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Digital Leadership in the Economies of the G20 Countries: A Secondary Research

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Abstract: Digitalization in leadership practice requires broader research. Today's economic leaders must be in line with the global mindset in supporting a culture of innovation. The purpose of this study is to investigate the digital leadership capabilities of the G20 countries in terms of digital readiness, innovation, and competitiveness 4.0 and to determine the relationship between these variables. The global digital readiness index 2019 (Cisco 2020) was utilized to obtain data on digital readiness (X), the global innovation index (Cornell University et al. 2019) was applied for the data collection on innovation (Y1), and the global competitiveness 4.0 index (WEF 2019) was used to obtain data on competitiveness 4.0 (Y2). All data were cross-sectional for the year 2019. Digital readiness consists of basic needs, human resources, ease of doing business, business and government investment, start-up environment, technology infrastructure, and technology adoption. The components of innovation are institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs. Competitiveness 4.0 is about institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability. We found that G20 countries had the digital leadership capability in digital readiness, innovation, and competitiveness 4.0. The G20 countries were leaders in global digitalization. Some of them were consistent in digital readiness and innovation. Some were consistent in digital readiness and competitiveness 4.0, and some others were consistent in their 4.0 innovation and competitiveness 4.0. Digital readiness, innovation, and competitiveness 4.0 positively related to each other.

Keywords: digital leadership; digital readiness; innovation; competitiveness 4.0; G20; secondary research

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1. Introduction

Victory in an economy cannot be separated from the leadership success that exists inside. It depends on the digital capabilities of the countries' economies. Economic activities and globalization are broadly inseparable from the existence of digitalization (Strielkowski et al. 2020; Abdurakhmanova et al. 2020; Borremans et al. 2018). However, most of the research on digital leadership investigated at the microeconomic level. There were over 2,000,000 documents on Google Scholar when we put "digital leadership" as keywords. Scopus showed more than 2000 results, and there were more than 1000 in Web Science. In addition, there were more than 500,000,000 on the Google search engine. The literature on economic leadership remains relative and general in the 21st century (Wang and Torrisi-Steele 2017). Thus, research on digital leadership on a macroeconomic scale is vital to understand leadership knowledge more broadly.

Flexibility in responding to digitalization is a measure of the success of global businesses that will encourage the revival of the countries' economies (Shkarlet et al. 2020). Business actors use supporting infrastructures that include resources and management using computer networks (Barefoot et al. 2018). It is a solution to economic problems in creating product-oriented efforts (Watanabea et al. 2018). Internet penetration and a high degree of digitization of device usage are prerequisites for its development (Nagy 2017). Through asymmetric information and the agency relations (Veselovsky et al. 2018), digitalization brought a significant technological change in the economy (Curran 2017).

Digital development is a demanding aspect for all economies to maintain their leadership positions (Gapsalamov et al. 2020). The G20 is an international forum that brings together the world's major economies. Its members account for more than eighty percent of the world's GDP, seventy-five percent of global trade, and sixty percent of the world's population. This forum has been conducting meetings annually since 1999. The innovations made by the G20 forum, either individually or collectively, have tremendous implications for global outcomes. Its members are the big producers of technology and drivers of digitization as well as education. In total, they account for nearly 95 percent of all investment in research and development. Nearly 90 percent of all scientific publications on artificial intelligence came from members of the G20. The opportunities and challenges posed by digital transformation and subsequent production revolution technologies increase the importance of policies that can help world countries take advantage of these new technologies at risk (OECD 2019). Understanding the leadership capabilities of the G20 countries is vital. G20 countries must be ready to engage in digitalization. They must also be innovative and competitive.

After the global crisis, the process of deglobalization has intensified and has raised questions about which countries will be the world economic leaders. The global leadership change in the economy means a profound rearrangement of economic systems (Shavshukov and Zhuravleva 2020). An economy with low digitization tends not to be psychologically empowering (Zeike et al. 2019), because digital leadership is a combination of digital culture and digital competence. Thus, the digitalization of business processes and changes in leadership practices are factors that must be taken into account more seriously today (Jakubik and Berazhny 2017). Economic leadership must be in line with a global mindset and be more creative in supporting the culture of innovation (Mihardjo et al. 2019). After focusing on increasing productivity, efficiency, and profitability, all economic leaders realize that the approach and culture in leading must adapt (Bolte et al. 2018). Digital leadership strongly encourages market orientation in the economy (Sasmoko et al. 2019). It generates knowledge about the new digital world, modern technology, and interpersonal skills (Kalashnikov et al. 2019). A clear digital leadership image must be built together with high intrinsic value to grow with technological change (Breuer and Szillat 2019). Digital leadership is also known as e-leadership or virtual leadership (Saputra and Saputra 2020). It is about creating an expanding digital environment that leads to a high level of effectiveness, productivity, and morale (Roman et al. 2018). The digital technology that will disrupt nearly every industry has become a reality. However, it is an economic opportunity (Kane et al. 2016).

