Innovation and Digital Transformation in Iran: Trends and Perspectives

Marzieh Asaadi, *Assistant Professor of Economics, Department of Management and Economics, Faculty of Humanities and Social Science, Golestan University, Gorgan, Iran (*m.asaadi@gu.ac.ir*)*

1. Introduction

This article analyzes the state and momentum of innovation and Digital Transformation (DT) in Iran. 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 growing literature on the concept of DT, the definition of this concept is controversial. Broadly speaking, DT is a management approach that refers to the growing acceptance of digital technologies and innovations by companies and societies in a way that fundamentally transforms internal and external activities and processes in such a way that products, business processes, sales channels or value chains, in other words, business models are redesigned and transformed [1]. Although organizational transformation, in general, includes changes in strategy, structure, and distribution of power, DT is specifically the impact of information technology and innovations on information flow, routines, and organizational structure and capabilities to adapt to technology. In other words, DT can be defined as the application of digital innovations in business that significantly improves organizational performance and gain comparative advantages for firms, enterprises, and the whole economy [2]. Given the dominant role of technological innovations in DT, a comprehensive discussion of digital transformation is more related to the use of new digital technologies such as social media, mobile computing, data analysis, and smart tools to significantly improve business in the areas of customer experience, operational processes, and business model creation [3], [4]. It is important to note that the term "transformation" as opposed to "change" refers to the comprehensive actions that the organization must take when faced with new technologies; therefore, DT is a strategy in the scope of the organization that goes beyond the thinking of the sector; in fact, it deals with the opportunities and risks caused by digital technologies with a comprehensive view and as such, DT strategy guides the organization in its journey towards digital transformation. However, DT is not just the acquisition and deployment of digital technology, but rather an approach to management issues such as human resources, business development, and business process redesign [5]. These bring about the second key concept to maintain innovation ecosystem dynamism which is Digital Evolution (DE) which can be considered the foundation of developing a stable DT path. With this regard, implementing effective strategies, continuous improvements, as well as increased investments by key economic agents to ensure the countries' DT and DE are crucial.

This discussion raises an important question: why hinging on DT and DE are so crucial for Iran? To investigate this question, the paper analyzes annual data on Iran`s frontier technology readiness index together with DT and DE state and momentum to provide key insight for businesses and policymakers to assist them in the investment decision-making process in technologies and innovative projects. The article is structured as follows. The next section has a quick look at the conceptual framework of DT and its contributor elements. Section 3 provides a brief review of implemented policies for DT, followed by a brief look at the state of Digital Evolution (DE) in Iran and its contribution to DT status and progress. Section 5 concludes the study and provides some policy recommendations.

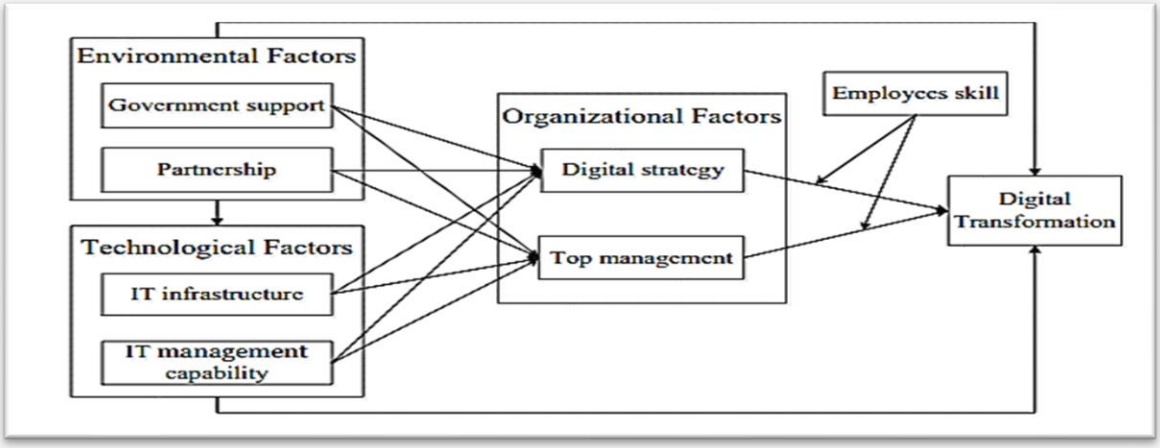
2. Conceptual Framework of DT and its Elements

