

Components of Industry Resilience to Maintain Sustainable Economic Growth under COVID-19 Within the Knowledge-Based Economy Framework: A Comparative Study Between Iran and South Korea

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I. Introduction

COVID-19 was first reported in Wuhan, China, in December 2019 and spread rapidly across the globe. Then on March 11, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic, causing more than 600 million confirmed cases and 6.49 million deaths around the world so far¹. Figure 1 presents the Case fatality Rate (CFR)² of COVID-19 for countries that are hit the most, including Iran and South Korea.

The effects of the pandemic on societies can be examined mainly by two criteria: 1) the number of lives lost due to the disease (Mortality Rate), and 2) the number of jobs lost due to social distancing rules (fall in GDP). Both have a wide consequence for economic growth and other key macroeconomic indicators. Figure

2 compares the impact of COVID-19 between Iran and South Korea based on the first criteria.

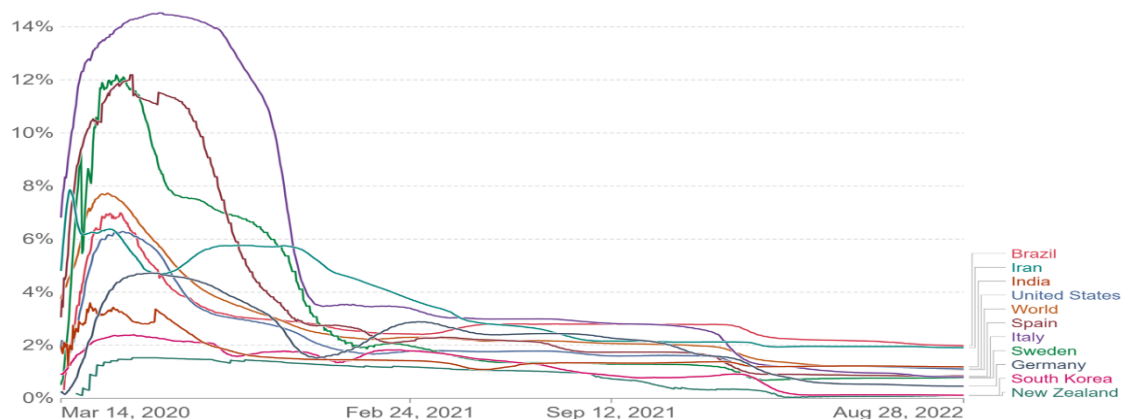
An important explanatory factor for the significant difference between CFR for Iran and Korea can be related to the Worldwide Governance Indicators (WGI) components (Daliri and Asaadi 2021). The WGI is a composite index consisting of six measurement factors, including voice and accountability, political stability, government effectiveness, regulatory quality, the rule of law, and control of corruption. Figure 3 compares the WGI's score for Iran and South Korea. The graph clearly shows that the performance of South Korea is better than Iran, which is reflected in higher scores in all these six components.

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¹ <https://covid19.who.int> (accessed on August 30, 2022)

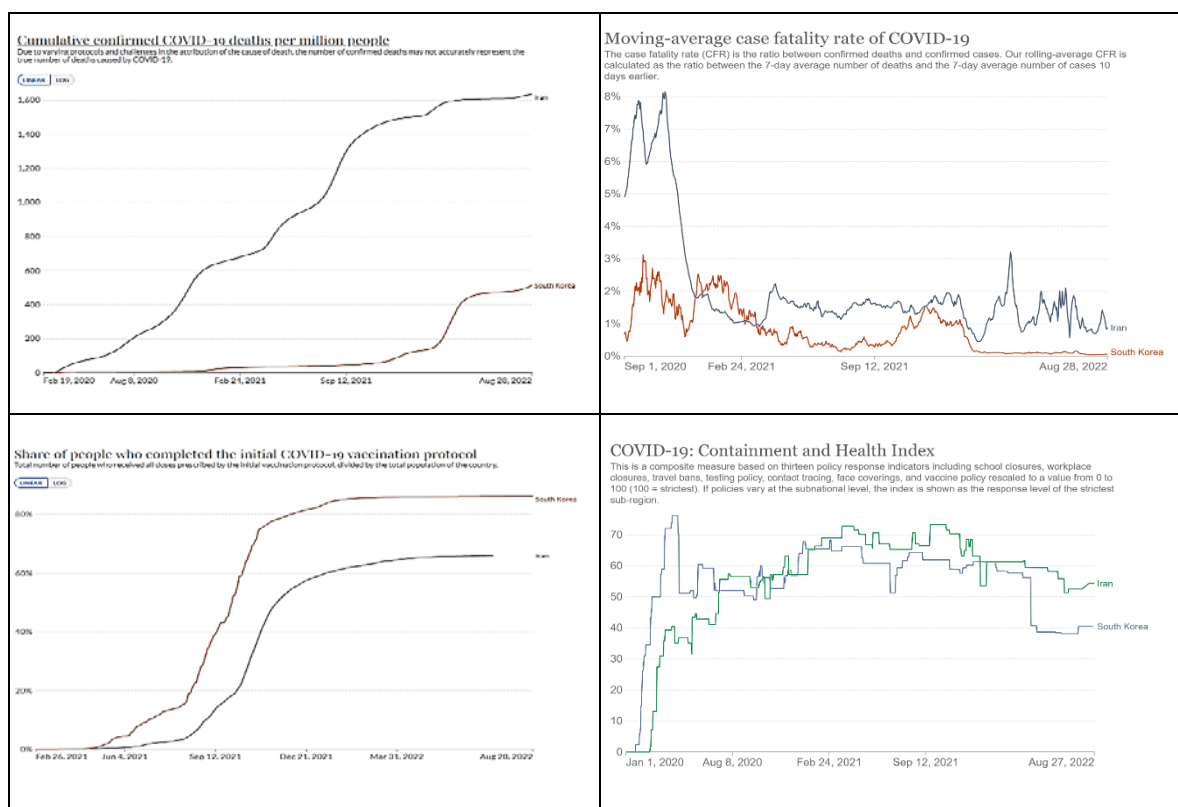
² The Case Fatality Ratio (CFR) is the ratio between confirmed deaths and confirmed cases which measure the mortality risk of disease.