Governments around the world are all at different phases of their digital transformation and have varying priorities on their national agendas toward building a digital economy. Agile digital government is the first and foremost essential step in establishing and developing a modern digital economy with comprehensive growth (DGRA—The Foundation of Digital Development, the Core Team 2020). The impact of automation, artificial intelligence, and the Internet of Things (IoT) is felt almost everywhere, in all countries, industries, and everyday life. However, while the impact of digitization is widespread, the benefits it yields are distributed unevenly. This study aims to determine the digital leadership capabilities of the G20 countries in terms of digital readiness, innovation, competitiveness 4.0, and to investigate the relationship between these variables. It explains digital leadership at a macroeconomic scale which is key to economic growth in the G20 countries.

Our paper focuses on digital leadership in the G20 countries in the context of the economy. It is structured as follows: first, the introduction explains a research gap and the linkages between the economy and the digital leadership capabilities of the G20 countries. Second, the literature review describes the definitions and pillars of digital readiness, innovation, and competitiveness 4.0. Third, methodology explains measurement variables, hypotheses, and research design. Fourth, results and discussion elaborates the digital readiness, the innovation, and the competitiveness of the G20 countries globally, the consistency and the correlation between the three variables, and their implications. Last but not least, the conclusion summarizes the discussion concerning the overall objectives of the study. Moreover, it states the limitations of the research that are the niches for future research.

2. Literature Review

All economies are facing challenges for the next generation (Maresova et al. 2018). Regarding the circular economy (Basl and Doucek 2019), digitization, robotization, and automation are the main goals in the industry trend 4.0. Digitalization is a mystery in various fields of study related to industry 4.0 and globalization. Industry 4.0 uses the terms digitization and transformation a lot (Machado et al. 2019) and requires high digital performance measurement by countries to see their maturity in facing this paradigm. Common ideas about digital readiness are scarce, especially in academia. New technology and business have clouded the focus on it (Bican and Brem 2020). Readiness refers to the knowledge, skills, and capabilities of technical infrastructure. It is the guide to digitization for processing and utilizing their resources as efficiently and effectively as possible (Pai et al. 2020). The term "readiness" has also led to innovation (Lokuge et al. 2019). Digital readiness is a strong desire to adopt digital technology to create new opportunities (Debrenti 2020). It is vital for individuals, organizations, industries, and even countries to achieve their economic goals faster and in bigger ways. Digital readiness is indeed a scourge for conventional competitive advantage in the economy (Ertan 2018).

Global innovation connects to local digitalization (Isaac et al. 2019). Digital technology becomes a driver of innovation and modern global economic growth and has contributed to national competitiveness (Nesterova et al. 2018; Sepashvili 2020). Innovation has been the basis for and has created a dependency on the modern competitive economy in economic growth. Territorial competitiveness is the subject of studies in various branches of the economy. In general, competitiveness is the ability to realize a mission (objectives, functions, and tasks) with the quality and value required in a competitive market. Competitiveness refers to the ability to maintain relatively high levels of income and employment while remaining open to international competition (Dmitrieva and Guseva 2019). Being competitive, economic actors must embrace technological innovation's applications (which is also one of the biggest challenges today) and, in parallel, must face the fifth industrial revolution (Manta 2019).