In the era of the Digital Economy, Digital Transformation has become a new approach for businesses, enterprises, organizations, and the whole economy to either gain or enhance their competitive advantages. DT necessitates a rapid development of required digital technologies and innovations which mainly includes: 1) Big Data, 2) Cloud Computing, 3) Internet of Things (IoT), 4) Artificial Intelligence (AI), and 5) Blockchain; to accelerate the transformation to the digital economy, and massive changes to the economy and society. Studies estimate that the current success rate for DT in enterprises is around 20%, while the success rate highly depends on three explanatory factors consisting of 1) Economics of Scale, 2) Financial Resources, and 3) Infrastructure and Organizations Capabilities [6]. Given the small scale, limited resources, and insufficient capabilities, small and medium-sized enterprises (SMEs) face higher barriers to digital innovation, and it is more difficult to successfully implement DT. Thus, it seems that there is a long way ahead to conceptualize and achieve the highest potential in DT which requires a lot of research, policy practice, and tries-error corrections.

As discussed earlier, DT can be discussed as a strategy, a process, and a business model [2]. Typically, DT emphasizes the use of new digital technologies to enable major business improvements. With the development of theory and practice, scholars have come to realize that the DT of enterprises requires not only the use of technology, but also the reshaping of the company's vision, strategy, organizational structure, process, capabilities, and culture to adapt to the ever-changing digital business environment. Mainly the purpose of DT is to create value, which includes but is not limited to operational efficiency, customer experience improvement, business model enhancement, strategic differentiation, competitive advantage, stakeholder relationship improvement, and cost savings. Thus, one can consider DT as a strategic intervention that enhances the digital capability of an organization to improve its business processes, products, services, and operations management [1].

DT can be categorized 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.

Figure 1. Key Factors for a Successful DT



Source: [6]

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. Institutional Framework (8); focuses on municipal e-government, organizational structure, legislation governing access to information and privacy, and open data policy.

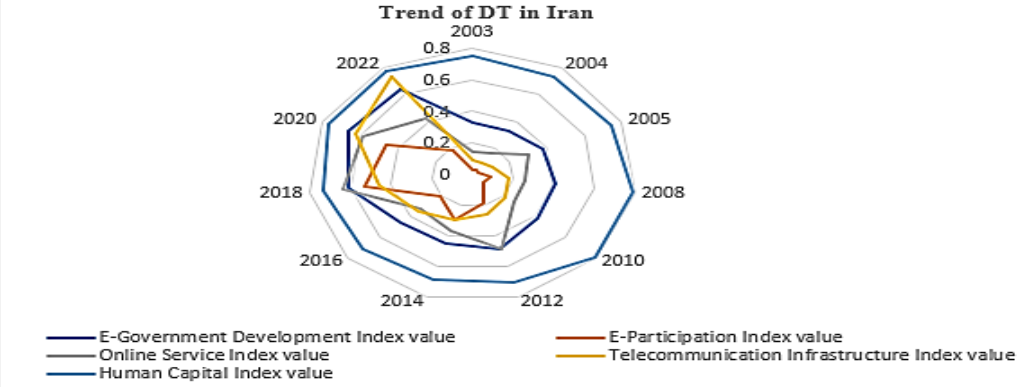
2. Content Provision (25); identifies the extent to which essential public information and resources are available online.
3. Services Provision (18); focuses on the availability and delivery of targeted government services.
4. Participation and Engagement (17); assesses the availability of mechanisms and initiatives for interaction and opportunities for public participation in local governance structures.
5. Technology (18); focuses on technical features of the portals to specify how the site and content are made available for users, relevant indicators relate to factors such as accessibility, functionality, reliability, ease of navigation, visual appeal, and alignment with technology standards.

