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# Innovation and Digital Transformation in Iran

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**ABSTRACT**

This article examines the current status and progress of innovation and Digital Transformation (DT) in Iran. It provides analytical insights into the factors that contribute to DT in Iran, as well as its trends and prospects. The growing digitalization of societies and economies underscores the significance of DT and its ability to increase the comparative advantage of companies. However, the phenomenon of globalization in recent decades has intensified the pressure on companies to adapt. Efficient integration is crucial for businesses to not just survive, but also thrive in competitive environments. This can only be achieved via digital processes and collaborative tools. The importance of Digital Transformation (DT) cannot be overstated. A substantial body of literature underscores the need to include DT in existing business perspectives since it addresses much more than just technological shifts and has an impact on numerous aspects of businesses and economies. This paper presents policy recommendations aimed at facilitating a successful transition to digital transformation. Policymakers can leverage the growing demand for digital inclusion by fostering a stable business environment for digital enterprises, thereby promoting private sector involvement. Causal connections between policy actions and outcomes will be essential for effective implementation. Technical terms will be introduced and defined for clarity. The language will be objective, formal, and balanced to avoid undue bias or affectation. Consistent adherence to style and formatting conventions will be maintained throughout. Concurrently, it seems that governmental bodies and policymakers must concentrate their efforts on enhancing the state of digitalization in Iran through legislation and the provision of steady advancements in institutional factors, e-government, and e-participation. A comparable approach ought to be taken towards the innovation ecosystem. This study provides a firm basis to suggest that policymakers prompt investors and private sectors to engage in the digital economy. Ultimately, promoting an environment of international entrepreneurship requires facilitating both the legal and policy economy factors.

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## 1. INTRODUCTION

This study aims to increase the understanding of two key concepts within the innovation ecosystem namely Digital Transformation (DT), and Digital Evolution (DE) within Iran`s economy, providing some insight for key market players, investors and policymakers. In doing so, it is necessary to analyze key elements of both the DT and DE and their dynamics by answering the following research questions.

1. What are DT and its key factors in innovation ecosystems?
2. Which factors influence the dynamics of DE?
3. Which policies and strategies are pivotal in the transmission mechanism?

Although there is increasing literature on the concept of digital transformation (DT), its definition remains a topic of debate. In general, DT represents a managerial approach that embraces the adoption of digital technologies and innovations by companies and society. The purpose of this adoption is to significantly modify internal and external activities and processes, leading to the redesign and transformation of products, business processes, sales channels, and value chains i.e., business models [1]. Although organizational transformation typically involves changes in strategy, structure, and power distribution, DT refers specifically to the impact of information technology and innovations on the flow of information, routines, organizational structure, and the ability to adapt to technology. In other words, digital transformation (DT) refers to using digital innovations in business to enhance organizational performance and gain competitive advantages for companies, enterprises, and the entire economy [2]. Given the prominent role of technological innovations in digital transformation (DT), a thorough exploration of this topic pertains to the use of novel digital technologies, such as social media, mobile computing, data analysis, and smart tools. This application can lead to significant enhancements in business operations, encompassing customer experience, operational processes, and the refinement of business models [3], [4]. It's crucial to clarify that "transformation," as opposed to "change," refers to the thorough actions an organization must take when confronted with new technologies. Therefore, DT should be considered a strategy within the organization's scope that transcends industry thinking. It addresses the opportunities and risks presented by digital technologies, providing a comprehensive view. Thus, a DT strategy leads the organization on its path to digital transformation.

However, Digital Transformation (DT) is not limited to acquiring and deploying digital technologies, but also encompasses a management approach that addresses concerns such as human resources, business development, and business process redesign [5]. This introduces the second key concept, Digital Evolution (DE), which serves as the bedrock for establishing a sustainable path for DT and maintaining dynamism in the innovation ecosystem. Effective strategies, continuous improvements, and increased investments by key economic agents are crucial to ensure Iran's digital transformation (DT) and digital economy (DE).

This discussion raises an important question: Why are DT and DE so crucial for Iran? The article analyzes annual data on Iran's frontier technology readiness index and examines its DT (Digital Transformation) and DE (Digital Economy) state and momentum. The objective is to provide key insights for businesses and policymakers to aid in their investment decision-making process regarding technology and innovative projects. The next section provides an overview of the conceptual framework of DT and its contributing elements. Section 3 briefly reviews the policies implemented for DT, followed by an overview of the current state of Digital Evolution (DE) in Iran and its role in DT progress. Finally, Section 5 presents policy recommendations and concludes the study.