Digital readiness was defined using a holistic model based on seven components, including technological aspects such as technology, infrastructure, and technology adoption, but also measuring the ease of doing business, human capital development, business and government investment, basic human needs, and the start-up environment (Yoo et al. 2018). All countries facilitate digital services for their people equally to be able to develop internally and externally (Florin et al. 2012). Several indices that measure digital readiness are DESI (European Commission), NRI (Portulans Institute), World Economic Forum, DAI (World Bank) DRI (Cisco Systems), DiGiX (BBVA Research), Banco Bilbao Vizcaya Argentaria, GCI (World Economic Forum), and World Economic Forum DB (World Bank). It is also related to the digital maturity index (Zhang et al. 2019), network readiness index, computer information technology development index, cybersecurity index, digital competitiveness index, and digital evolution index (Plutova et al. 2019). National innovation activities have been hindered by the demanding progress and speed of globalization (Lee et al. 2020).

Building our understanding of the factors supporting digital readiness, seven different components to build a complete picture of a county's digital readiness were provided by the Cisco Global Digital Readiness Index 2019. First, basic needs. The true value of technology and infrastructure is delivered through a population's ability to take advantage of it. Second, human capital. The ability to utilize and create advanced digital services is determined in part by the digital skills level within the workforce. Third, ease of doing business. Because human capital skills can only contribute to the economy if people are gainfully employed, having a thriving business ecosystem is another key determinant of a country's digital readiness. Fourth, business and government investment. Building digital infrastructure and capabilities requires significant investment on behalf of both governments and businesses. Fifth, start-up environment. Start-ups create new innovations that can benefit entire markets and communities. Sixth, technology infrastructure. Infrastructure plays a key role in enabling countries to advance digital services. Seventh, technology adoption. The level of technology availability, utilization, and adoption reflects a country's current level of digital readiness. The seven components to measure innovation were provided by Cornell University Global Innovation Index 2019 including institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs. Competitiveness 4.0 were explained by WEF Global Competitiveness Index 2019 consisting of twenty pillars, which are institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability.

3. Methodology

The overall objective of this study is to determine the digital leadership capabilities of the G20 countries. Figure 1 show the main variables, which are digital readiness (X), innovation (Y1), and competitiveness (Y2). The seven components of digital readiness are basic needs, human capital, ease of doing business, business and government investment, environment start-ups, technology infrastructure, and technology adoption (Cisco 2020). The seven components to measure innovation are institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs (Cornell University et al. 2019). Competitiveness 4.0 has twenty pillars: institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability (WEF 2019).

In pursuit of the purposes, we defined the following specific objectives: objective 1—to determine the consistency between digital readiness and innovation of the G20 countries; objective 2—to determine the consistency between digital readiness and competitiveness 4.0 of the G20 countries; objective 3—to determine the consistency between innovation and competitiveness 4.0 of the G20 countries; objective 4—determine the consistency between digital readiness, innovation, and competitiveness 4.0 of the G20 countries; and objective 5—to determine the relationship between digital readiness, innovation, and competitiveness 4.0. Once these objectives had been established and a review of the existing literature conducted, we formulated the following hypotheses:

Hypothesis 1 (H1). *Digital readiness has a positive relationship with innovation.*

Hypothesis 2 (H2). *Digital readiness has a positive relationship with competitiveness 4.0.*

Hypothesis 3 (H3). *Innovation has a positive relationship with competitiveness 4.0.*

