Journal of
Value Creating in Business Management
https://www.jvcbm.ir

Volume 5, Issue 2, Summer 2025, Pages 95 to 118

Original Article (Mixed)

eISSN: 2980-8359

Modeling the commercialization drivers of artificial intelligence-based knowledge in high-tech startups

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Receive:
27 May 2024
Revise:
31 August 2024
Accept:
07 November 2024

Keywords:
Commercialization of knowledge,
Artificial intelligence,
entrepreneurial Awareness,
Networking,
High-tech startups

Abstract

The present study was conducted with the aim of modeling the drivers of artificial intelligence-based knowledge commercialization in high-tech startups. In terms of the purpose, this study is an applicable-developmental research, and based on the method of data collection, it is considered a cross-sectional survey. In order to achieve the goal of the research, an exploratory mixed research design was used. The community of participants of the qualitative part includes theoretical experts (university professors) and experimental experts (managers of hi-tech startups). Purposive method was used for sampling, and theoretical saturation was achieved after 17 interviews. The statistical population of the quantitative section includes experts in the technical department of high-tech startups. The sample size was estimated to be 132 people using Cochran's formula, and sampling was done by cluster-random method. Qualitative theme analysis was used to identify the categories of the model. Partial least squares method was used to validate the model. Data analysis in qualitative phase was done with Maxqda20 software, and in quantitative phase with Smart PLS software. According to the theme analysis method based on Etrid-Sterling's (2001) six-step method, 201 codes were identified in the open coding stage, and 11 main themes and 71 secondary themes were obtained through axial coding. The results showed that there are environmental factors, networking, technical factors, managerial factors, customer factors, digital factors, strategic factors, technological opportunities, entrepreneurial knowledge, entrepreneurial awareness, and entrepreneurial characteristics that affect the commercialization of knowledge based on artificial intelligence in high-tech startups. Technical, environmental and networking factors play the most important role in the commercialization of knowledge based on artificial intelligence.

Please cite this article as (APA): Jalalniya, R. and Hamedi, O. (2025). Modeling the commercialization drivers of artificial intelligence-based knowledge in high-tech startups. *Journal of value creating in Business Management*, *5*(2), 95-118.

https://doi.org/10.22034/jvcbm.2024.459850.1387

Publisher: Research Center of Resource Management Studies and Knowledge-Based Business

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Value Creating in Business Management
https://www.jvcbm.ir
Volume 5, Issue 2, Summer 2025, Pages 95 to 118

Extended Abstract

Introduction

In recent years, a new approach of economic development has been placed on the agenda of societies, which is in line with the growth, expansion and application of knowledge, which is referred to as knowledge-based economy. In this new economic approach, knowledge is the main source of wealth creation and is considered a source of competitive advantage (Bahari & Taheri rouzbahani, 2023). On the other hand, knowledge has economic value when it leads to improvement in the production of products and providing services, otherwise it will have no value. This statement points to the importance of a new concept called "commercialization of knowledge" (Alizadeh et al, 2022). Among various businesses, startups are the most interested in commercializing knowledge. Startup companies do not have a strong economic base, but their scientific and technological base is strong. Therefore, if these companies can commercialize knowledge and research in a market-oriented way, they can attract the desired capital (Polidoro & Jacobs, 2024). The subject of innovation and commercialization in knowledge-based startups is more necessary than ever. In fact, technology is the main way to enter the business field, the main element of which is commercialization and added value resulting from it (Feiz et al, 2023).

Theoretical framework

Commercialization of knowledge

The commercialization of knowledge started with discussions of industry and university cooperation in 1862 and refers to the activities of academic staff members and university researchers to take advantage of market opportunities by using knowledge and research (Yaghubi et al, 2021). Commercialization of knowledge means converting new findings and research ideas into processes, technologies, services and products that can be presented to the market. This concept includes all the efforts made in order to sell research achievements with the aim of gaining profit and connecting education and research with economic and social goals as much as possible (Maurseth & Svensson, 2021). Various theories have been proposed about the commercialization of knowledge, some of the most important theories are:

Linear theory of knowledge commercialization: This theory inspired the first researches about knowledge commercialization. In this theory, the process of knowledge commercialization is drawn as a pattern that starts from idea generation and technology development in academic centers and continues until patenting and providing certificates to knowledge-based businesses and startup companies (Pohle, 2023).

Inverse linear theory of knowledge commercialization: Along with the growth of researches and field activities, inverse linear theory was formed. Based on this theory, the problems and issues in the industry are considered as the starting point of the knowledge commercialization process. When the issues and problems of the industries occur, knowledge enhancement and knowledge development in academic centers or business research and development are done to answer these problems. In this way, the resulting knowledge is used to solve industry problems (Leitner et al, 2021).

