

# “Is It Hype or Reality?”: A Global Study of Assessing the Rate of Digitalization



**Mahikala Niranga**

*Southern Cross University, Australia*

**Darshana Sedera**

*Southern Cross University, Australia*

## INTRODUCTION

Digitalization has become one of the most pronounced buzzwords in the corporate literature and academic press in the last decade (Adikari et al., 2021; Frost & Duan, 2020; Gavrilu & De Lucas Ancillo, 2021; Lokuge et al., 2019; Sedera, Tan, et al., 2022; Webb et al., 2021). The impact of digitalization has been attributed to high productivity (Kravchenko et al., 2019; Niranga et al., 2022a; Sedera & Lokuge, 2019), hyper-customization (Jain, 2018; Lokuge & Sedera, 2014; Sedera et al., 2016) and more broadly high competitiveness (Chung et al., 2017; Langley et al., 2021). Business operations can be made more effective, consistent, and high-quality with the help of digitization, which facilitates improved customer service (Lokuge et al., 2018). Additionally, it has given businesses a number of distinctive skills and improvement prospects (Rachinger et al., 2019; Reis et al., 2020). As such, much of the anecdotal commentary reported in the commercial press suggests that the world has never seen this rate of increase in digitalization, especially during the past decade (Gorenšek & Kohont, 2018; Sedera, Lokuge, et al., 2022).

Digitalization prior to the advent of digital technologies like social, mobile, analytics and cloud was expensive (Sedera et al., 2002; Urbach & Röglinger, 2019). It required substantial resources, and appropriately there were substantial differences between rich countries and developing countries, creating a digital divide that favors more resourceful countries (Aissaoui, 2021; Qureshi & Davis, 2007). However, with the cost of digital technologies reaching near zero (Lokuge et al., 2021; Sedera & Lokuge, 2018, 2020b; Sedera, Lokuge, et al., 2022) in some applications, and with the purported productivity benefits of digitalization, countries are said to be embarking on a rapid rate of digitalization (Kravchenko et al., 2019; Niranga et al., 2022a). Such endeavors are further supported by the high rate of internet coverage, where over 66.2% of the world is now having regular Internet usage (Internet World Stats, 2021).

Especially with the lockdowns and remote working required by the COVID-19 restrictions, there is a growing assumption that the whole world is moving fast in digitalization than in previous years (Frost & Duan, 2020; Gavrilu & De Lucas Ancillo, 2021). The effects of COVID-19 changed the very nature that organizations operate, with an immediate transition to the digitalization of processes in sectors like education, finance, and health (Alshubiri et al., 2022; Lokuge & Duan, 2021; Niranga et al., 2022b). Similarly, interactions with employees, decision-making, and corporate communications shifted more to online platforms (Anthony Jnr & Abbas, 2021; Niranga & Sedera, 2022). One of the pandemic's fastest-growing apps was Zoom in remote working, with meeting participants rising by 2900% to 350 million by December 2020 (Molla, 2020).

DOI: 10.4018/978-1-6684-7366-5.ch049

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Therefore, it is evident that an exponential rise was foreseen as a result of the COVID-19’s abrupt rate of digitalization transition, which compelled everyone to move quickly to digital (Lokuge & Duan, 2023). Accordingly, the state of global digitalization in various parts of the globe is investigated in this study, as the explosive growth of digitalization opens more contacts between nations and social groupings at all levels of development. More specifically, the paper observes whether there *‘Is there evidence of exponential growth of digitalization universally visible because of COVID-19 pandemic?’*. As such, this study examines the behavioral patterns of the rate of digitalization using the event study methodology, covering annual panel data from 2018 to 2020 by looking at 7 regions from 157 countries.

While every researcher and practitioner expected that digitalization would grow faster, especially in light of COVID-19, *the results of this study indicate controversial evidence, that the rate of digitalization in most parts of the world is slowing down*. As such, the data analysis presented herein does not support a fundamental assumption of a high rate of digitalization, which has been employed in critical strategies. In the remainder of this paper, the theoretical foundation is first introduced, followed by the research methodology. Then, the study presents preliminary results. Finally, the conclusion outlines the expected contributions. It sums up the findings and argument for a new approach to studying the rate of digitalization from a combined country and region perspectives.