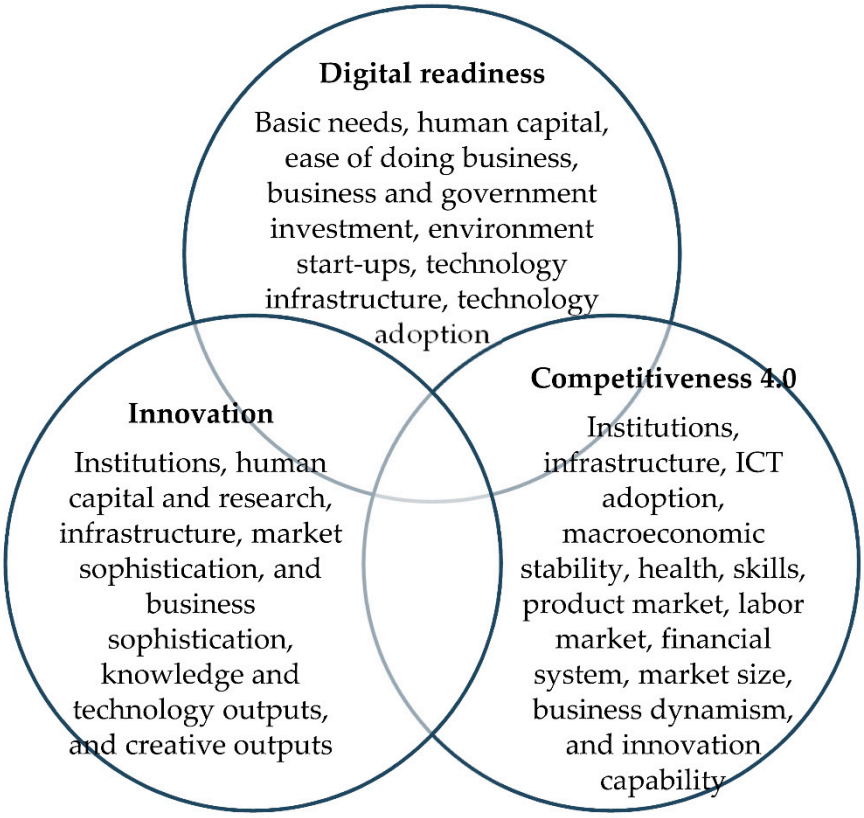

Figure 1. Digital readiness, innovation, competitiveness 4.0.

We followed the Wallace Foundation on secondary research (Workbook B; secondary data analysis). Figure 2 includes four steps in secondary research (Wallace n.d.): identifying the source of information, collecting existing data, normalizing data, and analyzing data. In the first step, the sources of information we used are the global digital Readiness index 2019 (Cisco 2020), the global innovation index 2019 (Cornell University et al. 2019), and the global competitiveness index 4.0 2019 (WEF 2019). We used a cross-sectional approach for the year 2019 data. In the second step, we used the global digital readiness rankings, the global innovation rankings, and the global competitiveness rankings. Based on these data, in the third step, we tabulated a digital rating for global digital readiness, global innovation, and global competitiveness 4.0 for the G20 countries. Next, in the fourth step, we conducted a comparative analysis between the G20 global digital readiness data and the G20 global innovation data, between the G20 global digital readiness data and the global competitiveness 4.0 data, and between the global innovation data and the global competitiveness 4.0 data. This was done to see whether the global digital readiness, global innovation, and global competitiveness ratings showed consistencies. Finally, we conducted a Pearson correlation analysis using SPSS to determine the relationship between the three variables. We used the available scores in the sources of each country based on each variable.

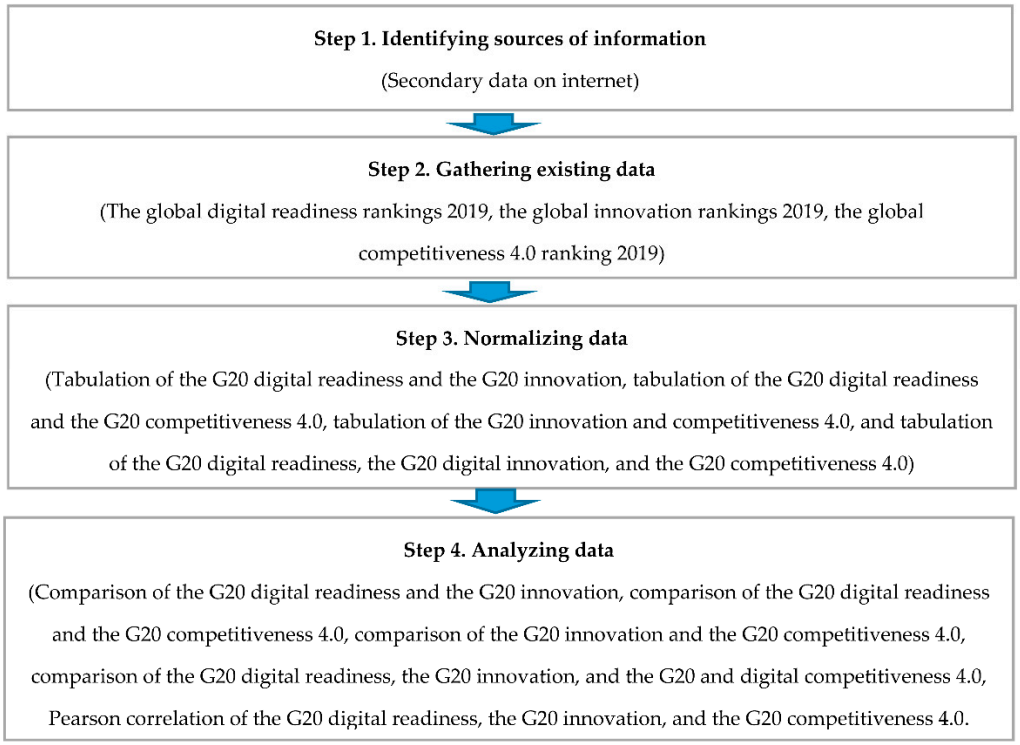

Figure 2. Steps in secondary research (Wallace n.d.).