Based on these five elements of DT, the next section provides a brief discussion of the DT state in Iran and compares it within the region and world economies.

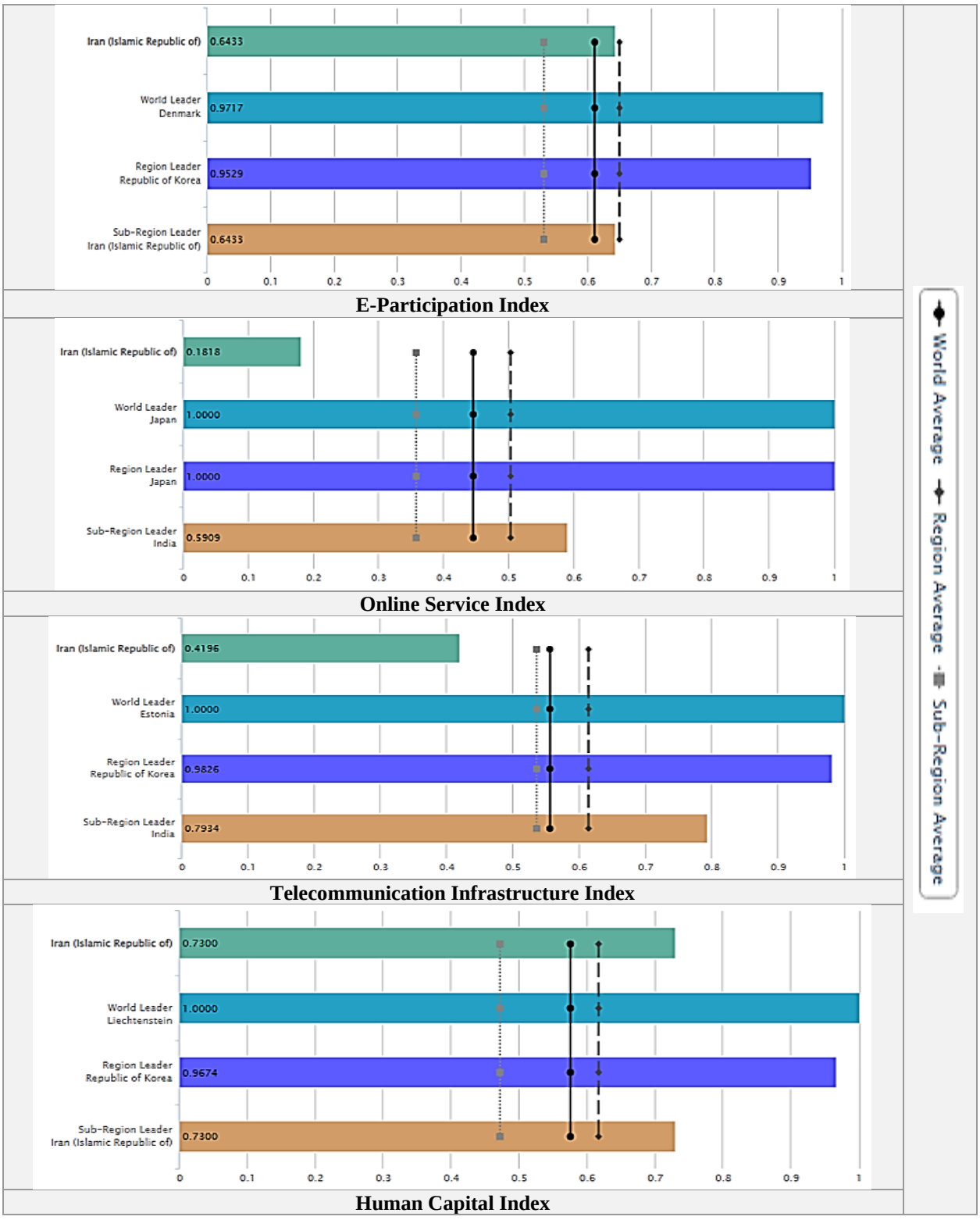
3. Pivotal Strategies and Policies for DT