## BACKGROUND

### Digitalization and The Rate of Digitalization

Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business (Parida et al., 2019). It has changed how people produce goods and services, innovate, and interact with other firms, workers, consumers, and governments (Graupner et al., 2021; OECD, 2019). These digital technologies seem to propose an enormous potential to develop a country’s productivity and, ultimately, living standards (Alshubiri et al., 2022). Similarly, digitalization has brought positive changes to business corporations, such as increased productivity, cost efficiency, enhanced security, enhanced information preservation, disaster recovery space-saving, staying competitive, and environmentally friendly digital transformation (Gorenšek & Kohont, 2018; Vilkas et al., 2022).

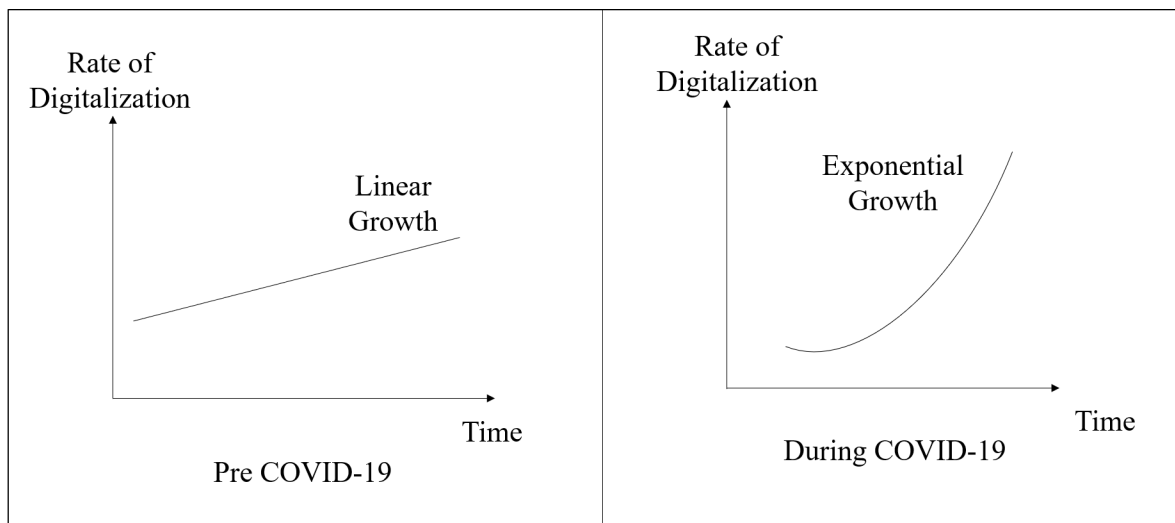
Overall, literature addressing digitalization has received increased attention from the firm and country perspectives (GSMA Intelligence, 2021; OECD, 2020). Over the past few years, there has been a surge in digital tools and technologies (Aly, 2020). As a result, digitalization has significantly altered the business landscape in every nation; corporate leadership has become more involved in decision-making and has delegated authority to others, employees have become much more collaborative and encouraged to work in teams, and agility has become a buzzword everywhere (Atapattu et al., 2016; Sedera & Atapattu, 2019; Sedera et al., 2017). Equally, it has parted everyone from being in one place to operate business activities due to more accessible, available, and transparent digital technologies (Langley et al., 2021). Nevertheless, it has progressed to 24×7 flexible work schedules with work remotely approach.

Apparently, there is consensus in recent times that the world has become gradually digitalized, mainly due to the COVID-19 pandemic (Venkatraman, 2020). Given the global developments ushered in by COVID-19, it’s no wonder that digitalization has made and will continue to make huge technological adaptations that have altered how people produce goods and services, innovate, and engage with other businesses, workers, consumers, and governments (Forums, 2020; Graupner et al., 2021; Hess, 2020;

OECD, 2019; Sedera et al., 2021). The cumulative effect of the myriad use of digital technologies and their impact on society has created a considerable amount of interest in understanding this new opening that all are experiencing today. Correspondingly, in the last few quarters, the adoption of digital technology has significantly increased, which is apparent from online banking, phone-based payments, chatbots, e-commerce, and online deliveries that have experienced hyper adoption (Lokuge & Sedera, 2018; Venkatraman, 2020). As a result, the pandemic in particular made rapid social transformation required for a more important cause than before (Sasikumar & Sersia, 2020). In order to respond to the COVID-19 by making positive changes to their lives, people and organizations have increased their usage of digital technologies in daily activities (Ghazali et al., 2018; Lokuge & Sedera, 2018; Tan et al., 2017; Walther et al., 2018).