4. Results and Discussion

4.1. Global Digital Readiness of G20 Countries

This subsection shows the digital readiness score of the G20 countries, a basis for analyzing objective 1 (consistency between digital readiness and innovation), objective 2 (consistency between digital readiness and 4.0 competitiveness), and objective 4 (consistency between digital readiness, innovation, and competitiveness of 4.0). Based on secondary data in the form of scores and stages from the global digital readiness index 2019, we compiled the digital readiness data for the G20 countries as shown in Table 1. Each country had a digital readiness score derived from seven components (basic needs, human resources, ease of doing business, business and government investment, start-up environment, technology infrastructure, and technology adoption). The score determined what stages each country had gone through. Countries in the activate stage were going through the earliest stages of digitalization dynamics with an average digital readiness score of 6.24 out of 25. Countries that were in the accelerate stage were those with average digital readiness scores of 11.82. They had taken several steps forward and had the opportunity to accelerate their digital readiness. In the third stage, amplify, they were the countries with an average digital readiness score of 17.89. They were matured into digital but were not a guarantee for sustainability.

Table 1 showed that the G20 countries were categorized into amplify and accelerate stages. All G20 countries' digital readiness scores ranged between 9.6 and 19.03 on a scale of 25. The G20 countries in the amplify stage were (1) the United States of America, (2) South Korea, (3) Australia, (4) The United Kingdom, (5) Germany, (6) Japan, (7) Canada, and (8) France. The other eleven G20 countries in the accelerate stage were (1) Italy, (2) Russia, (3) Saudi Arabia, (4) China, (5) Argentina, (6) Turkey, (7) Mexico, (8) Brazil, (9) Indonesia, (10) South Africa, and (11) India.

Table 1. Scores and stages of digital readiness for G20 countries in 2019.

Ranks	G20 Countries	Scores (0–25)	Stages
1	The United States of America	19.03	Amplify
2	South Korea	18.22	Amplify
3	Australia	17.89	Amplify
4	The United Kingdom	17.86	Amplify
5	Germany	17.85	Amplify
6	Japan	17.69	Amplify
7	Canada	17.33	Amplify
8	France	16.25	Amplify
9	Italy	14.84	Accelerate
10	Russia	13.63	Accelerate
11	Saudi Arabia	13.40	Accelerate
12	China	13.22	Accelerate
13	Argentina	13.06	Accelerate
14	Turkey	12.88	Accelerate
15	Mexico	12.34	Accelerate
16	Brazil	12.31	Accelerate
17	Indonesia	11.68	Accelerate
18	South Africa	11.39	Accelerate
19	India	9.6	Accelerate

Source: Adopted from The Global Digital Readiness Index 2019 (Cisco 2020).

4.2. Global Innovation of G20 Countries

In line with the previous subsection, this subsection will explain the score of the innovation of G20 countries for analyzing objective 1, objective 3 (consistency between innovation and competitiveness 4.0), and objective 4. We compiled innovation data for the G20 countries as shown in Table 2 based on secondary data in scores and income groups from the global Innovation Index 2019. The four income categories were HI = high income; UM = upper-middle-income; LM = lower-middle-income; and LI = low income. Table 2 shows that the eleven countries in the HI category were (1) the United States of America, (2) The United Kingdom, (3) Germany, (4) South Korea, (5) Japan, (6) French, (7) Canada, (8) Australia, (9) Italy, (10) Saudi Arabia, and (11) Argentina. The six countries in the UM category were (1) China, (2) Russia, (3) Turkey, (4) Mexico, (5) South Africa, and (6) Brazil. The two countries in the LM category were (1) India and (2) Indonesia.

