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Identifying and prioritizing factors affecting the development of IoT-based businesses

Zahra Ghanbari Gheshlaghi[1], Bizhan Rezaei[2], Yosef Mohammadifar[2]

1- Master's student, Department of Management and Entrepreneurship, Razi University of Kermanshah, Kermanshah, Iran
2- Department of Management and Entrepreneurship, Razi University of Kermanshah, Kermanshah, Iran

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Abstract

The main objective of this research is to identify and prioritize factors affecting the development of Internet of Things (IoT)-based businesses in Iran. This research is applicable in terms of purpose, and descriptive and survey in terms of methodology. It was conducted using content analysis method and in two qualitative and quantitative stages. In the qualitative stage, the required data were collected and analyzed by using semi-structured interviews with 8 experts in the field of information technology in Kermanshah science and technology parks and professors working in related universities. In this stage, 6 main factor categories were identified, including financial-economic, technological, cultural-social, political-legal, human, and managerial factors, as well as 22 sub-criteria. In the quantitative stage, the factors were prioritized using the Analytic Hierarchy Process (AHP) technique and Expert Choice software. The research findings showed that among the factors affecting the development of IoT-based businesses, the financial-economic factor has the highest priority, and the managerial factor has the lowest.

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Corresponding Author: Bizhan Rezaei | **Email:** b.rezaee@razi.ac.ir

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Extended Abstract

Introduction

The evolution of the Internet began with the connection of computers. Later, many computers were connected to each other, creating the World Wide Web. Then, mobile devices were able to connect to the Internet, which led to the mobile Internet technique. People began to use the Internet through social networks. Finally, the idea of connecting everyday objects to the Internet was proposed, which led to IoT technology (Internet of Things). When the concept of such a connection emerged, various companies focused on it and tried to recognize its importance and began to identify its role and future aspects related to it. Then these companies began to invest in this area in different periods but at certain intervals (Korade et al., 2019). From an economic perspective, the Internet of Things can transform business models and provide new solutions for creating added value. Using data generated by IoT devices, digital businesses can better understand customer needs and optimize their products and services (Manyika et al., 2015). Due to the increased productivity resulting from IoT, many advanced countries such as the United States and Japan have developed special strategies for the development of this technology (Lee et al., 2019). According to research, the market size of IoT equipment in 2018 was nearly $2 billion, which is expected to reach more than $11 billion by 2026 (Wang et al., 2021). In Iran, several studies have examined the capabilities of the Internet of Things in various fields and emphasized its importance in economic development and improving productivity (Razavi et al., 2019). Given the increasing importance of the Internet of Things in the future of the digital economy, it is necessary to identify and analyze the key factors affecting the development of businesses related to this technology in a scientific and systematic manner in order to provide a basis for effective planning and policymaking. Despite the efforts made, a review of the research background shows that previous studies have had a limited focus on identifying the factors affecting the development of these types of businesses or have not conducted a comprehensive and structured study of them. The present study seeks to fill this gap and was designed and presented with the aim of providing a scientific framework for it; therefore, this study seeks to answer the question from a perspective different from previous studies: what are the factors affecting the development of IoT-based businesses and what is their priority?

Theoretical Framework

The Internet of Things is a conceptual paradigm that connects billions of Internet-enabled devices to exchange data between themselves and their environment and enable intelligent interactions. This paradigm is a digital-physical infrastructure that establishes a connection between the physical environment and digital systems (Whitmore, 2015).

Ajalli et al., (2023) examined how the Internet of Things affects human resource management in the Fourth Industrial Revolution. This study states that the Internet of Things, as a paradigm in which objects equipped with sensors, actuators, and processors communicate with each other, enables the creation of digital workflows and the simplification of human resource management processes. These findings are important for the development of IoT-based businesses, because using this technology to simplify processes and increase efficiency can help improve organizational performance, including in the field of human resource management.

Rezaei et al., (2022) examined the role of artificial intelligence in optimizing IoT data and its impact on Iranian businesses. The results of this study showed that integrating IoT and artificial intelligence can create a significant competitive advantage for businesses. This study used the Big Data analysis method to examine the effects.