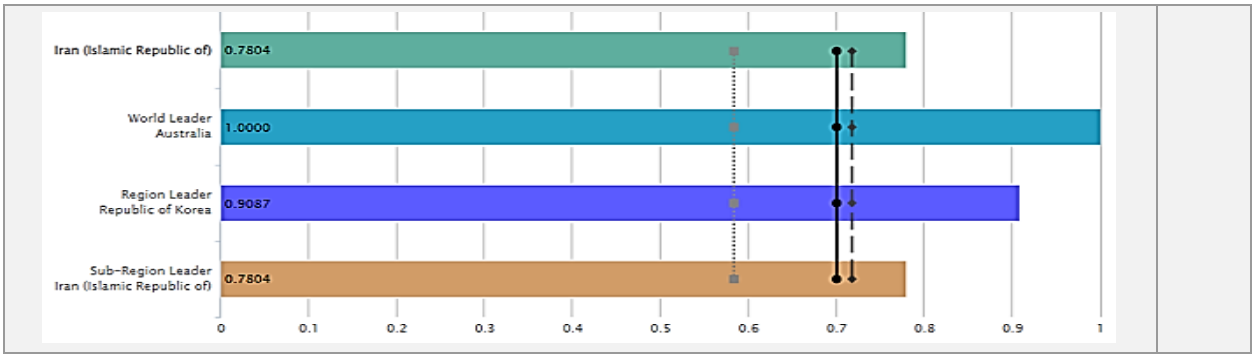
To implement DT policies, any strategy and action plan requires that both the Government and Private Sector leverage digital innovation capabilities via 1) large-scale financial investment, 2) improving laws and institutions, 3) improving economic vitality, and 4) facilitating the growth of the emerging industries [5]. Figure (2) demonstrates the trend of the main pillars of DT in Iran and compares it within the region and the best performance in the world economies. Note that scores are between zero and 1, while the best performance scored 1. Starting with the E-Government index, it can be observed that Iran ranked near to the region's average score of around 0.65, while EU countries ranked first with 0.82, Denmark was the world leader with 0.98 scores, and South Korea was the region leader with 0.94 scores in 2022. Turning to the E-Participation indicator, Iran shows a weak performance (0.16) while Japan was both the world and region leader scoring 1.

Figure 2. Trend of Main pillars of DT in Iran



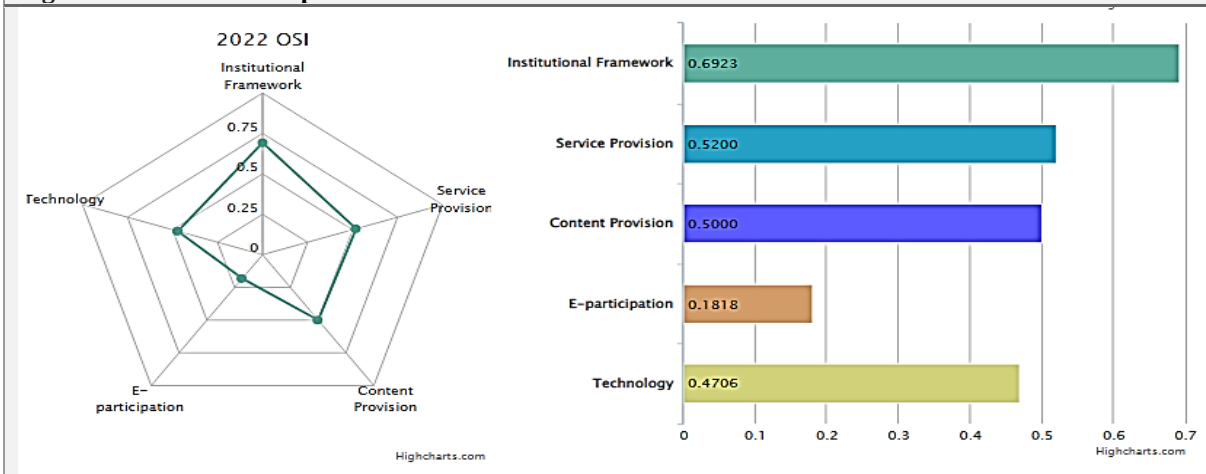
E-Government Development Index


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
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
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
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
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
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Telecommunication Infrastructure Index
Iran (Islamic Republic of) 0.7300
World Leader Liechtenstein 1.0000
Region Leader Republic of Korea 0.9674
Sub-Region Leader Iran (Islamic Republic of) 0.7300
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Human Capital Index
World Average
Region Average
Sub-Region Average



