure The factor of this scale has a suitable fit and this indicates the alignment of the questions with the construct on organizational entrepreneurship.

In order to determine the validity of the variables of causal, strategic, contextual, central, intervening, and impacting conditions of the model, the confirmatory factor analysis method was used. The results showed that all factor loadings are higher than 0.3. Also, the indicators related to the descriptive statistics for the studied sample, including the mean and standard deviation for the studied variables in this research, are given. which is given in table 4.

Table 4: Descriptive indices of research variables

The standard deviation	Average	Variables
80%	3.59	Organizational entrepreneurship
96%	3.05	Intelligent information gathering
78%	3.18	Resource efficiency
90%	3.08	Budget allocation
93%	2.85	competitive environment
91%	2.74	Organizational cooperation
85%	2.80	Efficacy
92%	3.07	Creating value through the network
1.04	2.86	Personal relationships among employees
1.12	2.75	teamwork
96%	2.82	Skills in the service sector
94%	2.94	Monitoring and control
80%	3.34	Opportunity oriented
48%	2.59	Stable environmental conditions
87%	3.45	Riskiness
84%	2.14	Close communication with the client
75%	3.89	General satisfaction with the performance of organizations
84%	3.48	Employment
88%	2.59	Optimal performance of the organization

According to the output of Lisrel software, T-coefficients above ±1.96 to ±2.58 are significant at the 0.05 level, and T-coefficients above ±2.58 are significant at the 0.01 level. Also, in Table 5, the coefficients of the path and explained variance of the research variables are given.

Table 5: The results of path coefficients and explained variance ($*p < 0.05 \quad **p < 0.01$)

Variance explained	Path coefficients	Direction
22%	(2.39)*15%	Organizational entrepreneurship
	(3.84)**24%	Intelligent information gathering
	(2.51)*16%	Resource efficiency
3%	(4.24)**24%	Budget allocation
	(4.84)**28%	competitive environment
	(4.74)**26%	Organizational cooperation
28%	(−2.73)** − 18%	Efficacy
	(−1.80)7.* − 0%	Creating value through the network
	(2.48)*16%	Personal relationships among employees
	(2.24)*14%	Team collaboration
	(3.61)**21%	Skills in the service sector
46%	(−6.33)** − 37%	Monitoring and control
34%	(2.17)*12%	Monitoring and control
	(5.08)**29%	Monitoring and control
53%	(2.36)*15%	General satisfaction with the performance of organizations
	(2.65)**17%	General satisfaction with the performance of organizations
	(2.33)*15%	Employment
	(4.32)**24%	Optimal performance of the organization

The fit indices obtained for the tested model in table 6 show that the RMSEA index in the estimated model has an acceptable level of 0.064 and other fit indices such as CFI, GFI, NFI, and AGFI respectively equal to 0.97, 0.94, 0.95 and 0.92, all of them are at a suitable level and these characteristics of the goodness of fit show that the data of this research has a good fit with the factor structure of this model.

Table 6: The fitting characteristics of the fitted model

Criterion	Estimate	characteristic
$\chi^2/df < 5$	2.03	Chi-square ratio to degrees of freedom (χ^2/df)
RMSEA¡0.8	64%	root mean square error estimate (RMSEA)
GFI¡0.9	94%	goodness of fit index (GFI)
AGFI¡0.9	92%	Adjusted Goodness of Fit Index (AGFI)
CFI¡0.9	97%	Comparative Fit Index (CFI)
NFI¡0.9	95%	Softened Fit Index (NFI)

Friedman's test was used to prioritize the components of the model. In this test, after the necessary calculations, a score was assigned to each of the influencing components. The higher the score obtained from the test, it can be

said that the studied component has a higher priority.

According to the results obtained for prioritizing the components of the model, prioritizing the employment component with 11.12 ranks first, the organizational performance component with 11.63 ranks second, and the intra-organizational capabilities component with 10.17 ranks third. and customer orientation component with 6.15 and resource management component with 6.26 are in the last ranks. Also, the chi-square test is 595.794 with 14 degrees of freedom and a significance level of 0.001.

5 Conclusion

The purpose of this research is to investigate the development model of technological entrepreneurship in the banking system based on the open innovation approach. Data analysis in this research was done based on open, central and selective coding method. In the open coding phase, the interviews are implemented and the summaries of the documents are re-read. In this way, the interpretative analysis method of Strauss and Corbin's constant comparison approach was used to analyze the data. In the first step of data analysis, which is open coding, the data was read line by line and open codes were extracted. In the central coding section, the codes obtained in the free coding section were examined and studied, and related and similar codes were grouped together in larger categories. The research findings for the paradigm model were categorized as the following factors:

Key category: organizational entrepreneurship; In the present research, organizational entrepreneurship marketing has been proposed as a focal phenomenon or a central category.