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Khan et al., (2024) in a study titled IoT Adoption in the Fourth Industrial Revolution showed that success in implementing IoT requires combining it with complementary technologies such as AI, big data, and cloud computing; and factors such as digital infrastructure, human resource skills, and cybersecurity are influential.
Prasetyo et al., (2023) studied the key success factors in implementing the Internet of Things in Indonesian automotive companies, and the results showed that factors such as strategic alignment with organizational goals, top management support, technology readiness, employee training, supply chain digitization, and the use of smart products play a decisive role in the success of implementing the Internet of Things.

Research Method

This research is applicable in terms of purpose, and descriptive and survey in terms of methodology. It was conducted using the content analysis method. The statistical population of this study included experts and specialists in the field of information and communication technology who were working in companies present in science and technology parks and university growth centers. The statistical sample in the qualitative section included 8 experts and specialists selected from the Kermanshah Science and Technology Park, Kermanshah Innovation Factory, and professors at Razi University of Kermanshah. The sampling method was snowball sampling. The statistical sample in the quantitative part consisted of 15 people, 6 of whom were the same participants in the interview and 9 others were selected from among the experts and specialists and added to them.

Research findings

After a careful and meticulous review of the interviews and content analysis, the main codes and concepts were extracted. The extracted codes were analyzed in the first coding stage and evaluated several times to extract categories from it. After identifying; 6 main factor categories and 22 sub-criteria was obtained, and in the next stage, the Analytic Hierarchy Process (AHP) method was used for quantitative analysis. 15 questionnaires were distributed among the experts, and pairwise comparisons were made with the Expert Choice software.

Conclusion

The results of this study are consistent with the findings of many previous studies. Specifically, the role of economic investment, the importance of technological infrastructure, and the effect of education and awareness on the adoption of the Internet of Things has also been confirmed in the studies of Hossain et al. (2015), Zhang et al. (2021), Li et al. (2020), and Khan et al. (2019). Also, the impact of sanctions and legal problems on the development of this technology in Iran is consistent with the results of Wang et al. (2020). Studies such as Camarinha-Matos et al. (2009) and Sadeghi et al. (2020) also consider the role of organizational cooperation in the success of IoT-based businesses to be similar to the findings of this study.
According to the results of this study, one of the solutions used in the world in the field of IoT businesses and their development is the use of venture capitalists. Despite economic and political problems at the international level prevent the introduction of new technologies and the country's synchronization with them, a country like Iran, which has a large workforce of experts in various fields of information technology; however, needs to find new ways to improve its economy and its position in the international arena; therefore, the importance of the Internet of Things for a country like Iran is obvious and can play a role in all fields. On the other hand, West Asia and North Africa are currently the second largest Internet of Things

market, which the UAE, Saudi Arabia and Turkey have taken over. While Iran can be a developer and play a decisive role in the heart of this region and earn significant profits and thereby bypass sanctions.

Iran also has the largest number of metropolises in the Middle East, in which cities such as Tehran, Mashhad, Isfahan, etc. are always struggling with optimal urban management. Becoming smart cities, using smart cars and home appliances connected to the Internet of Things can play a significant role in improving and preventing the problems caused by them.

One of the most important reasons given for the incorrect and late functioning of Internet-connected objects is the slowness in sending them in these fields. By developing smart networks based on the Internet of Things, such problems can be overcome.

Businesses and stakeholders should pay special attention to investing in information and communication technology infrastructure to be able to benefit from the benefits of the Internet of Things. Businesses themselves should pay attention to continuous research and development in the field of the Internet of Things to be able to keep up with rapid technological changes. Designing and implementing training programs for employees and users can help improve their awareness and capabilities in using the Internet of Things.

Creating and strengthening cooperation networks between businesses and different organizations can help exchange information and resources. Businesses should also pay special attention to collecting and analyzing customer feedback to be able to better identify their needs and improve their services.