Therefore, everyone anticipated that the use of digitalization would increase exponentially over time with COVID-19 as opposed to linearly after COVID-19 (Melluso et al., 2020). Evidently, an exponential rise was anticipated as a result of the COVID-19's immediate rate of digitalization transition, which forced everyone to migrate quickly to digital. Business transactions can advance at an exponential rate, attributable to the exponential expansion of information technology usage. Figure 1 presents the presume behavior of the rate of digitalization prior to COVID-19 and expected behavior during COVID-19.

*Figure 1. Patterns of Purported Rates of Digitalization*



### **Digitalization, Measured Using ICT / Digital Indicators**

Digitalization indexes have long been a source of countless openings for personal realization, professional development, and value creation. With technology advances, it has become a vital necessity for working, learning, accessing essential services, and keeping in touch to assess digital activities (Ahmad et al., 2013; Hanafizadeh et al., 2009). In this scenario, plenty of world organizations kept working and trying to show the potential of ICT in various nations, regions, and the world as a whole (Momino & Carrere, 2016). International Communication Union (ITU), the World Bank, the Organization for Economic Cooperation and Development (OECD), International Institute for Management Development (IMD), and CISCO are a few examples of organizations that actively participate in this enormous role.

Various researchers and practitioners have used the digital/ICT/Telecommunication indicators in their studies (Aleksandrova & Khabib, 2021; Hanafizadeh et al., 2009; Lokuge & Sedera, 2016; Momino & Carrere, 2016).

## **Active Mobile-Broadband Subscriptions**

This indicator has been adapted from ITU and used in various other data sources such as CISCO digital readiness index (CISCO, 2022), IMD world competitiveness ranking (CISCO, 2022), and the world bank database (World Bank, 2022). Accordingly, this indicator has been defined as *“the sum of active handset-based and computer-based mobile-broadband subscriptions to the public Internet”* (ITU, 2022a, p. 2). The data has been presented per 100 inhabitants based on data collected annually through questionnaires, government reports, and operators’ annual reports. Additionally, the IS researchers too (Aleksandrova & Khabib, 2021; Momino & Carrere, 2016) have used this indicator to assess international connectivity in communications networks. As per Johansson and Andersson (2016) acceptance and adoption of e-services would be simple and automatic, given the high growth rates of wireless broadband subscriptions and smart devices. Moreover, the most vibrant platform for providing ICT benefits is mobile broadband, which guarantees greater reach and reduced prices (Alderete, 2017).

## **Digital/Technological Skills**

Under the assessments of the International Institute for Management Development (IMD), digital competitiveness ranking has been foreseen to identify digital/technology skills, mobile broadband subscribers, and e-participation of 64 economies (IMD, 2021a) with the sub-factor rankings of the regulatory framework, capital, and technology framework (IMD, 2021b). This has been taken from IMD World Competitiveness Executive Opinion Survey based on an index from 0 to 10. Additionally, this has been defined as *“Know-how necessary to discover, understand and build new technologies”*. Moreover, the assessment was based on three subcategories; talent, training and education, and scientific concentration (IMD, 2021a, 2021b). Moreover, Budzinskaya and Teregulova (2021) used digital/technology skills to look at the staffing priorities of a digital economy. Equally, digital skills and knowledge has been identified as one of the influencing factors of the level of digitalization that leads to economic development (Pyroh et al., 2021; Sedera & Dey, 2013). Through the digital divide, James (2021) has discussed the value of digital skills and quantified the problem of their shortage. However, due to the widespread adoption of social distancing practices during the COVID-19 outbreak, digital skills were essential for most of the business corporations (Katz et al., 2020; Venkatraman, 2020).