The third measurement index in DT is OSI which consists of 5 criteria as detailed in Figure (3) and its trend for Iran`s economy suggests a moderate improvement during 2003-2022. Figure (2) compares Iran`s rank in OSI within the region and world, while Estonia and South Korea are the world and regional leaders, respectively.

Figure 3. Trend of Main pillars of OSI in Iran

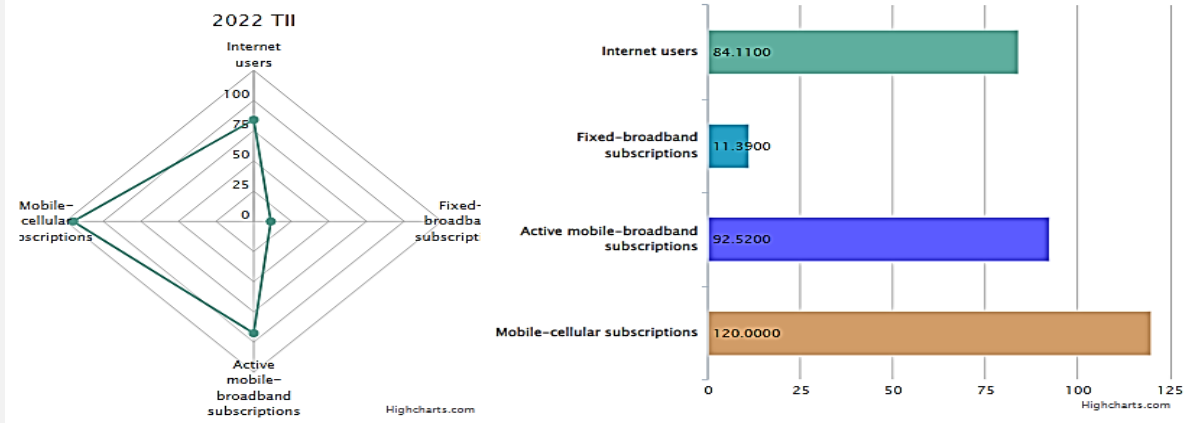


Online Service Index	2022	2020	2018	2016	2014	2012	2010	2008	2005	2004	2003
Iran (Islamic Republic of) (Value)	0.41960	0.58820	0.63190	0.33333	0.37007	0.49019	0.26666	0.25752	0.29615	0.16216	0.14847

Source: https://un.org/

Regarding the Telecommunication Infrastructure Index, Iran scored 0.72 which shows a better performance, while Lichtenstein and South Korea are marked as the world and region leaders, respectively.

Figure 4. Trend of Main pillars of TII in Iran



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

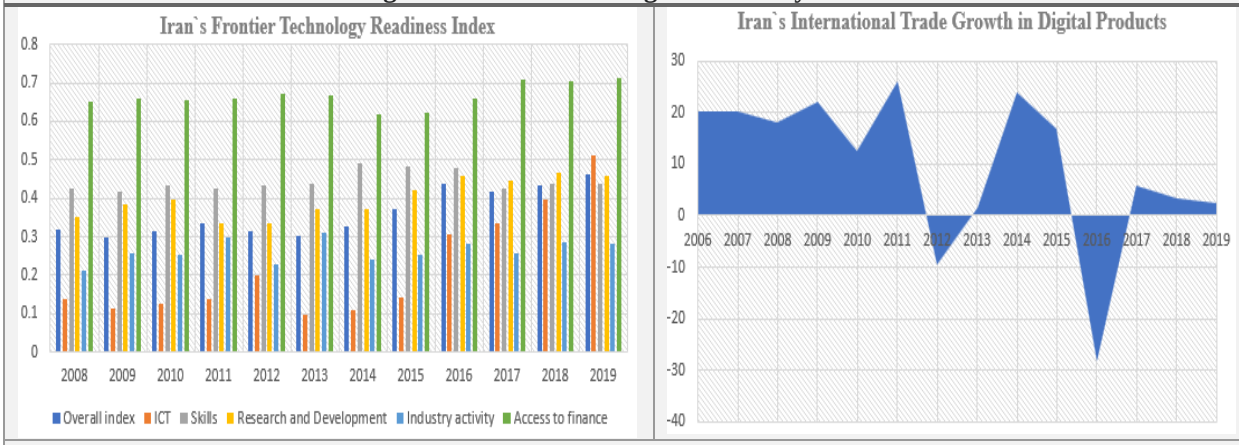
Source: Author Calculations, https://un.org/