## 2. LITERATURE REVIEW

Innovation and digital transformation have become crucial aspects for organizations and industries in today's rapidly changing and competitive business environment. This literature review aims to integrate and synthesize research findings on innovation and digital transformation, highlight knowledge gaps, and suggest potential future research directions.

García-Morales, Garrido-Moreno, & Martín-Rojas (2021) explored the transformation of higher education after the COVID disruption, focusing on emerging challenges in an online learning scenario. While the study did not explicitly mention innovation and digital transformation, it shed light on the significant impact of disruptive events

such as the COVID-19 pandemic on the adoption of online learning technologies and the need for continuous innovation in the education sector [6]. Feng, Zhang, & Li (2022) examined the relationship between environmental decentralization, digital finance, and green technology innovation. Although the study did not directly address innovation and digital transformation, it provided insights into the role of digital finance in fostering green technology innovation. This suggests the potential for future research to explore the intersection of digital transformation and environmental sustainability in driving innovation [7].

Hahn (2020) focused on Industry 4.0 from a supply chain innovation perspective. The study highlighted the importance of digital technologies and advanced manufacturing processes in driving innovation within supply chains. While the specific link to digital transformation was not explicitly discussed, the findings underscore the significance of technological advancements in fostering innovation within industry 4.0 [8].

Appio, Frattini, Petruzzelli, & Neirotti (2021) conducted a comprehensive synthesis of existing research on digital transformation and innovation management, outlining an agenda for future studies in this area. The study emphasized the need for further exploration of the relationship between digital transformation and innovation, indicating a knowledge gap in understanding the mechanisms through which digital initiatives contribute to innovation outcomes [9]. In conclusion, the literature review has provided insights into the relationship between innovation and digital transformation across diverse contexts, including higher education, environmental sustainability, industry 4.0, and innovation management. However, there is a need for future research to delve deeper into the specific mechanisms and processes through which digital transformation drives innovation outcomes in various domains. This could involve examining the role of digital technologies, organizational capabilities, and strategic initiatives in fostering innovation and competitive advantage in the digital era. Additionally, exploring the implications of digital transformation for innovation ecosystems and value creation could be a valuable avenue for future research in this field.

## 3. CONCEPTUAL FRAMEWORK OF DT AND ITS ELEMENTS

In the current era of the Digital Economy, Digital Transformation has become a crucial strategy for businesses, enterprises, organizations, and the economy as a whole to enhance their competitive advantage. A key requirement of Digital Transformation is the rapid development of essential digital technologies and innovations, which primarily involve: The incorporation of Big Data, Cloud Computing, Internet of Things (IoT), Artificial Intelligence (AI), and Blockchain has the potential to accelerate the transition to a digital economy. This shift could result in significant changes for both the economy and society at large. Studies indicate that the current success rate of digital transformation (DT) in enterprises is approximately 20%. The success of DT depends greatly on three key factors: 1) Economics of Scale, 2) Financial Resources, and 3) Infrastructure and Organizational Capabilities, as outlined in source [10]. Small and medium-sized enterprises (SMEs) encounter major challenges in deploying digital innovation due to their limited resources and scale. This highlights the ongoing need for extensive research, policy implementation, and trial-and-error adjustments before achieving the full potential of DT.

As a result, successfully implementing digital transformation (DT) becomes even more arduous. As previously stated, DT encompasses a strategy, a process, and a business model [2]. Typically, digital transformation (DT) entails utilizing novel digital technologies to drive significant business improvements. However, experts have since recognized that successful DT for organizations requires more than just implementing technology. It necessitates reshaping a company's vision, strategy, organizational structure, processes, capabilities, and culture to adapt to the ever-changing digital business landscape. The primary objective of DT is to generate value, including operational efficiency, improving customer experience, enhancing business models, and more.

Thus, one can view digital transformation (DT) as a strategic intervention that boosts an organization's digital capability to enhance its business processes, products, services, and operations management [1].

DT can be classified into three clusters: digital business transformation, technology as a driver for DT, and institutional and social impact. To succeed, three critical factors must be considered namely 1) Environmental, 2) Technological, and 3) Organizational Factors as Figure (1) presents.