## **Fixed Broadband Subscriptions**

World Bank (2022) has defined the fixed broadband subscriptions indicator as *“fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s”*. Further, this includes cable modem, DSL, fiber-to-the-home/building, other fixed (wired)-broadband subscriptions, satellite broadband, and terrestrial fixed wireless broadband. Accordingly, this total is measured per 100 people irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks and includes fixed WiMAX and any other fixed wireless technologies both in residences and organizations. (World Bank, 2022). Similarly, these world development indicators have been used in

previous studies in plenty of directions to examine the growth, economic development (Alshubiri et al., 2022; Aly, 2020), Internet usage, and diffusion (Na et al., 2018).



## Households with Internet Access at Home

It is noted that this indicator has been presented as a percentage from 0-100 by ITU to assess international connectivity in communications networks under the key category, ICT infrastructure and access (ITU, 2021; Wathuge & Sedera, 2021, 2022; World Bank, 2022). This indicator has been defined as “the proportion of individuals who have used the Internet from home in the last three months that have access to a number of communication services including the world wide web and carries e-mail, news, entertainment, and data files, irrespective of the device used” (ITU, 2022b, pp. 1-2). Moreover, Carroll et al. (2005) and Deursen (2020) have used this in their medical research to assess the digital divide in a pediatric clinic population from the socio-economic status. Besides, Zhang and Maruping (2008) assessed the household technology adoption by incorporating the role of espoused cultural values.

## Individuals Using the Internet

This indicator has been used by many researchers and practitioners to look at Internet usage by individuals in a nation. As per ITU (2017) this indicator illustrates “*the proportion of individuals who have used the Internet from any location in the last three months*”. Internet usage has been assessed as a percentage value from 0 to 100 of the population by looking at access via a fixed or mobile network. Further, this has not been assumed to be only via a computer – it may also be by mobile telephone, tablet, PDA, games machine, digital TV, etc.(ITU, 2017, p. 47). Further, different scholars study Internet usage from an individual’s perspective to assess the digital inequality (Deursen, 2020), diverse outcomes of engaging with the Internet (Deursen & Helsper, 2017), and as well as in Internet research using public data sources (Hanafizadeh et al., 2009).

## Mobile Broadband Subscribers

As per IMD (2021b) mobile broadband subscribers have been identified in the “*4G & 5G market as a percentage (%) of the mobile market*”. This has been adopting and exploring digital technologies as a key driver for economic transformation in business, government, and wider society, which has been measured as a percentage of the mobile market on a 0 to 100 scale. 5G connectivity is expected to drive the market growth of the Internet of Things in the coming years, as the newer mobile technology will connect machines and devices with higher data speeds, ultra-low latency, and increased availability, among other benefits. Although 5G offers faster data transfer and lower latency, 4G/LTE will be a major feature of the mobile broadband landscape in the future (Statista, 2022). The current scientific literature on the level of digitalization in the world economies combines 4G and 5G mobile markets to understand competitiveness as driving forces to boost economies (Lehr et al., 2021). Equally, it has been widely adapted to recognize advanced communication possibilities promising a growing economy (Schneir et al., 2019).

## Secure Internet Servers

Above and beyond the fact that, at the World Bank, secure Internet servers have been used to measure the development progress of a nation in relation to science and technology from the Netcraft Secure Server Survey based on the evaluation of one million people (World Bank, 2022). Subsequently, secure Internet servers have been identified by the World Bank and Netcraft surveys related to *“those sites bear the distinct, publicly-trusted TLS/SSL certificate, is valid for the hostname, and the certificate has been issued from a publicly-trusted root in the mean of the use of encrypted transactions through extensive automated exploration”* (Indexmundi, 2019). It is evident that this indicator has been used by scholarly work especially under cyber and information security (Garg et al., 2013) and ethical considerations of web-based behavior of individuals (Kravchenko et al., 2019; Sedera & Lokuge, 2020a).