Even though China was in the UM category, its innovation score (institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs) was higher than the innovation ranks of Japan, France, Canada, Australia, Italy, Saudi Arabia, and Argentina. India's innovation rank was higher than the innovation ranks in Mexico, South Africa, Brazil, Saudi Arabia, and Argentina despite being in the LM category.

Table 2. Scores and incomes of G20 countries in 2019.

Ranks	G20 Countries	Scores (0–100)	Incomes
1	The United States of America	61.73	HI
2	The United Kingdom	61.30	HI
3	Germany	58.19	HI
4	Republic of Korea (South Korea)	56.55	HI
5	China	54.82	UM
6	Japan	54.68	HI
7	France	54.25	HI
8	Canada	53.88	HI
9	Australia	50.34	HI
10	Italy	46.30	HI
11	Russia (Russia Federation)	37.62	UM
12	Turkey	36.95	UM
13	India	36.58	LM
14	Mexico	36.06	UM
15	South Africa	34.04	UM
16	Brazil	33.82	UM
17	Saudi Arabia	32.93	HI
18	Argentina	31.95	HI
19	Indonesia	29.72	LM

Source: Adapted from Cornell University Global Innovation Index 2019 (Cornell University et al. 2019).

4.3. Global Competitiveness 4.0 of the G20 Countries

This subsection describes the global digital competitiveness score 4.0 of the G20 countries to analyze objective 2, objective 3, and objective 4. We collected competitiveness 4.0 data for the G20 countries as shown in Table 3 based on secondary data in scores and differences from the previous year from the global competitiveness report 2019. The six countries had increased: namely, (1) Korea, (2) France, (3) Saudi Arabia, (4) Italy, (5) South Africa, and (6) Brazil. On the other hand, the ten countries experienced a downgrade compared to the previous year's ranking. They were (1) the United States of America, (2) Japan, (3) Germany, (4) The United Kingdom, (5) Canada, (6) Australia, (7) Mexico, (8) Indonesia, (9) India, and (10) Argentina. The three other stable ones were namely (1) China, (2) Russia, and (3) Turkey.

Despite the decline, the United States of America still had the highest scores obtained from assessing institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability. The highest increase was by South Africa (+7). On the contrary, the highest decrease was by India (−10).

Table 3. Global competitiveness 4.0 scores and their fluctuations of G20 countries in 2019.

Ranks	Countries	Scores (0–100)	Fluctuations from 2018
1	United States of America	83.7	Decrease (−1)
2	Japan	82.3	Decrease (−1)
3	Germany	81.8	Decrease (−4)
4	The United Kingdom	81.2	Decrease (−1)
5	Korea Representative	79.6	Increase (+2)
6	Canada	79.6	Decrease (−2)
7	France	78.8	Increase (+2)
8	Australia	78.7	Decrease (−2)
9	China	73.9	Stable
10	Saudi Arabia	70.0	Increase (+3)
11	Italy	71.5	Increase (+1)
12	Russia Federation	66.7	Stable
13	Mexico	64.9	Decrease (−2)
14	Indonesia	64.6	Decrease (−5)
15	South Africa	62.4	Increase (+7)
16	Turkey	62.1	Stable
17	India	61.4	Decrease (−10)
18	Brazil	60.9	Increase (+1)
19	Argentina	57.2	Decrease (−2)

Source: Adapted from WEF Global Competitiveness Report 2019 (WEF 2019).

4.4. Consistency between Digital Readiness Ranks, Innovation Ranks, and the Competitiveness 4.0 Ranks of G20 Countries

This subsection elaborates the consistency between global digital readiness, global innovation, and global competitiveness 4.0 of the G20 countries. We compare the ranks described in the previous subsections to analyze objective 1, objective 2, objective 3, and objective 4.

Table 4 showed that the United States of America was the only G20 country consistent in its digital readiness, innovation, and competitiveness 4.0 and consistently ranked the highest. The six G20 countries that had partial consistency, or only two of the three variables (digital readiness, innovation, and competitiveness 4.0), were namely (1) Germany (innovation and competitiveness), (2) England (digital readiness and 4.0 competitiveness), (3) Japan (digital readiness and innovation), (4) France (innovation and competitiveness 4.0), (5) South Africa (innovation and competitiveness 4.0), and (6) Brazil (digital readiness and innovation). The twelve other countries that did not show consistency in the three variables were (1) South Korea, (2) Australia, (3) China, (4) Canada, (5) Italy, (6) Russia, (7) Arabic Saudi, (8) Turkey, (9) Argentina, (10) Mexico, (11) India, and (12) Indonesia.