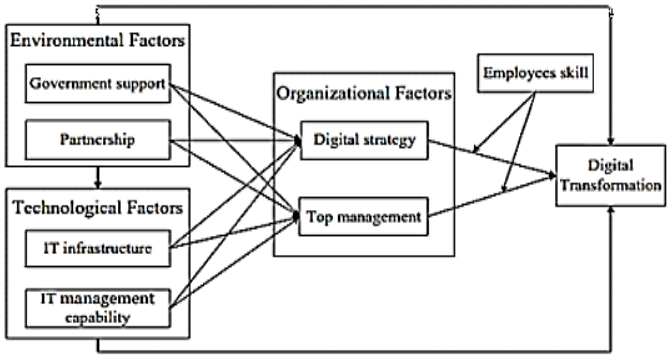



**Fig. 1.** Key Factors for a Successful DT [10]

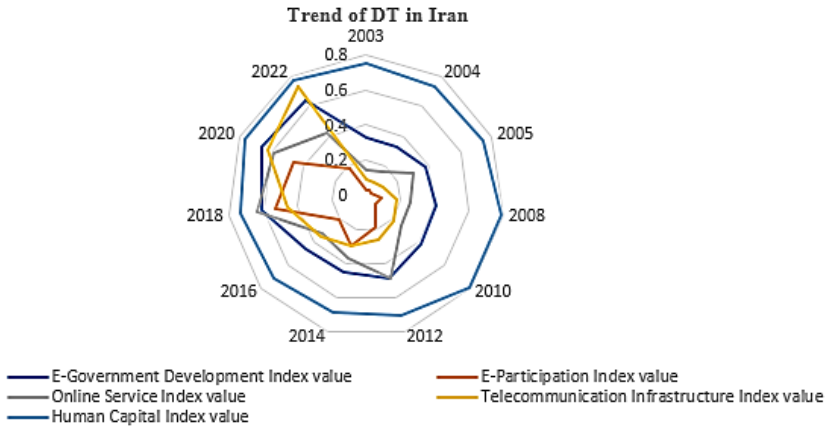
These factors can be measured in five main components contributing to the DT including 1) E-Government Development, 2) E-participation, 3) Online Service, 4) Telecommunication Infrastructure, and 5) Human Capital. Note that Local Online Service Index (LOSI) comprises 86 indicators relating to five criteria as follows.