Figure 1. Case Fatality Rate of COVID-19



Source: John Hopkins University CSSE COVID-19 Data.

Figure 2. Case Fatality Rate of COVID-19: Iran and South Korea Comparison

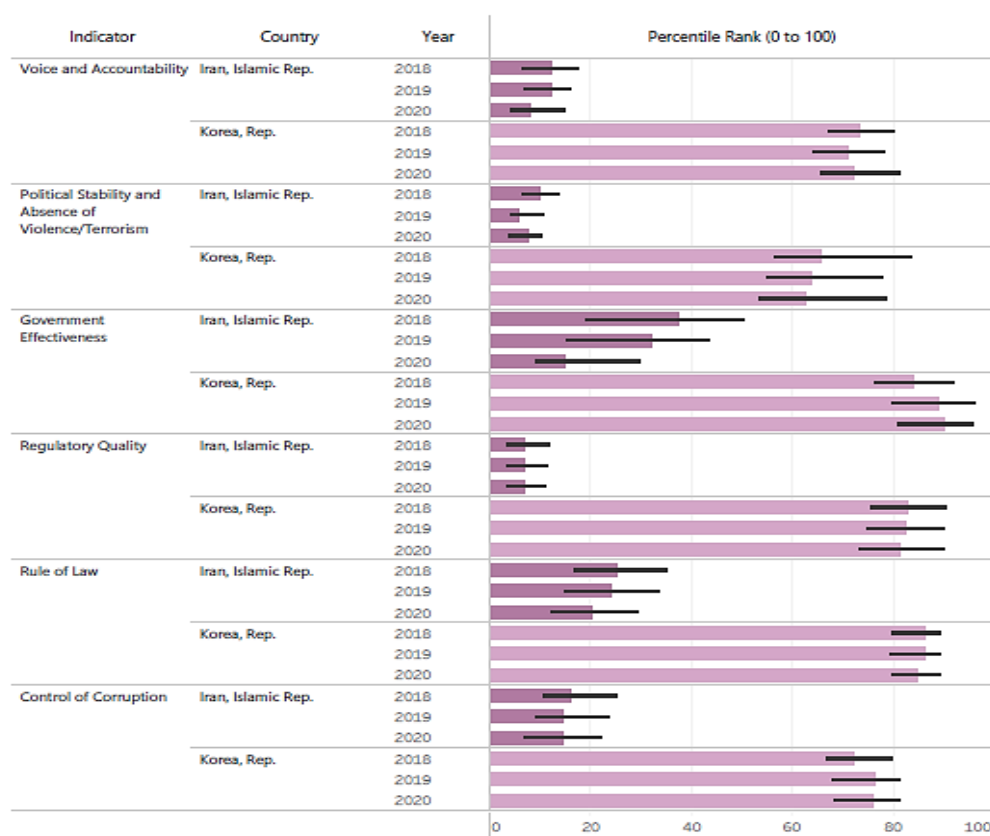


Source: John Hopkins University CSSE COVID-19 Data, official data collected by Our World in Data.

Furthermore, another critical factor is COVID-19 governance which can be monitored by calculating Government Stringency Index, as presented in Figure 4. This index is

a composite measure based on several indicators which monitor the state of lockdowns and social distancing and range to values between 0-100, while 100 presents the most restrictive.