Finally, the best performance of Iran belongs to Human Capital Index, scored 0.78, and again South Korea marked as the regional leader and Australia as the world leader.

4. Digital Evolution in Iran

This section will consider analyzing DE state and momentum in Iran. Before proceeding to the core elements and drivers of DE, it is essential to have a quick look at Iran`s digital economy profile. Iran is one of the largest economies in the Middle East and North Africa region with a population of about 88 million people in third place in the region and per capita production, ranking 6-7 in the region. Iran has experienced stagflation in recent years, and the country's growth rate has been among the lowest in the region. In 2017, the share of ICT in Iran's GDP was 2.5% and the share of the digital economy was 4.1%, while these numbers are respectively for the global economy were 4.5% and 15.5%. According to IDC, by 2022, with the huge investment in DT, the share of the digital economy in the global economy will increase by more than 65%. The initial target is to achieve a 15.5% share in 2023, in Iran. Achieving these goals requires the development of new business models in the IT sector and form new businesses and facilitating the transition from a traditional to a digital economy [7]. Figure (5) demonstrates digital economy trends in Iran which fluctuated over time.

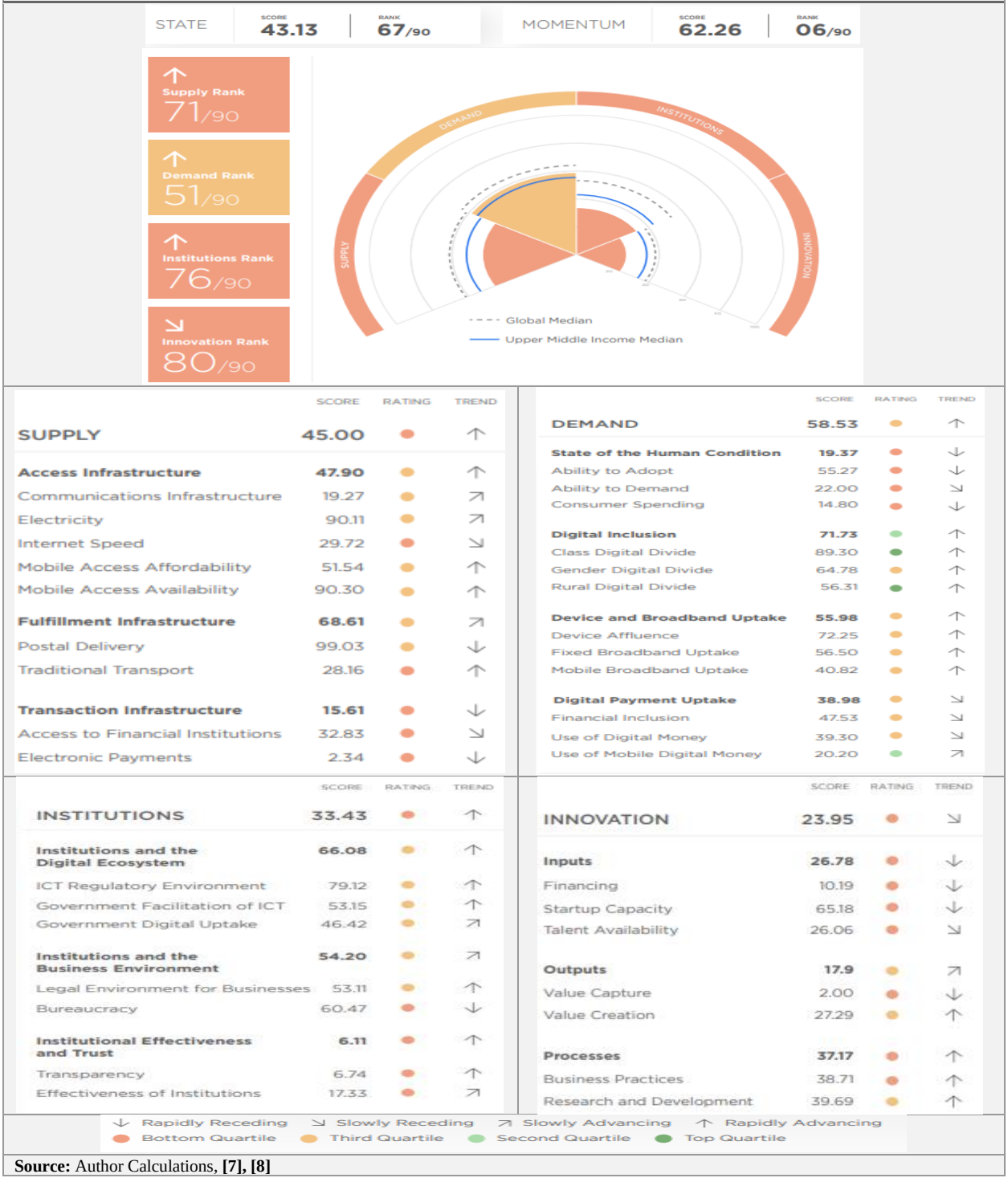
Figure 5. The trend of Digital Economy in Iran