Causal conditions: intelligent information gathering, resource efficiency, budget allocation, competitive environment, organizational cooperation, self-efficacy, value creation through the network, personal relationships among employees; Among the existing categories, intelligent information gathering, resource efficiency, budget allocation, competitive environment, organizational cooperation, self-efficacy, value creation through the network, personal relationships between employees, are considered as reasons that have an active role in presenting the model and If these factors are not provided, the proposed model will not be formed.

Strategies: teamwork, service skills, supervision and control; The meaning of strategies in the foundation approach are purposeful actions that provide solutions for the desired phenomenon and lead to the creation of consequences and results. The most important strategies adopted in this research are: teamwork, skill in the service sector, supervision and control.

Background: environmental conditions with stability and vulnerability; that the background conditions in the current research include stable and risky environmental conditions.

Intervening conditions: close relationship with the client and general satisfaction with the performance of organizations; In the current research, close communication with the client and general satisfaction with the performance of organizations have been considered as the intervening conditions of the paradigm model.

Consequences: employment and optimal performance of the organization; The results of the current research are: employment and optimal performance of the organization.

Friedman's test was used to prioritize the components of the model. In this test, after the necessary calculations, a score was assigned to each of the influencing components. Prioritization of employment component with 11.12 ranks first, organizational performance component with 11.63 ranks second, internal capabilities component with 10.17 ranks third, and customer orientation component with 6.15 and resource management component with 26. 6 are in the last ranks. Also, the chi-square test is 595.794 with 14 degrees of freedom and a significance level of 0.001.

The results of analytical analysis show confirmation; In order to determine the validity of the variables of causal, strategic, contextual, central, intervening and impacting conditions of the model, confirmatory factor analysis method was used. The output of Lisrel software shows that all factor loadings are higher than 0.3. In causal conditions, the calculated χ^2/df is 2.07, the presence of χ^2/df smaller than 5 indicates the appropriate fit of the model, and the root mean square error estimate (RMSEA) should be less than 0.08, which in the presented model The value is equal to 0.066. The amount of GFI, AGFI, CFI and NFI indicators should be more than 0.9, which is higher than the determined amount in the model under study. Therefore, the data of this research fits well with the factor structure of this scale, and this indicates the alignment of the questions with the variables of the causal conditions. The findings related to the strategies show that the value of χ^2/df calculated is 1.80, the presence of χ^2/df smaller than 5 indicates the proper fit of the model, and the root mean square error estimate (RMSEA) should be less than 0.08. Let it be that in the presented model this value is equal to 0.057. The amount of GFI, AGFI, CFI and NFI indicators should be more than 0.9, which is higher than the determined amount in the model under study. Therefore, the data of this research

fits well with the factor structure of this scale and this indicates the alignment of the questions with the variables of the strategies. The findings related to the background factors show that the calculated χ^2/df value is 1.54, the presence of χ^2/df smaller than 5 indicates the appropriate fit of the model, and the root mean square error estimate (RMSEA) should be less than 08. be 0.047, which is equal to 0.047 in the presented model. The amount of GFI, AGFI, CFI and NFI indicators should be more than 0.9, which is higher than the determined amount in the model under study. Therefore, the data of this research fits well with the factor structure of this scale, and this indicates the alignment of the questions with the background variables of the phenomenon. The findings related to the fit indices of the intervening factors indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these good fit characteristics show that the data of this research has a good fit with the factor structure of this scale. And this shows the alignment of the questions with the structure of intervening factors. The findings related to the fit indices of the result indicate that the CFI, GFI, NFI, RMR and RMSEA indices have an acceptable level and these good fit characteristics show that the data of this research has a good fit with the factor structure of this scale and this indicates It is the alignment of the questions with the structures of the consequences.

The findings show that according to the output of the Lisrel software, the research model for t-coefficients above ± 1.96 to ± 2.58 are significant at the 0.05 level, and t-coefficients above ± 2.58 are significant at the 0.01 level. are. The fit indices obtained for the tested model, the RMSEA index in the estimated model has an acceptable level of 0.064, and other fit indices such as CFI, GFI, NFI, and AGFI are equal to 0.97, 0.94, respectively. 0.95 and 0.92 are all at a suitable level and these characteristics of the goodness of fit show that the data of this research has a good fit with the factor structure of this model.

Despite the effort made to increase the dispersion of people participating in the research, it is not possible to speak with confidence about the representativeness of the sample and it is necessary to consider this issue in the generalization of the research findings. Paying attention to the dimensions and indicators of transformational and technological management and leadership is highly necessary in organizations and needs more attention. Weak teamwork culture and strong resistance to changes are among the most important failures in the field of technological entrepreneurship culture in the studied organizations, and since these two indicators are the main characteristics of technological entrepreneurial organizational culture, they should be considered. get more attention Also, recognizing and strengthening the motives and characteristics of technological entrepreneurship, the growth and development of their human capital based on the banking system. Supporting networking and providing the necessary facilities and background for the entrepreneur to have expert advisors, consulting institutions and specialized, commercial and professional associations.

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