Figure 3. Worldwide Governance Indicators: Iran and South Korea Comparison

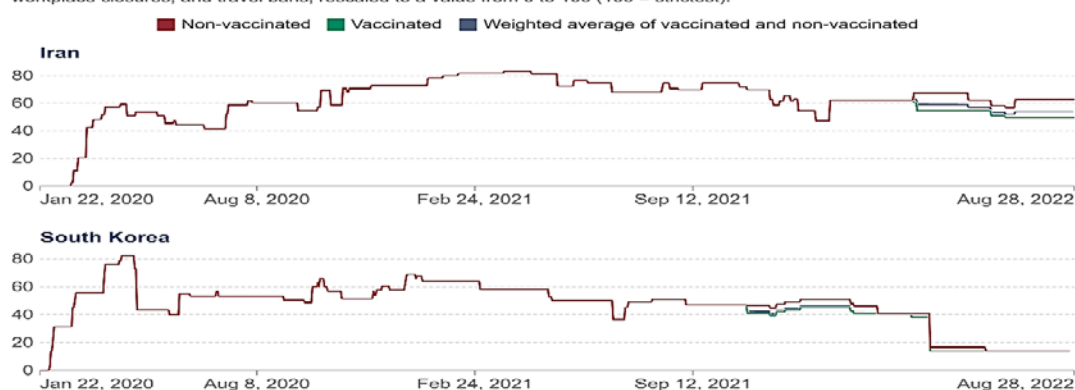


Source: <https://databank.worldbank.org/source/worldwide-governance-indicators>

Figure 4. Stringency Index: Iran and South Korea Comparison

COVID-19: Stringency Index

The stringency index is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest).



Source: Oxford COVID-19 Government Response Tracker, University of Oxford, OurWorld in Data.

In addition to the governance of COVID-19, from the perspective of public health and lives saved, maintaining jobs and supporting the resilience of industries to achieve SEG has been

another important concern for nations and governments worldwide. As stated by Bernanke (2020), it is widely believed that the global economic crisis caused by COVID-19 is different

from past crises in terms of cause, scope, and severity that suddenly disrupted economic activity. These necessitate research on the potential determination factors influencing the response of countries, companies, and individuals to the COVID-19 crisis. The key to ensure Business Continuity and SEG is to identify factors that increase the resilience of businesses under COVID-19 circumstances and other potential public health crises.

Theoretical and empirical studies confirm that three main explanatory factors are at play: 1) macroeconomic structure and governance, 2) financial resilience of companies which is traced by available capital (i.e., the physical and human capital), and firms' adopted strategies and 3) digital evolution state and momentum and the adaptation of countries to technological innovations and Digital Intelligence, which is an indicator of transmission to KBE.

By examining these components, it is possible to evaluate the structure and response of countries to the pandemic and post-COVID era. Thus, the report seeks to contribute to the literature on sustainable economic growth under crisis through a comparative study of Iranian industries with South Korea. The main research question here relates to the components of successful covid-19 governance from the perspective of SEG and business continuity within a KBE environment.