Table 4. Global digital readiness ranks, global innovation ranks, global competitiveness 4.0 ranks and their consistencies of the G20 countries.

Digital Capabilities' Ranks	Digital Readiness Ranks	Innovation Ranks	Competitiveness 4.0 Ranks	Consistencies
1	The United States of America	The United States of America	The United States of America	Full
2	South Korea	The United Kingdom	Japan	No
3	Australia	Germany	Germany	Partial
4	The United Kingdom	Republic of Korea (South Korea)	The United Kingdom	Partial
5	Germany	China	Korea Rep.	No
6	Japan	Japan	Canada	Partial
7	Canada	France	France	Partial
8	France	Canada	Australia	No
9	Italy	Australia	China	No
10	Russia	Italy	Saudi Arabia	No
11	Saudi Arabia	Russia (Russia Federation)	Italy	No
12	China	Turkey	Russia Federation	No
13	Argentina	India	Mexico	No
14	Turkey	Mexico	Indonesia	No
15	Mexico	South Africa	South Africa	Partial
16	Brazil	Brazil	Turkey	Partial
17	Indonesia	Saudi Arabia	India	No
18	South Africa	Argentina	Brazil	No
19	India	Indonesia	Argentina	No

Source: Adapted from Global Digital Readiness Index 2019 (Cisco 2020); Global Innovation Index 2019 (Cornell University et al. 2019); Global Competitiveness 4.0 Report 2019 (WEF 2019).

4.5. Correlation between Global Digital Readiness Scores, Global Innovation Scores and Global Competitiveness 4.0 Scores of the G20 Countries

This subsection explains the correlation between global digital readiness, global innovation, and global competitiveness 4.0 of G20 countries. We compare the scores described in Sections 4.1–4.3 to analyze objective 5 (the relationship between digital readiness, innovation, and competitiveness 4.0). Based on the digital readiness score, innovation and competitiveness 4.0, Table 5 showed that the United States was the G20 country with the highest score. In terms of digital readiness, South Korea was second best and Australia third. Britain was second best and Germany third when it comes to innovation. Japan was in second place and Germany third in terms of 4.0 competitiveness. (1) The United States, (2) South Korea, (3) Australia, (4) the United Kingdom, (5) Japan, and (6) Germany were the countries with the highest digital capabilities.

Table 5. Global Digital Readiness Scores, Global Innovation Scores and Global Competitiveness 4.0 Scores of the G20 Countries.

Ranks	G20 Countries	Digital Readiness Scores	Innovation Scores	Competitiveness 4.0 Scores
1	The United States	19.03	61.73	83.7
2	South Korea	18.22	56.55	79.6
3	Australia	17.89	50.34	78.7
4	The United Kingdom	17.86	61.30	81.2
5	Germany	17.85	58.19	81.8
6	Japan	17.69	54.68	82.3
7	Canada	17.33	53.88	79.6
8	France	16.25	54.25	78.8
9	Italy	14.84	46.30	71.5
10	Russia	13.63	37.62	66.7
11	Saudi Arabia	13.40	32.93	70.0
12	China	13.22	54.82	73.9
13	Argentina	13.06	31.95	57.2
14	Turkey	12.88	36.95	62.1
15	Mexico	12.34	36.06	64.9
16	Brazil	12.31	33.82	60.9
17	Indonesia	11.68	29.72	64.6
18	South Africa	11.39	34.04	62.4
19	India	9.6	36.58	61.4

Source: Adapted from the Global Digital Readiness Index 2019 (Cisco 2020); Global Innovation Index 2019 (Cornell University et al. 2019); and Global Competitiveness 4.0 Report 2019 (WEF 2019).

Table 6 showed a significant and strong positive relationship (0.600–0.799) existed between digital readiness and innovation (0.603). There was also a significant and strong positive relationship between digital readiness and competitiveness of 0.77. Meanwhile, a significant and very strong positive relationship (0.800–1000) existed between innovation and competitiveness 4.0 (0.931). Table 7 show that hypothesis 1, hypothesis 2, and hypothesis 3 are accepted.