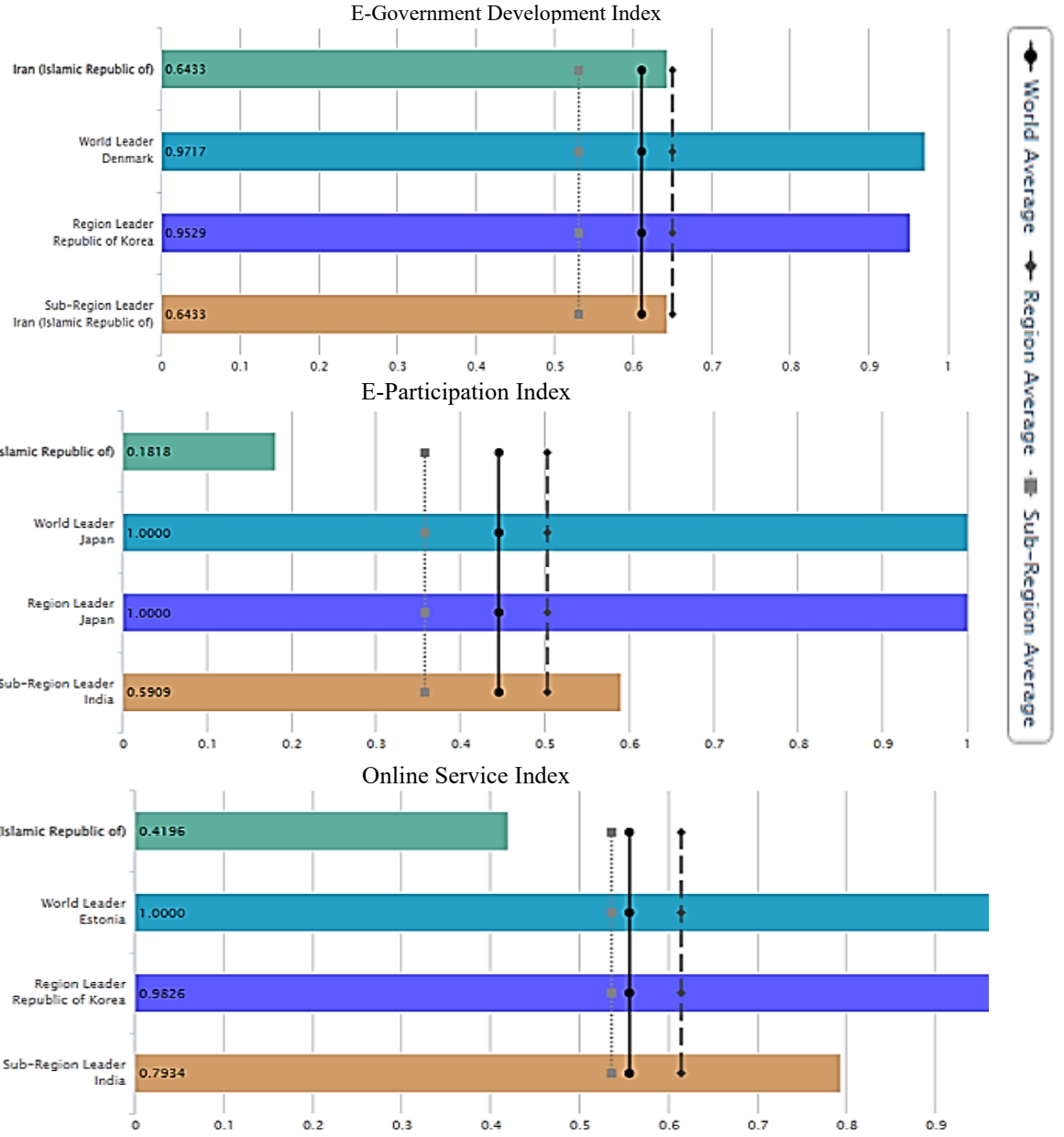
1. The study analyses various aspects of the municipal e-government framework, including its organizational structure, legislation concerning access to information and privacy, and open data policy.
2. Content Provision (25) evaluates the availability of crucial public information and resources on the internet.
3. Services Provision (18); focuses on the availability and delivery of targeted government services.
4. Participation and Engagement (17) evaluates the accessibility of measures and schemes for communication and opportunities for civic involvement in regional governance frameworks.
5. Technology (18) examines the technical aspects of the portals, outlining how both the website and its content are presented to users. Key indicators include accessibility, functionality, reliability, ease of navigation, visual appeal, and compliance with technology standards.

Based on these five elements of DT, this section provides a brief summary of Iran's present state of DT contrasted with the economies of both the region and the world. The purpose is to uphold objectivity by using simple, direct language and adhering to academic conventions. Technical terminology is clearly defined, traditional sections are featured, and titles are informative and precise. Bias is eliminated, and the language utilized is formal, with accurate word selection and grammatical accuracy. Logical progression is achieved through the establishment of causal connections between statements.

## 4. PIVOTAL STRATEGIES AND POLICIES FOR DT

To implement digital transformation policies, both the government and private sector must utilize digital innovation capabilities through large-scale financial investment, improving laws and institutions, enhancing economic vitality, and facilitating growth in emerging industries. Figure 2 illustrates the trend of the primary pillars of digital transformation in Iran, comparing it with other regions and top-performing global economies. Note that scores range from zero to one, with one being the highest possible score. In terms of the E-Government Index, Iran's score is close to the regional average of approximately 0.65. Meanwhile, EU countries claimed the top spot with a score of 0.82, Denmark ranked first globally with a score of 0.98, and South Korea led the region with a score of 0.94 in 2022. Shifting to the E-Participation measure, Iran exhibited poor performance with a score of 0.16, while Japan emerged as the region and world leader with a perfect score of 1.


Trend of DT in Iran
2003
2004
2005
2008
2010
2012
2014
2016
2018
2020
2022
0.8
0.6
0.4
0.2
0
E-Government Development Index value
Online Service Index value
Human Capital Index value
E-Participation Index value
Telecommunication Infrastructure Index value


E-Government Development Index
Iran (Islamic Republic of)
0.6433
World Leader
Denmark
0.9717
Region Leader
Republic of Korea
0.9529
Sub-Region Leader
Iran (Islamic Republic of)
0.6433
E-Participation Index
Iran (Islamic Republic of)
0.1818
World Leader
Japan
1.0000
Region Leader
Japan
1.0000
Sub-Region Leader
India
0.5909
Online Service Index
Iran (Islamic Republic of)
0.4196
World Leader
Estonia
1.0000
Region Leader
Republic of Korea
0.9826
Sub-Region Leader
India
0.7934
World Average
Region Average
Sub-Region Average