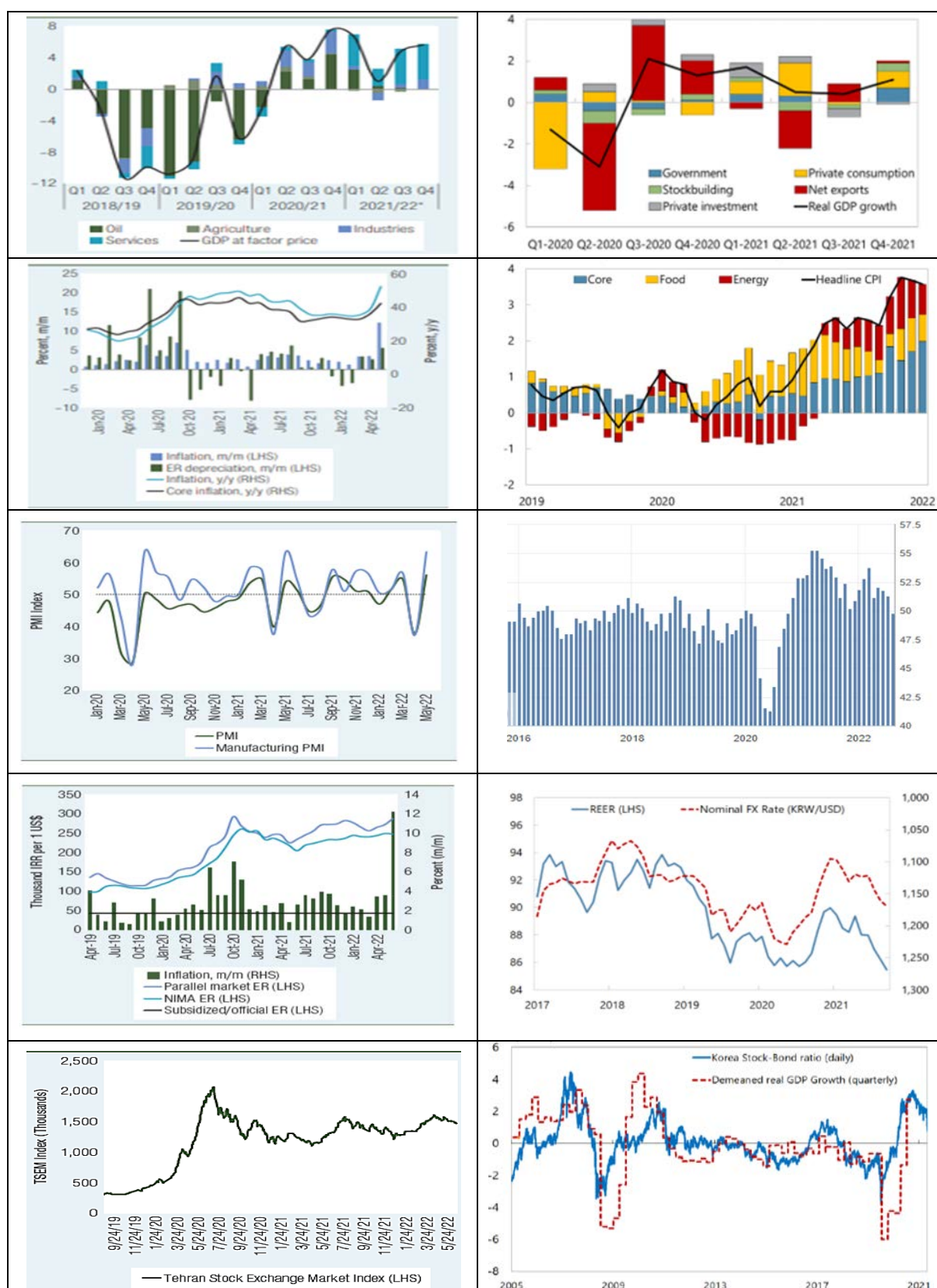
II. Review of the Literature: SEG, Business Continuity, and Digital Evolution under COVID-19

As discussed, the spread of the Coronavirus led to complex economic problems which demanded different but supportive responses from each country based on their Scio-Economic structure and capacities. Countries started to mitigate the spread of the virus with quick responses. However, it was not a straightforward response since it gradually transformed from just a public health issue to a wide range of areas, mainly with three common pillars including SEG, Business Continuity, and Digital Evolution. This section compares the performance of Iran and South Korea under COVID-19 based on these criteria.

1. SEG and Key Macroeconomic Indicators

Evidence shows that key macroeconomic indicators, such as production, economic growth, inflation, and unemployment rate, have been severely weakened by COVID-19 through four main channels, including 1) supply, 2) demand, 3) local and global supply chain management, and 4) economic uncertainties (Asaadi and Daliri 2021). Given the fact that all countries around the world were hit by COVID-19, consequently, it can be considered a global and external shock to the world economies. The shock imposed damages on the business environment in which the effectiveness of shock management highly depends on the resilience level of the economies affected. Figure 5 shows the main macroeconomic indicators trend for Iran's economy in the course of COVID-19, and compares them with those of South Korea.

Figure 5. Key Macroeconomic Indicators: Iran and South Korea Comparison



Sources: <http://data.worldbank.com> (for Iran) and <http://www.imf.org> (for Korea)

It can be observed from Figure 5 that, despite the differences in their composition, real GDPs recovered in both countries in 2021. It also shows that industries and sectors responded to the crisis differently, which could be associated with both the COVID-19 governance and stringency index, the structure of the public health system, and most importantly, the resilience of the economy in response to shocks. As the two earlier elements are investigated in Figures 2 and 4, the last element relates to the growing literature on the companies' resilience. Although the impact of Covid-19 on the economy will continue to improve, all sectors and economic components will not recover from the crisis in the same proportion. Private businesses and companies have been severely exposed to the damage caused by this pandemic. Therefore, their recovery can take more time and demand more resources to overcome the long-term consequences of the pandemic, depending on the level of preparation and innovative capacity they have. For example, companies in tourism and transportation are among the most immediately affected by the spread of the coronavirus. Companies active in the field of health will have different situations. Thus, it is important to examine the role of the specific characteristics of the companies in their response to the spreading Covid-19. This issue is explored in the next section.