Source: Author Calculations, https://unctad.org/

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.

Figure 6. State and Momentum of DE in Iran



SUPPLY	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		

DEMAND	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		

INSTITUTIONS	SCORE	RATING	TREND
INSTITUTIONS	**33.43**		
Institutions and the Digital Ecosystem	**66.08**		
ICT Regulatory Environment	79.12		
Government Facilitation of ICT	53.15		
Government Digital Uptake	46.42		
Institutions and the Business Environment	**54.20**		
Legal Environment for Businesses	53.11		
Bureaucracy	60.47		
Institutional Effectiveness and Trust	**6.11**		
Transparency	6.74		
Effectiveness of Institutions	17.33		

INNOVATION	SCORE	RATING	TREND
INNOVATION	**23.95**		
Inputs	**26.78**		
Financing	10.19		
Startup Capacity	65.18		
Talent Availability	26.06		
Outputs	**17.9**		
Value Capture	2.00		
Value Creation	27.29		
Processes	**37.17**		
Business Practices	38.71		
Research and Development	39.69		

Source: Author Calculations, **[7], [8]**

5. 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?
According to the data-driven discussion, three main finding stands out. First, an improvement in the state of E-Government Development, E-Participation, and Online Service, plays a key role and significantly can advance a faster DT in Iran. Second, there are two strengths pillars for Iran DT includes Human Capital and Telecommunication Infrastructure. Third, participating investors and the private sector in the Online service sector, supply of innovation, and supply of digital payment systems and technologies significantly can increase the speed of DT and DE in Iran.
To point out some potential key policy insights, it seems that to facilitate a successful transition to DT policymakers can take advantage of the high demand for digital inclusion by providing a stable improvement in the doing-digital business environment to increase private sector participation. Simultaneously, it appears that institutions require a great deal of focus by the government and policymakers to improve the state of digitalization in Iran by legislating and providing stable improvements in institutional factors, e-government, and e-participation. The same applies to the innovation ecosystem as well. This study would provide a solid ground to recommend policymakers to encourage investors and private sectors to participate in the digital economy and promote an international entrepreneurship environment by facilitating both the legal and policy economy factors.

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