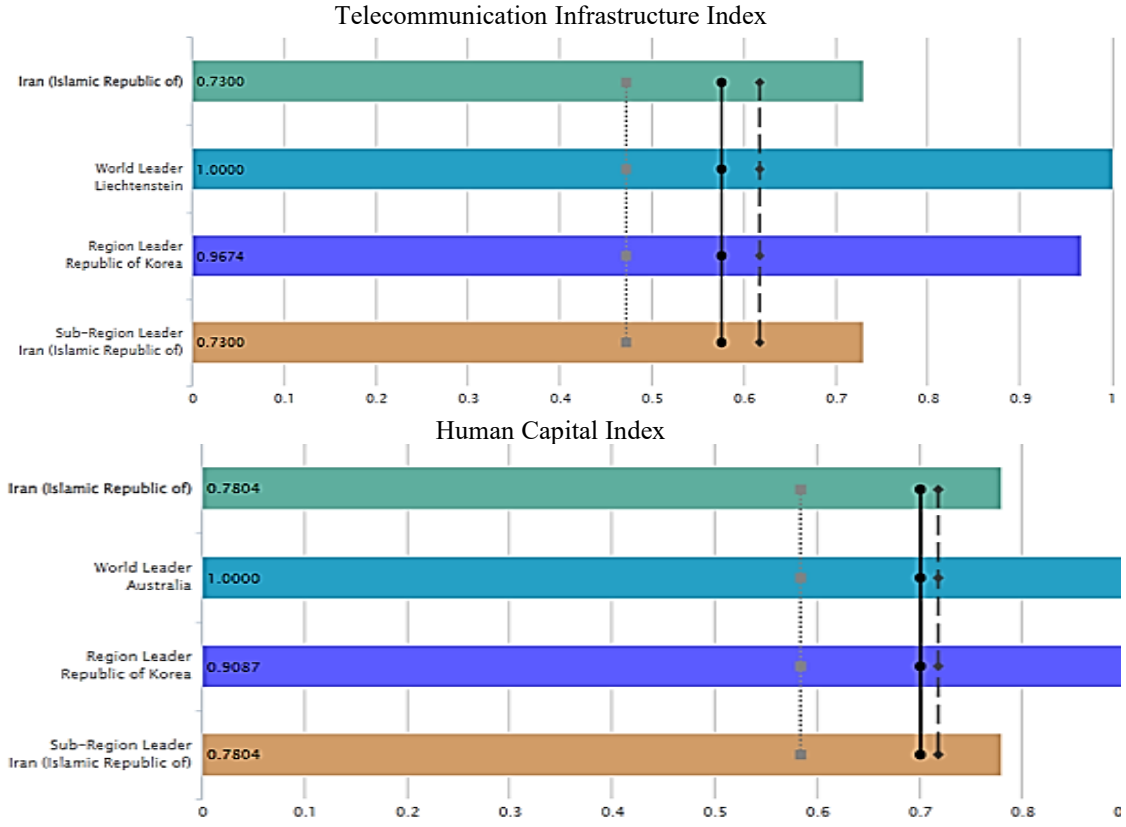
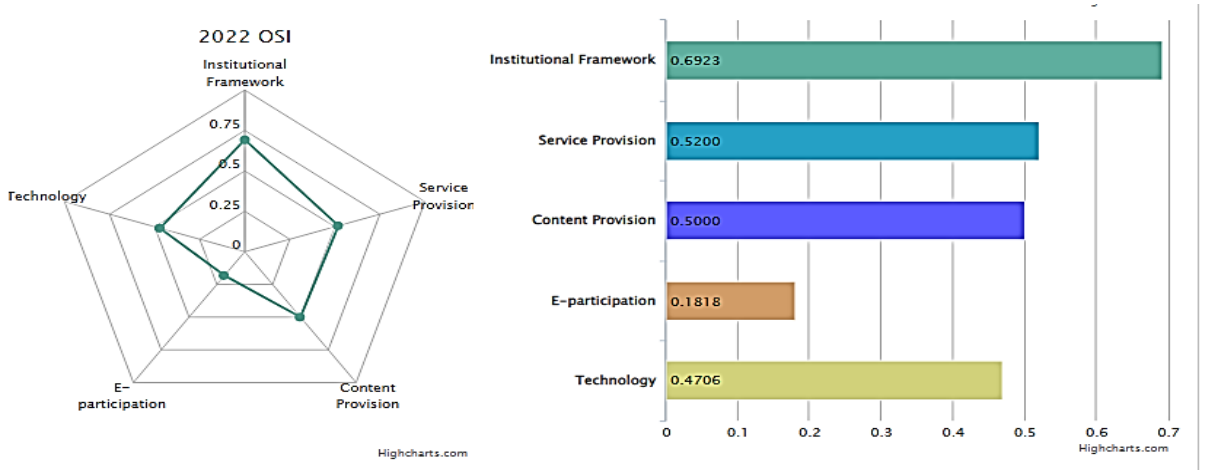