2. Business Continuity and Firms' Strategies under COVID-19

Industrial Economics provides a theoretical

background and insight into the key components of firms that increase industries' resilience and shape their response to crises such as the COVID-19 outbreak. The literature explains that the key factor that impacted reactions to COVID-19 relates to the firms' liquidity constraints. Given the adverse impact of the pandemic on cash flows, firms' access to cash and credit may influence firm performance and hence market valuations. From this perspective, firms with more cash, and greater access to credit reflect more profit. They will experience less severe stock price declines than otherwise identical firms. Bartik et al. (2020) surveyed more than 5800 companies and showed that the majority of the damaged and closed companies were the companies that had little cash available. They believe that Covid-19 does not affect all businesses equally. Therefore, they argue that in such a situation, innovation is a powerful driver to help these companies as they not only can utilize a better resource allocation which decreases production or distribution costs, but also provide a more flexible work style and options to keep business open under lockdowns and social distancing. They also emphasized the use of digital resources as the main facilitator of networking.

Another factor is the firms' networks of suppliers and customers/ the more hit the country by COVID-19, the greater disruptions to production and sales firms would experience. Thus, the extent of exposure to COVID-19 is expected to be more severe for firms with global supply chain networks and customers

rather than those which concentrate on the local network (Ding et al. 2020).

In terms of the firms' strategies in response to the crisis, studies point to four strategies as follows. 1) Withdrawal Strategy or cost-cutting measure allows companies to temporarily or permanently reduce production activities giving the company potential to provide the resources needed by more stressed other sectors, though it cannot be adopted in the long run. 2) Persistence Strategy is related to the current way of business activities adopted by a company in times of crisis. Studies show that persistence can be a suitable strategic response to a crisis in the long term. 3) Innovation Strategy refers to strategic renewal in response to the crisis that provides new insights for companies and allows them to improve and go beyond the boundaries of technology. 4) Exit Strategy can be a strategic response to the crisis

which frees committed resources. In this sense, the exit strategy is not necessarily a manifestation of business failure. And it may even be a valuable strategic response to a crisis at any time (Salimi Zaviyeh 2020).

Though, in practice, picking a definitive decision for companies from the four strategies mentioned above might be impossible and rather destructive. Thus, firms adopted a more flexible and broader perspective on rescue and recovery plans, as presented in Figure 6. These strategies are based upon four main pillars, including 1) market segmentation, 2) remote work, 3) Digital Intelligence and 4) product line changes (Salimi Zaviyeh 2020). The resilience of businesses in critical conditions caused by Covid-19 states that these strategies emphasize new techniques that help companies adapt quickly in conditions of uncertainty and take advantage of new opportunities.

Figure 6. Firms' Strategies under COVID-19 Crisis

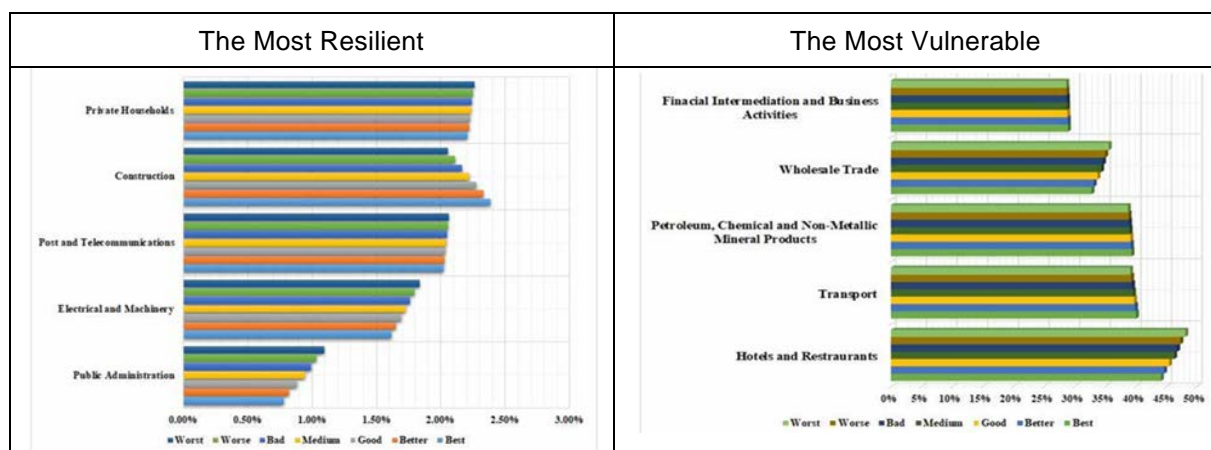


Source: Research Studies.

