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

Volume 6, Issue 1, Spring 2026, Pages 17 to 40

Original Article (Mixed)

eISSN: 2980-8359

Value creation through technology transfer from university to industry in Iran; Mixed Method

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Receive:
13 May 2025
Revise:
07 June 2025
Accept:
28 June 2025

Keywords:
Technology transfer, commercialization, open innovation, technology supplier, entrepreneurship.

Abstract

This research aims to address the challenge of universities in commercializing technology and strengthen cooperation between universities and industry, presenting a comprehensive model for technology transfer from universities to industry. The research method is a mixed method, applicable in terms of purpose, and exploratory in nature. The statistical population in the qualitative section was articles in the field of technology transfer and academic commercialization published in the two databases Scopus and Web of Science from 2013 to 2023. The data collection tool was a systematic review of previous studies, selection of articles based on the criteria of the PRISMA method; and the data analysis method was the meta-synthesis method. In the quantitative part, a researcher-made questionnaire and library resources were used to collect data, and its statistical population was Iranian public universities in 2024 and the sampling method was purposive. SPSS and Smart PLS software were used to analyze and evaluate the results. In the qualitative section, first, the environmental factors affecting technology transfer from university to industry were categorized into 5 main categories: "technology supplier characteristics", "technology recipient characteristics", "technology characteristics", "region characteristics", and "laws and regulations". Then, their relationship to each other and to technology transfer methods was evaluated. The results showed that among the identified environmental factors; "laws and regulations" have the greatest impact on the methods of technology transfer from university to industry. Also, "technology characteristic" has a direct effect on "sales-based technology transfer methods", and "technology supplier characteristic" has a direct effect on "consultation-based technology transfer methods". However, the "technology recipient characteristics" and "regional characteristics" do not directly affect the methods of technology transfer.

Please cite this article as (APA): Saberikohan, S, Kasraee, A, R and Sohrabi, T. (2026). Value creation through technology transfer from university to industry in Iran; Mixed Method. *Journal of value creating in Business Management*, *6*(1), 17-40.

https://doi.org/10.22034/jvcbm.2025.523228.1558

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

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Journal of
Value Creating in Business Management
https://www.jvcbm.ir
Volume 6, Issue 1, Spring 2026, Pages 17 to 40

Extended Abstract

Introduction

Today, the mission of universities is no longer limited to education and research, and their mission to contribute to the economic growth and social well-being of the regions in which they are located is obvious (Abramo & D'Angelo, 2022). In this regard, one of the duties of universities is technology transfer. Technology transfer is an iterative, continuous, and strategic process that requires close collaboration between all stakeholders (Bustamante et al., 2021). Despite the many benefits of technology transfer from university to industry, knowledge diffusion processes become more complex over time (Wang & Liu, 2022). Numerous evidences indicate that the complexities of the commercialization process and the existence of various obstacles in its path mean that despite the technical success of a large number of research projects, few of them successfully pass the commercialization stage (Battaglia et al., 2021). Each of the previous studies has looked at this issue from a specific perspective and by considering some factors. But the process of technology transfer from university to industry takes place in the dynamic environment of the "innovation ecosystem," where all interactions between its different elements influence the ultimate success of this process. Therefore, identifying all factors affecting technology transfer (internal and external factors of universities and industry) and examining the simultaneous relationship between these factors can lead to the identification of important factors in this process. In addition, different universities use different methods to transfer technology to industry. Therefore, examining whether universities can use any desired method for technology transfer, regardless of their environmental characteristics, can facilitate interaction between universities and industry in technology transfer policymaking. For this purpose, this research aims to provide a quantitative model to predict and determine the relationships between factors and measure their effects. In this regard, the main research question is: To what extent do environmental factors affect each other and the methods of technology transfer in technology transfer from university to industry?

Theoretical framework

Features of the technology provider (University)

There are several factors in universities that influence the commercialization of academic technology. Contextual factors such as the nature, size, and geographical location (Zhao et al., 2020), the diversity of academic disciplines (Abramo & D'Angelo, 2022), interdisciplinary research (Hsu et al., 2015), the online development of academic services (Petrunia et al., 2019), the university's skills in communicating with the community and identifying entrepreneurial opportunities (Rocha et al., 2022), university human capital (Marozau & Guerrero, 2016), and individual characteristics of researchers such as age, gender, academic rank, and research performance (Abramo & D'Angelo, 2022) can influence academics' opportunities to interact with industry. Also, technology intermediary structures are considered a resource for facilitating the transfer and commercial exploitation of academically produced knowledge (Marozau & Guerrero, 2016).

Technology Receiver Features (Industry)

According to the World Bank report, although universities play an important role in innovation systems, the importance of their role in most industrial economies is significantly influenced by factors such as the structure of the domestic industry, the size of the industry, the number and composition of human and social capital, and the business model of industrial firms (Calcagnini & Favaretto, 2016).