## METHODOLOGY AND DATA PREPARATION

The present research seeks to contribute to a better understanding of the nature of the rate of digitalization during the COVID-19 pandemic which has been recognized in 2019. Drawing from previous studies on diverse streams of ICT/digital indicators and measurements (Aleksandrova & Khabib, 2021; Momino & Carrere, 2016), this study involves an assessment of the rate of digitalization from regional and country perspectives. This assesses the behavioral patterns of the rate of digitalization using the event study methodology – for a period of 3 years from 2018 to 2020 (Nagm & Cecez-Kecmanovic, 2009). This study uses the annual panel data covered. The indicators were collected from the International Communication Union indicators (ITU, 2021), the World Development indicators (World Bank, 2022), and the IMD world digital competitiveness ranking (IMD, 2021b). Based on the comprehensive data availability, the researchers have identified 7 significant digital/ICT indicators for the investigation. The set of indicators and the sources are shown in Table 1. below.

*Table 1. Indicators and Source Document*

<b>Indicator</b>	<b>Indicator</b>	<b>Source Document</b>
<b>I1</b>	Active mobile broadband subscriptions (per 100 inhabitants)	ITU (2021)
<b>I2</b>	Digital/ Technology Skills (readily available)	IMD (2021b)
<b>I3</b>	Fixed broadband subscriptions (per 100 people)	World Bank (2022)
<b>I4</b>	Households with Internet access at home (% of population)	ITU (2021)
<b>I5</b>	Individuals using the Internet (% of population)	ITU (2021)/ World Bank (2022)
<b>I6</b>	Mobile broadband subscriptions- 4G & 5G market (% of mobile market)	IMD (2021b)
<b>I7</b>	Secure Internet servers (per 1 million people)	World Bank (2022)

These 7 indicators were analyzed by 7 regions across different nations similar to the studies that have been used with equal criteria (Aleksandrova & Khabib, 2021; McKinsey & Company, 2020; Shahiduz-zaman et al., 2018). The regions are Europe and Northern America, Latin American and Caribbean, Eastern and South-Eastern Asia, Central and Southern Asia, Oceania, Northern Africa and Western

Asia, and Sub-Saharan Africa. The below Table 2. shows the regions and particular nations that the researchers have considered for the assessment of the rate of digitalization as per the categorizations presented by United Nations (Beltekian, 2021; United Nations, 2021, 2022). Additionally, nations were chosen based on the requirement that at least 2 data points for each of the seven indicators be present.



*Table 2. Regions and Nations as per United Nations Categorization*

Region	Sub Regions	Countries
<b>Europe and Northern America</b>	Northern Europe	Denmark, Norway, Sweden, Finland, Iceland, United Kingdom, Lithuania, Latvia, Estonia, Ireland
	Southern Europe	Albania, Andorra, Bosnia and Herzegovina, Montenegro, San Marino, Serbia, Malta, Croatia, Greece, Italy, Spain, Portugal, Slovenia
	Eastern Europe	Hungary, Poland, Romania, Bulgaria, Russia, Slovakia, Belarus, Moldova, Czech Republic, Slovak Republic, Ukraine
	Western Europe	Belgium, Germany, Austria Netherlands, Luxembourg, Liechtenstein, Switzerland, France, Monaco
	Northern America	Canada, United States
<b>Latin American and Caribbean</b>	South America	Bolivia, Ecuador, Paraguay, Suriname, Uruguay, Venezuela, Argentina, Brazil, Colombia, Chile, Peru
	Central America	Belize, Costa Rica, El Salvador, Honduras, Nicaragua, Panama, Mexico
	Caribbean	Barbados, British Virgin Islands, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago
<b>Eastern and South-Eastern Asia</b>	Eastern Asia	Korea Rep., Mongolia, Japan, Hong Kong, China
	South-Eastern Asia	Viet Nam, Brunei Darussalam, Myanmar, Timor-Leste, Singapore, Cambodia, Indonesia, Philippines, Thailand
<b>Central and Southern Asia</b>	Central Asia	Kazakhstan, Uzbekistan
	Southern Asia	India, Afghanistan, Bangladesh, Bhutan, Pakistan, Iran (Islamic Republic of), Sri Lanka
<b>Oceania</b>	Oceania	Australia, Fiji, Kiribati, Solomon Islands, Vanuatu, New Zealand
<b>Northern Africa and Western Asia</b>	Western Asia	Armenia, Azerbaijan, Georgia, Syrian Arab Republic, Turkey, Cyprus, Israel, Qatar, Bahrain, Kuwait, Lebanon, Oman, United Arab Emirates, Iraq, Jordan, Saudi Arabia
	Northern Africa	Morocco, Tunisia, South Sudan, Sudan, Algeria, Egypt
<b>Sub-Saharan Africa</b>	Eastern Africa	Burundi, Comoros, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Tanzania, Uganda, Zimbabwe, Zambia, Djibouti
	Middle Africa	Angola, Cameroon, Chad, Equatorial Guinea, Gabon
	Western Africa	Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea-Bissau, Mali, Mauritania, Nigeria, Senegal, Togo
	Southern Africa	Botswana, Lesotho, Namibia, South Africa