According to these factors and the structure and capacity of Iranian industries, Mirnezami and Rajabi (2020) simulated the vulnerability of different sectors of Iran's economy during the pandemic, using an input-output model for 26 leading industries of the economy as presented in Figure 7. The research results show that the most resilient companies with the least loss in their value-added are those in private households' consumption, construction, telecommunications, electronics and machinery

industries, and public administration. In contrast, industries with a focus on financial sectors, wholesale trade, petroleum and mineral products, transport, and tourism industries are among those experiencing the most fall in their value-added. Finally, Zorar (2019), evaluated the effects of COVID-19 on the industrial sector in Iran and found that the consequences of the pandemic are more pronounced for Iran's economy due to the existence of sanctions, as it associates the economy with more intensity and complexity.

Figure 7. Resilient and Vulnerable Industries in Response to COVID-19: Simulation for Iran Economy in 2020-Q3



Source: Mirnezami and Raiabi (2020).

Figure 8 also presents the most important factors contributing to the Korean industries' resilience. These five factors include Financial Performance, Supply Chain Management Performance (SCM), Social Sustainability, Environmental Sustainability, and Economic Sustainability.

Another factor in a firm's resilience is its access to technological innovation. Innovation refers to new or substantially improved products or processes within industries that, when implemented, affect operational performance, such as revenue, cost, and product quality. Innovation is the main pillar of the 4th Industrial Revolution³ and KBE. Such products and services allow companies to gain a competitive

³ During the second and third Industrial Revolutions, the success or failure of companies depended on the

characteristic of products or services in terms of cost-efficiency, using capital competitiveness. However,

advantage in the market, and success in the market further accelerates the company's technological innovation. When an economy expands as KBE, it requires the adaption of IR 4.0, in which technological innovation is a determinant factor for survival and sustainable growth in the industrial and national dimensions. Therefore, it is necessary to investigate both the access and efficiency of technological innovation to secure the resilience of firms in

the face of crisis. Finally, the strategy of innovation activities depends on an industry's technical advancements and the development of KBE. (Im and Cho 2021). As discussed, the key determining factor for a firm's resilience is related to the state of digital evolution and the advancement of KBE. The next section reviews the components of digital evolution first and then compares its advancement between Iran and South Korea.

Figure 8. Resilient and Vulnerable Industries in Response to COVID-19: Korean Industries

Construct and scale items	Standardized Loading	P	Cronbach's α	CR	AVE
Sustainability					
Economic Sustainability					
Continuous improvement in return on investment	0.750	***	0.889	0.873	0.634
Overall productivity inventory	0.809	***			
Improve product and service sales	0.891	***			
Increasing the number of companies wishing to do re-transactions and new transactions	0.724	***			
Environmental Sustainability					
Increasing the resource recycling rate	0.758	***	0.912	0.914	0.682
Increased use of renewable resources	0.788	***			
Improve Echo efficiency	0.877	***			
Application of environmental pollution control systems	0.882	***			
Construction of environmental management systems	0.817	***			
Social Sustainability					
Compliance with required legal liability	0.765	***	0.866	0.867	0.620
Efforts to keep ethical responsibility	0.835	***			
Efforts to uphold charitable responsibility	0.785	***			
Efforts to cooperate with stakeholders	0.763	***			
SCM Performance					
More productive than any other company	0.818	***	0.901	0.903	0.653
Lower Logistics costs than other companies	-	-			
Lower inventory level than other companies	0.807	***			
High competitiveness using supply chains	0.848	***			
Fast lead time from order to supply	0.868	***			
Financial Performance					
Sales have increased over the past three years	0.832	***	0.933	0.933	0.778
Profitability has increased over the past three years	0.859	***			
Cash has been flowing smoothly over the past three years	0.920	***			
Asset turnover has increased over the past three years	0.914	***			

Source: Han and Choi (2022)

over the IR 4.0 era which is known for market-led and hyper-connectivity-based, customers respond to firms

that can reflect their individual needs by supplying innovative products.

3. Digital Evolution: States and Momentums

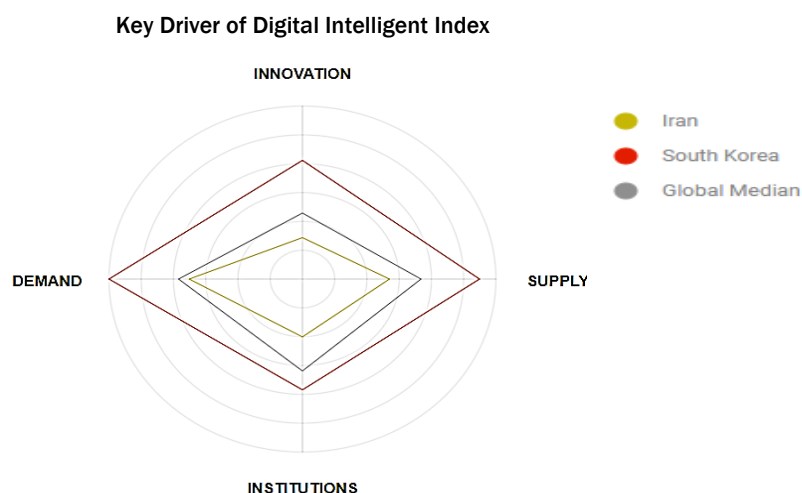
Digital Evolution measurement, namely Digital Intelligence Index, is a data-driven evaluation of the progress of the digital economy across 90 economies. The index is built upon 160 different indicators into four key drivers of 1) Supply Conditions, 2) Demand Conditions, 3) Institutional Environment, and 4) Innovation. It represents a composite picture of the Digital Evolution and the advancement of the digital economy. The index compounds 160 indicators to measure the current state and pace of digitalization in an economy, known as momentum. The structure of the index consists of four categories, including indicators, clusters, components, and drivers. Indicators are standardized data points that answer a specific question. Indicators are aggregated up into clusters, which represent 35 aspects of digitalization, clusters are then converted to the 13 higher-order components, and ultimately components create the four-mentioned drivers.