**Fig. 2.** Trend of Main pillars of DT in Iran

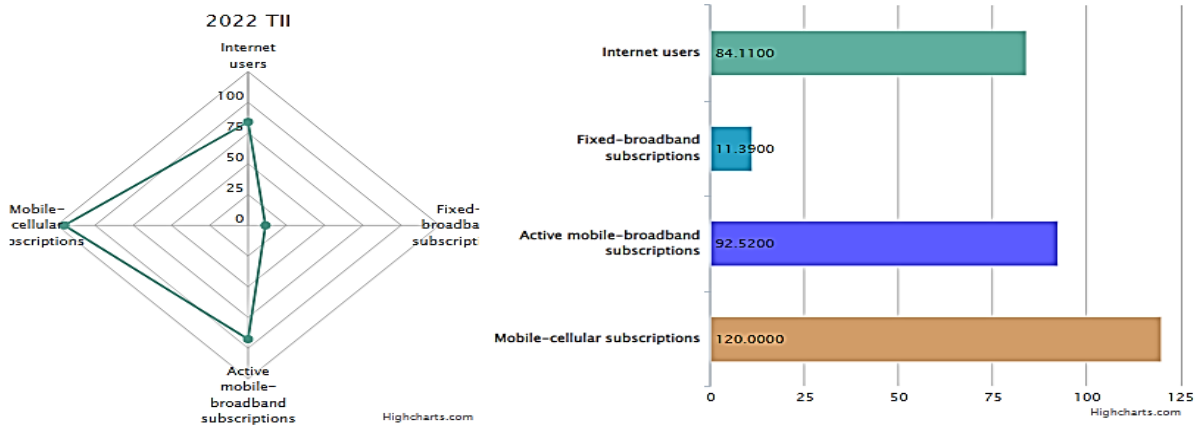
The third measurement index in DT is the Objective Subjunctive Index (OSI), composed of 5 criteria as illustrated in Figure (3). As per the data, Iran's economy displays a moderate improvement trend over the period 2003-2022. In Figure (2), Iran's regional and global rank in OSI is shown, with Estonia and South Korea being the respective leaders.




| Online Service Index | 2022 | 2020 | 2018 | 2016 | 2014 | 2012 | 2010 | 2008 | 2005 | 2004 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Iran (Islamic Republic of) (Value) | 0.41960 | 0.58820 | 0.63190 | 0.33333 | 0.37007 | 0.49019 | 0.26666 | 0.25752 | 0.29615 | 0.16216 | 0.14847 |

**Fig. 3.** Trend of Main pillars of OSI in Iran
Source: https://un.org/

Regarding the Telecommunication Infrastructure Index, Iran scored 0.72, demonstrating a better performance. However, Lichtenstein and South Korea are identified as the world and regional leaders, respectively.




| Telecommunication Infrastructure Index | 2022 | 2020 | 2018 | 2016 | 2014 | 2012 | 2010 | 2008 | 2005 | 2004 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Iran (Islamic Republic of) (Value) | 0.73000 | 0.62100 | 0.45660 | 0.35136 | 0.29401 | 0.26380 | 0.21571 | 0.17466 | 0.10786 | 0.09243 | 0.09040 |

**Fig. 4.** Trend of Main pillars of TII in Iran
Source: Author Calculations, https://un.org/

Finally, Iran achieved the highest performance on the Human Capital Index, scoring 0.78. South Korea once again secured its position as the regional leader, while Australia maintained its position as the world leader.