The researchers have carried out a number of clarifying activities to demonstrate the actual utilization of digital technologies using these initial datasets and regional categorization. In order to determine if there will be an increase or decline from 2018 to 2020, the researchers first discovered the raw figures of the discrepancies between 2018-2019 and 2019-2020. Second, using the equation below, the researchers determined the rate of change as a percentage (%) value. The appendix contains the whole table as well as the additional supporting tables.

$$\text{Rate of Change}(\%) = \frac{(\text{Difference } 2019 - 2020) - (\text{Difference } 2018 - 2019)}{(\text{Difference } 2018 - 2019)} \times 100$$

**PRELIMINARY RESULTS AND DISCUSSION**

An event study was conducted based on publicly available data consisting of 7 digital/ICT indicators from 2018 to 2020. Figure 2 to 8 display the average results of all 7 digital/ICT indicators as per the region which has been presented as a percentage increase or decrease of the rate of change in digitalization.

**Europe and Northern America:** Only one indicator, individuals using the Internet (I5), has shown an exponential growth in Europe and Northern America (45 countries) which is the biggest region, with an 11% increase. Nearly 15 countries in the region have expressed support for I5 growth. The remaining six indicators varied widely from -20% to -139%. Even though 12 countries were backed by a features and patterns, the households with internet access at home (I4) had the largest negative impact with a -139%. Active mobile broadband subscriptions (I1) and digital/technological skills (I2) had the next-largest negative effects, with -51% and -45%, respectively. Fixed broadband subscriptions (I3) experienced the smallest decline because the indicator has seen positive development in 22 of the region’s countries. Secure internet servers (I7) and mobile broadband users (I6), which present by -28% and -32% fall rates, respectively, have similar outcomes during 2018 to 2020. More fascinatingly, 15 countries out of 45 were shown to have exponential growth as the average result in all 7 indicators. Figure 2, which presents a visual representation of behavioral patterns for seven digital/ICT indicators with a geographic focus, is shown below.

Figure 2. Rate of Change in Europe and Northern America  
Image source: MapChart (2022)