Note that in computing the index, it is assumed that the digitalization of an economy depends on these four drivers with equal weight and importance. After indicators have been aggregated up into clusters, components, drivers, and ultimately final scores, final scores are rescaled to fit a 0 to 100 range. Momentum scores are generated by applying the Compound Annual Growth Rate Formula (CAGR) to final index scores. Both the final index scores and momentum scores are relative. And finally, the calculation process consists of different statistical

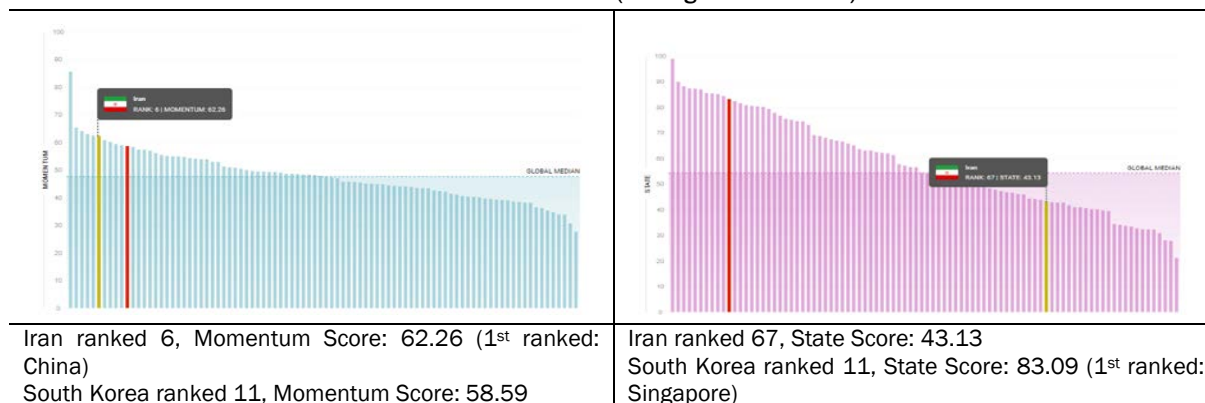
tools, including data cleaning, variance analysis, regression analysis, simulations, and stress-test at multiple levels to ensure the robustness of the calculation. Figure 9 below compares Digital Evolution based on four key drivers in terms of state and momentum scores between Iran and South Korea. As expected, South Korea is among the countries with an excellent score among the 90 economies, with the first-rank performance in demand conditions.

According to the estimated Digital Intelligence Index scores for the two countries, and having considered Iran's score in these four key drivers for digital evolution, the key lesson for Iran is to concentrate on the demand and supply sides of the digital intelligence index more and to facilitate a fast and steady transmission to KBE. Given the success of South Korea in digital evolution, it seems that there is a common ground for cooperation between the two countries in terms of the supply of digital products and technological innovations.

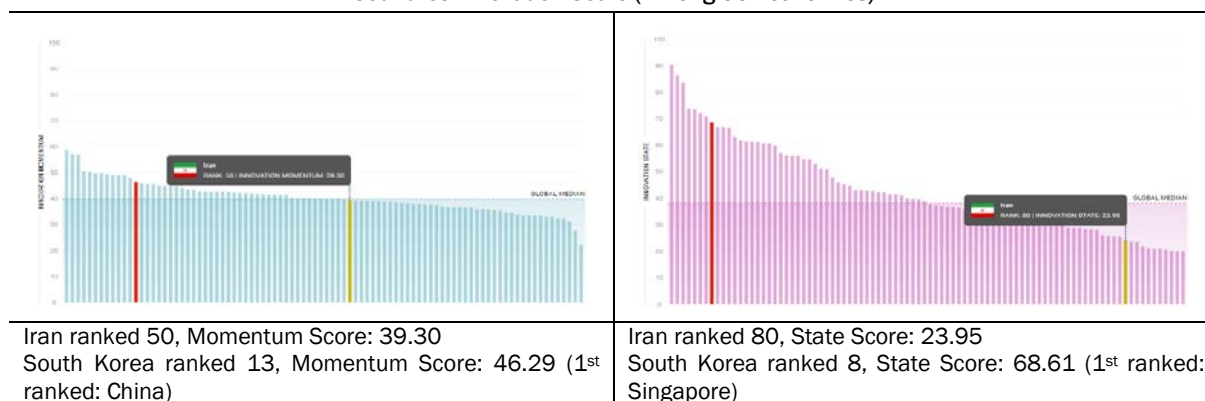
Figure 9. Digital Intelligence Index: Iran and South Korea Comparison