## 5. DIGITAL EVOLUTION IN IRAN

This section aims to analyze the current status and growth of the Digital Economy (DE) in Iran. Before exploring the key components and drivers of the DE, it is crucial to examine Iran's digital economy profile. Iran has one of the largest economies in the Middle East and North Africa (MENA) region and ranks third in terms of population with approximately 88 million inhabitants. Its per capita production also falls within the ranks of 6-7 in the MENA region. Iran has experienced stagflation recently, with one of the region's lowest growth rates. In 2017, Iran's GDP consisted of 2.5% ICT and 4.1% from the digital economy. In comparison, the figures for the global economy were 4.5% and 15.5%, respectively. IDC predicts the share of the digital economy in the global economy to rise by over 65% by 2022 due to significant investments in DT. The objective is to achieve a 15.5% share within Iran by 2023. To reach this goal, fresh business models in the IT sector must be developed, and new ventures established. Additionally, the transition from a traditional to a digital economy must be seamless [11]. Digital economy trends in Iran, which have exhibited variations over time, are depicted in Figure (5).

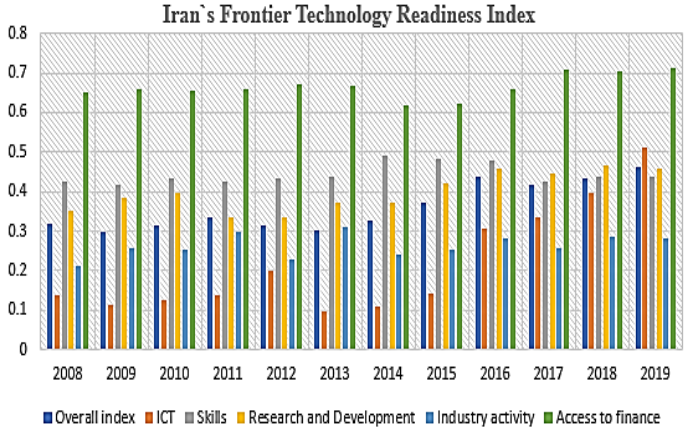
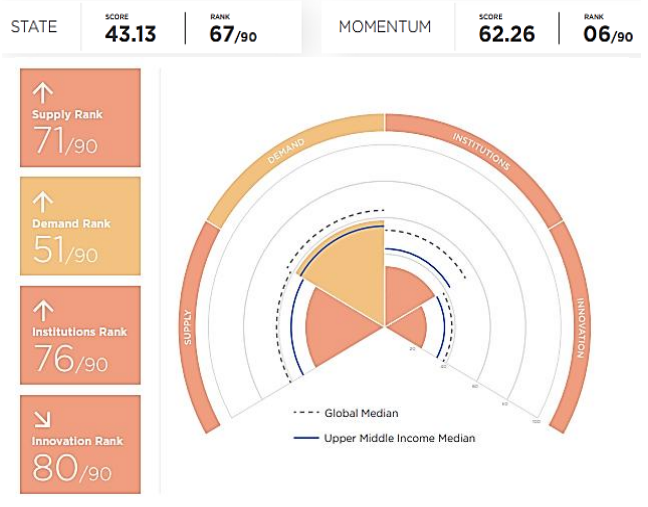



**Fig. 5.** The Trend of Digital Economy in Iran
Source: Author Calculations, https://unctad.org/




| | SCORE | RATING | TREND |
|---|---|---|---|
| **SUPPLY** | **45.00** | | |
| **Access Infrastructure** | **47.90** | | |
| Communications Infrastructure | 19.27 | | |
| Electricity | 90.11 | | |
| Internet Speed | 29.72 | | |
| Mobile Access Affordability | 51.54 | | |
| Mobile Access Availability | 90.30 | | |
| **Fulfillment Infrastructure** | **68.61** | | |
| Postal Delivery | 99.03 | | |
| Traditional Transport | 28.16 | | |
| **Transaction Infrastructure** | **15.61** | | |
| Access to Financial Institutions | 32.83 | | |
| Electronic Payments | 2.34 | | |

| | SCORE | RATING | TREND |
|---|---|---|---|
| **DEMAND** | **58.53** | | |
| **State of the Human Condition** | **19.37** | | |
| Ability to Adopt | 55.27 | | |
| Ability to Demand | 22.00 | | |
| Consumer Spending | 14.80 | | |
| **Digital Inclusion** | **71.73** | | |
| Class Digital Divide | 89.30 | | |
| Gender Digital Divide | 64.78 | | |
| Rural Digital Divide | 56.31 | | |
| **Device and Broadband Uptake** | **55.98** | | |
| Device Affluence | 72.25 | | |
| Fixed Broadband Uptake | 56.50 | | |
| Mobile Broadband Uptake | 40.82 | | |
| **Digital Payment Uptake** | **38.98** | | |
| Financial Inclusion | 47.53 | | |
| Use of Digital Money | 39.30 | | |
| Use of Mobile Digital Money | 20.20 | | |