Technology features

The most important component in creating a link between university and industry is the existence of university technology with characteristics and features that meet the needs of industry and society (Amirghodsi et al., 2020). Academic technology will be valuable when it results in the production of a product that is competitively priced, in line with foreign models, environmentally friendliness, ergonomic, and resource-saving (Chukhray & Mrykhina, 2018).

Regional features

Factors such as the existence of social ties (Taheri et al., 2016), mutual benefits of innovation ecosystem stakeholders (Dell'Anno & del Giudice, 2015), interaction between regional universities (Rocha et al., 2022), the existence of a strong innovation network (Perkmann et al., 2013), the diversity of industrial sectors in geographical proximity to universities (Perkmann et al., 2013), and the characteristics and advantages of… (Agasisti et al., 2023) can enhance technology transfer from university to industry.

Rules and regulations

In university-industry relations, many policies and programs of the higher education sector; at national, regional, and university levels, have a direct impact on technology transfer. The government's general policies towards higher education should be formulated according to the specific situation of the region and pay attention to regional factors that are beyond the control of university administrators (Agasisti et al., 2023). Institutional policies including financial incentives such as an inventor's share of the revenue from the commercialization of knowledge, or non-financial incentives such as the impact of patenting on faculty performance evaluation and promotion or awarding prizes for commercialized inventions, can foster university-industry collaboration (Cullen et al., 2020).

Research methodology

The present study is applicable in terms of purpose, exploratory in nature; and a mixed method including meta-synthesis and structural equation modeling was used to conduct the research. In the qualitative part, a systematic review of sources was conducted in two databases, Scopus and Web of Science, between 2013 and 2023. In the quantitative part, library sources (secondary data) and a researcher-made questionnaire were used to collect data. The sampling method was purposive sampling and the questionnaire was completed by research assistants, directors of industry liaison centers, directors of growth centers, or selected faculty members of public universities.

Research findings

In the qualitative part of the research, factors affecting technology transfer from university to industry were categorized into 137 concepts, 30 subcategories, and 5 main categories including "university characteristics," "industry characteristics," "technology characteristics," "regional characteristics," and "laws and regulations" (Saberi et al., 2025). The quantitative results showed that "technology characteristics" are related to "technology transfer methods based on sales"; "technology supplier characteristics" to "technology transfer methods based on consulting"; and "laws and regulations" to "technology transfer methods based on sales, consulting, joint ventures and service provision". The five main categories are also interconnected. "Technology supplier characteristics" are related to "technology characteristics", "regional characteristics" are related to "technology recipient characteristics", and "laws and regulations" affect all other factors.

Conclusion

The present study aimed to present a model of technology transfer from university to industry with an emphasis on environmental components. The findings of this study showed that the

higher the level of a technology (Amirghodsi et al., 2020), the greater the demand from industrial companies or foreign entrepreneurs to acquire it. Technology supplier characteristics such as university reputation (Shen et al., 2022), researcher expertise (Rocha et al., 2022), marketing skills (Kalantaridis & Küttim, 2023), university's history of collaboration with industry (Carayannis et al., 2016), and the university's ability to brand technological products (Burkholder & Hulsink, 2022) are among the characteristics that increase industry's sense of trust in the university. Laws and regulations at three levels: internal university guidelines and regulations (Gu, 2023), regional guidelines (Agasisti et al., 2023), and national laws (Xia et al., 2022) were evaluated as factors influencing the success of technology transfer. Some other characteristics of technology suppliers, such as the diversity of academic fields at the university (Ma et al., 2022), interdisciplinary research (Kalantaridis & Küttim, 2023), specialized laboratories and advanced equipment (Gachanja, 2023), adequate financial resources (Kalantaridis & Küttim, 2023), and management support for researchers (Rosdi et al., 2022) can lead to the acquisition of valuable technologies. Regional characteristics such as population (Petrunia et al., 2019), poverty and crime rates in the region (Gachie & Govender, 2017), gross regional product (Mascarenhas et al., 2019), exports (Wang & Liu, 2022), local market capacity (Amirghodsi et al., 2020), ability to export outside the region (Calcagnini & Favaretto, 2016), and the number of industrial companies present in the region (Fedosova & Babikova, 2017) are also characteristics that can affect the presence of investors and large industrial companies in the region.

In this regard, for the success of technology transfer from university to industry, the consideration of these factores is suggested: the entrepreneurial motivation of researchers during recruitment, the requirement to formulate a sustainability annex for university technologies, strengthening alumni associations, the existence of an appropriate structure for technology intermediary centers in universities and the establishment of branches in faculties, strengthening interdisciplinary research, creating necessary incentives for researchers, allocating financial resources to applicable research in line with the priorities of the universities' strategic document, the existence of an independent center in universities for the social and economic valuation of university research, identifying and coding the research priorities of organizations and industries to guide student theses and research projects, and establishing a liaison organization between universities and industry in the governorates.