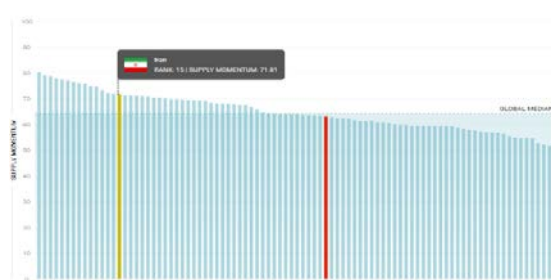
Countries Overall Score (Among 90 Economies)



Countries Innovation Score (Among 90 Economies)



Countries Supply Score (Among 90 Economies)



Iran ranked 15, Momentum Score: 71.81 (1st ranked: Rwanda)
South Korea ranked 51, Momentum Score: 63.11

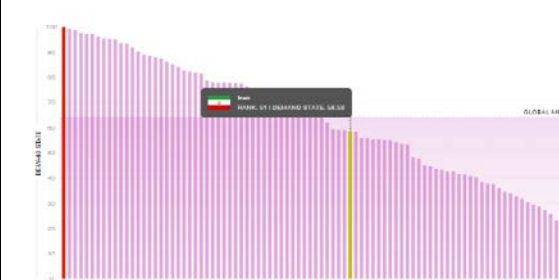


Iran ranked 71, State Score: 45.00
South Korea ranked 5, State Score: 91.55 (1st ranked: Singapore)

Countries Demand Score (Among 90 Economies)

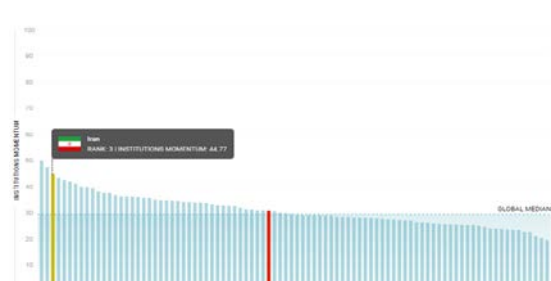


Iran ranked 11, Momentum Score: 55.29
South Korea ranked 2, Momentum Score: 65.89 (After China)

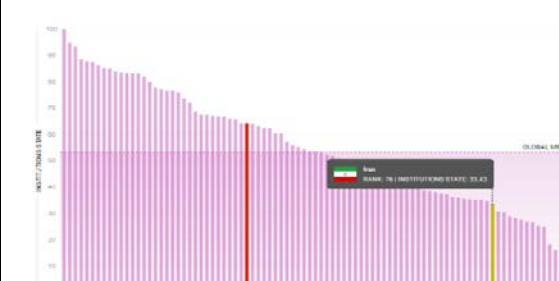


Iran ranked 51, State Score: 58.53
South Korea ranked 1, State Score: 100.00

Countries Institutions Score (Among 90 Economies)



Iran ranked 3, Momentum Score: 44.77 (1st ranked: Azerbaijan)
South Korea ranked 41, Momentum Score: 30.71



Iran ranked 76, State Score: 33.43
South Korea ranked 33, State Score: 64.06 (1st ranked: Singapore)

III. Conclusion and Policy Recommendation

Which features would contribute to industrial resilience and economic recovery in response to the COVID-19 pandemic and similar crises

in the future? This research tried to investigate the impact of the COVID-19 outbreak on the sustainability of economic growth. In particular, the four main explanatory factors that shape the response were 1) Worldwide Gover-

nance Indicators (WGI) and the macroeconomic structure, 2) the financial resilience of companies which is traced by available capital (i.e., both the physical and human capital), 3) firms' adopted strategies and 4) the digital evolution state and momentum alongside with the adaptation of countries to Digital Intelligence, which is an indicator of transmission to KBE.

Given that the study shed some light on the fact that the advancement of Digital Evolution is the key factor in increasing the resilience of both societies and economies, it seems policy-makers in the post-COVID-19 era have no choice but to plan and facilitate a fast transmission to KBE. **KIEP**

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