Knowledge Commercialization Interaction Theory: In this theory, knowledge commercialization is described as including the interaction between various actors in a network of intertwined relationships. This theory rejects the linear approach and emphasizes the role of networks, interactions, collaborations and mutual learning between academia and industry. Interactive models of technology transfer actually imply the joint development of technology between the academic sector and businesses. This theory describes a process that includes a network of factors involved in the production, dissemination and application of knowledge (Heighton & Gaubert, 2021).

Hi-tech startups

A startup (new company) is a business that has recently been created as a result of entrepreneurship, has rapid growth and is formed to provide an innovative and sustainable solution to meet a need in the market (Vazifeh Doost et al, 2024). To put it better, startups are a business model whose development is an inseparable part of them, and unlike pure entrepreneurship, they try to get rid of individuality and by attracting capital, they employ many employees and demand expansion and scalability (Hsu & Tambe, 2023).

□Artificial intelligence

Artificial intelligence was proposed since 1950 with the study of Alan Turing, a British mathematician. Turing raised the question "Can machines think?". After this initial question, artificial intelligence was formally proposed and defined as a new field of research at the Dartmouth Academic Conference in 1956. Then, in 1965, John McCarthy introduced the concept of artificial intelligence in its current common sense. Then came the first blossom of artificial intelligence, when the field was rapidly applied in various contexts (Grzybowski et al, 2024).

Commercialization drivers: Commercialization drivers is a process during which ideas and results or products obtained from research departments in universities, research centers and industrial departments are transformed into products, services and processes that can be offered in the market and through which the findings of research are brought to the market. And new ideas are expanded into new products and services or technologies that can be distributed around the world.

Research methodology

The current study is an applicable research conducted with the aim of modeling the drivers of commercialization of knowledge based on artificial intelligence in high-tech startups in the spring of 2013. Also, based on the method of data collection, it is a non-experimental (descriptive) study that was conducted with a cross-sectional survey method. In order to achieve the goal of the research, an exploratory mixed research design was used.

The population of participants of the qualitative part includes theoretical experts (university professors) and experimental experts (managers of hi-tech startups) who have enough experience in the field of knowledge commercialization system. Based on the view of Miller et al, (2010), five criteria of key-role playing, popularity, theoretical knowledge, diversity, and participation motivation were used to select the participants. Sampling was done with a purposeful method and theoretical saturation was obtained with 17 interviews. In the quantitative part, the statistical population includes managers and experts in the technology sector of high-tech startups. For this purpose, Science and Technology Park of Tehran University, Shahid Beheshti, Amirkabir, and Technology and Innovation Center of Azad University (SINTEC) were monitored. The power analysis rule (Cohen, 1992) and G*Power software were used to calculate the sample size. Using the rule of power analysis, the minimum sample size of 132 people was estimated at the confidence level of 95% with the effect size of 0.15 and the statistical power of 80%. A cluster-random method was used for sampling in the quantitative part.

Data collection tools are interviews and questionnaires. The interview included 6 questions and the research questionnaire included 11 main topics and 71 secondary topics with a five-point Likert scale. Based on the analysis of the research questionnaire, 11 hypotheses were created and validated. The results of the aforementioned analysis are presented in Tables 2 and 3.

To identify the categories of artificial intelligence-based knowledge commercialization drivers, qualitative content analysis and Maxqda20 software were used, and partial least squares method and Smart PLS software were used to validate the model.

Research findings

The results of the interviews were conducted with thematic analysis method based on the six-step method (Attride-Stirling, 2001): and 201 primary codes were identified in the open coding stage, and 11 main themes and 71 secondary themes were obtained through axial coding. Based on the results, it was determined that environmental factors, networking, technical factors, managerial factors, customer factors, digital factors, strategic factors, and technological opportunities affect the commercialization of knowledge based on artificial intelligence in high-tech startups. It was also found that entrepreneurial knowledge, entrepreneurial awareness, and entrepreneurial characteristics also affect the commercialization of artificial intelligence-based knowledge in high-tech startups. The results showed that technical, environmental and networking factors play the most important role in the commercialization of knowledge based on artificial intelligence.

Conclusion

Considering the importance of the issue of commercialization and on the other hand, despite the obstacles in the commercialization of created products and ideas (such as financial obstacles, government obstacles, etc.), it is necessary to emphasize more on the commercialization process in high-tech startups in our country .Since commercialization is one of the main links of the innovation process and attention is mostly paid to creating innovation and commercialization in commercial complexes of the country and solving the existing problems of commercialization in third world countries and especially Iran, we should improve commercialization in high-tech startups so that we will be able to achieve innovation and technology transfer to other industries and countries in addition to commercialization of ideas created in research and development and universities. Increasing the rate of technology commercialization brings many achievements for society, organizations and innovators, the most important of which are: raising standards and quality of life, generating national/organizational/individual wealth, creating competitive advantage, productivity growth, success in market and innovation in processes and products, and development of industries and products related to technology/inventions. Therefore, the present research is innovative and value-creating in providing practical results in this field.