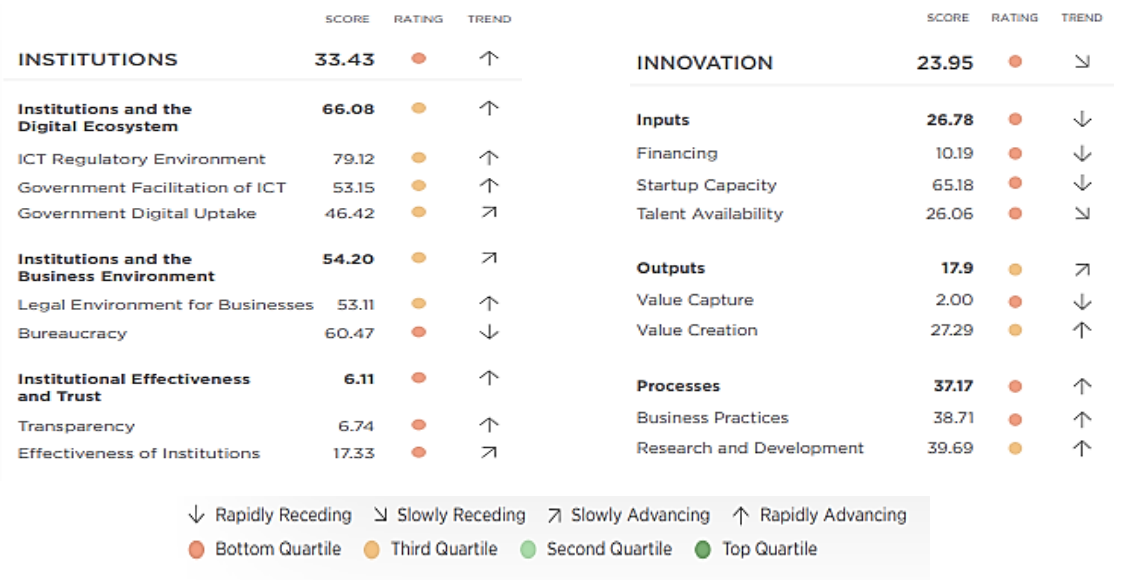



**Fig. 6.** State and Momentum of DE in Iran
**Source:** Author Calculations [11-13]

To understand the fluctuations, Figure (6) presents the state and momentum of DE by its main driving forces including 1) supply, 2) demand, 3) institutions, and 4) innovations, among the 90 economies in the world. In terms of DE state Iran is ranked 67 out of 90, while is ranked 6 out of 90 in terms of DE momentum, which suggests a high potential for investment and private sectors to participate in the innovation ecosystem and digital market in Iran.

## 6. CONCLUSION AND POLICY RECOMMENDATION

This paper tried to investigate two research questions as follows.

1. Which features contribute to a successful DT and DE in Iran?
2. How private sector can be involved in the transmission mechanism?

Based on the data-driven discussion, three main findings stand out. Firstly, an enhancement in the state of E-Government Development, E-Participation, and Online Services could play a pivotal role in advancing DT in Iran at a faster pace. Secondly, there are two strong pillars for Iran's DT, including Human Capital and Telecommunication Infrastructure. Third, the participation of investors and private sector entities in the online services industry, as well as the supply of innovative digital payment systems and technologies, can significantly increase the pace of digital transformation and digital economy development in Iran.

To facilitate a successful transition to digital transformation (DT), policymakers can capitalize on the high demand for digital inclusion by providing a stable improvement in the business environment for digital operations to encourage private sector participation. This offers potential policy insights for policymakers. It seems that institutions demand significant attention from the government and policymakers to enhance digitalization in Iran by establishing regulations and facilitating expedient progress in institutional facets, electronic government, and electronic participation. The innovation ecosystem requires the same. This study provides a basis for policymakers to incentivize investors and private sectors to engage in the digital economy, cultivating a global entrepreneurial ecosystem by streamlining legal and policy economic components.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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