Table 6. Pearson Correlations between Digital Readiness, Innovation, and Competitiveness 4.0 of the G20 Countries.

		Digital Readiness	Innovation	Competitiveness
Digital Readiness	Pearson correlation	1	0.694 **	0.770 **
	Sig. (two-tailed)		0.001	0.000
	N	19	19	19

Table 6. *Cont.*

		Digital Readiness	Innovation	Competitiveness
Innovation	Pearson correlation	0.694 **	1	0.932 **
	Sig. (two-tailed)	0.001		0.000
	N	19	19	19
Competitiveness	Pearson correlation	0.770 **	0.932 **	1
	Sig. (two-tailed)	0.000	0.000	
	N	19	19	19

** Correlation is significant at the 0.01 level (2-tailed). Source: Output of SPSS conducted by the authors (2020).

Table 7. Conclusion of Hypotheses.

Hypotheses	Pearson Correlation	Conclusions
H1. Digital readiness and innovativeness are related	0.694	Accepted
H2. Digital readiness and competitiveness 4.0 are related	0.770	Accepted
H3. Innovation and competitiveness 4.0 are related	0.931	Accepted

Source: Output of SPSS conducted by authors (2020).

4.6. Discussion

The results of this study have shown that digital leadership exists at a macroeconomic or country level. We proved empirically that the G20 countries had digitally ready basic needs, human capital, ease of doing business, business and government investment, start-up environment, technology infrastructure, and technology adoption in 2019. They had innovative institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs in 2019. They also had competitive 4.0 institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and competitive innovation capability in 2019.

Because the world digital capability was explained through digital readiness only by Cisco in 2019, the results of this research showed that digital readiness collectively explained with innovation by WIPO in 2019 and competitiveness 4.0 by WEF in 2019. We indicate that the G20 countries had high innovation in institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge, technology outputs, and creative outputs in 2019. It was in line with the global outcomes achieved by the G20 countries either individually or collectively. Moreover, the G20 countries have had competitiveness 4.0 in institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability. It followed the fact that the G20 countries were the big producers of technology and drivers of digitization. Eventually, our finding showed that the G20 countries had high and wide digital capabilities, not only digital readiness, or only innovation, or even competitiveness 4.0 only. It matched with the world's major economies that had been achieved by the G20 countries as an international economics forum.

5. Conclusions

Digital readiness, innovation, and 4.0 competitiveness are positively and significantly related. The G20 countries had the digital leadership in digital readiness, innovation, and

competitiveness. It is a consideration at the macroeconomic level not microeconomics. The digital readiness of the G20 countries had been compared in innovation and the competitiveness of 4.0. Indeed, these three variables could be analyzed simultaneously. The G20 countries were adopting digital technology to create new opportunities. They were the drivers of modern global economic growth. They depended on the competitive economy to determine economic growth and realize the global mission (goals, functions, tasks).

The G20 countries were leaders in global digitization. The United States of America, Japan, and Brazil were consistent in digital readiness and innovation. The United States of America and the United Kingdom were consistent in digital readiness and competitiveness 4.0. The United States of America, Germany, France, and South Africa were consistent in their 4.0 innovation and competitiveness. In particular, the United States of America was the only G20 country consistent in digital readiness, innovation, and 4.0 competitiveness. Inconsistencies were in more G20 countries, namely in 12 countries. They were (1) South Korea, (2) Australia, (3) China, (4) Canada, (5) Italy, (6) Russia, (7) Saudi Arabia, (8) Turkey, (9) Argentina, (10) Mexico, (11) India, and (12) Indonesia. It showed that the consistency between digital readiness, innovation, and 4.0 competitiveness in the G20 was still low in that time.

This paper focuses on digital leadership capabilities. It contributes to the main preceding works through an original idea from us. We combined global digital readiness researched by Cisco in 2019, innovation researched by (Cornell University et al. 2019), and competitiveness 4.0 researched by (WEF 2019) to be the main components of digital leadership capabilities in the economy. In this context, we used the G20 countries as the objects.

Further research will need to analyze digital capabilities in more groups of countries such as Asian countries, European countries, developed countries and developing countries. Digital capabilities at the macroeconomic level are closely related to the gross domestic product, inflation, unemployment, government spending, interest rates, and exchange rates. It is a niche and a need for future study.

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