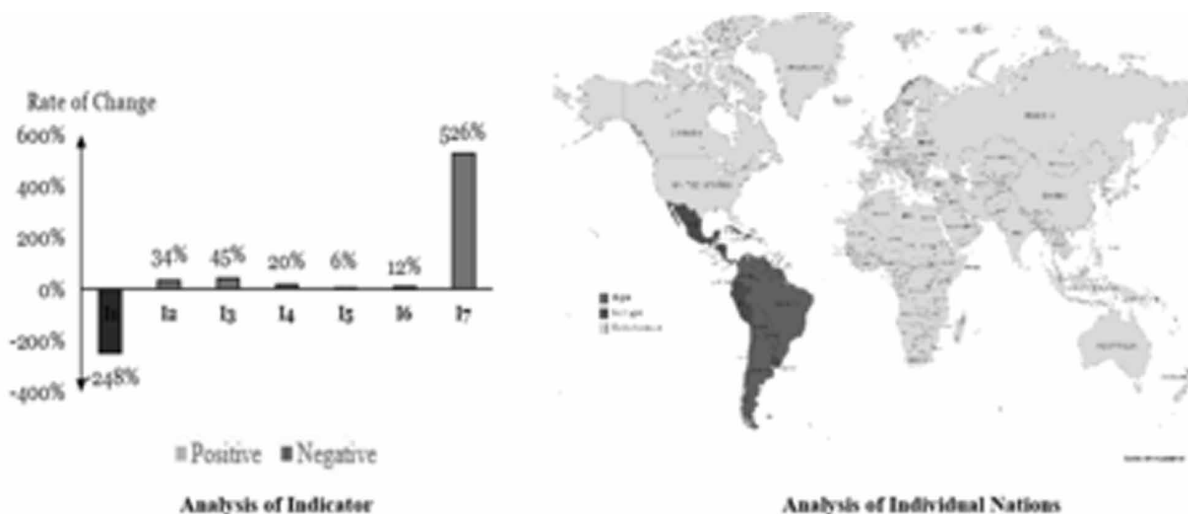






**Latin American and Caribbean:** The data presentation demonstrates that the Latin American and Caribbean region gave priority on digitization from 2018 to 2020. Surprisingly, all indicators reported in the region exhibit exponential growth rates, with the exception of active mobile broadband subscribers (I1). Secure internet servers (I7) have experienced the highest growth, at 526%. Then, fixed broadband subscriptions (I3), digital/technological skills (I2), households with home internet access (I4), mobile broadband subscribers-4G and 5G markets (I6), and individuals using the Internet (I5) all reported a positive rate of change growth of 45%, 34%, 20%, 12%, and 6%, respectively. The majority of the countries in the region have reported I1 results that are negatively curving, which may be attributed to the indicator’s overall average’s unfavorable outcome. Furthermore, the aggregate analysis using all 7 indicators demonstrated exponential growth in 13 of the 28 countries. Figure 3 shows the graphical representation of the behavioral patterns of seven digital/ICT indicators with a geographic focus.

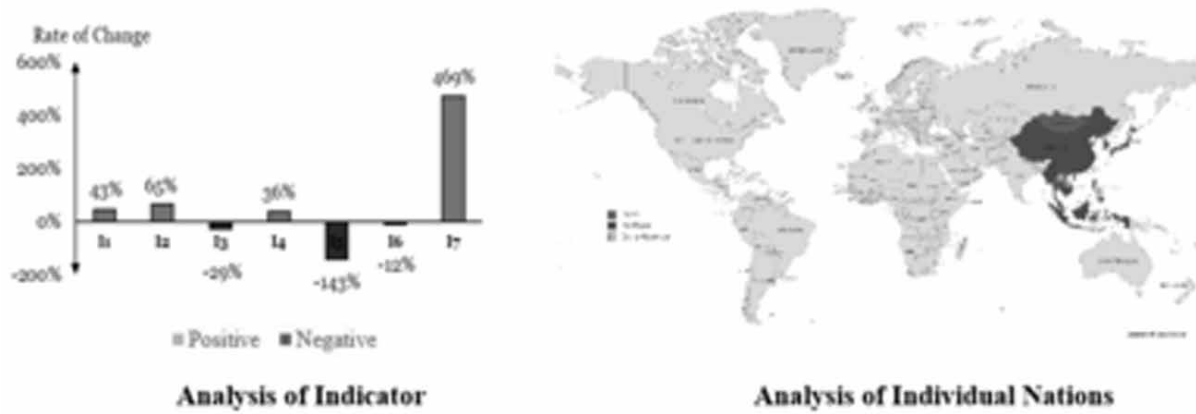
Figure 3. Rate of Change in Latin American and Caribbean  
Image source: MapChart (2022)



**Eastern and South-Eastern Asia:** The rate of change for four indicators—active mobile broadband subscribers (I1), digital/technological skills (I2), households with home internet access (I4), and secure internet servers (I7)—shows an exponential growth in the Eastern and South-Eastern region, with respective values of 43%, 65%, 36%, and 469%. It is evident that the region has prioritized secure internet servers, which may be connected to the new COVID-19 policies and guidelines. However, the results are negative for fixed broadband subscriptions (I3), individuals using the Internet (I5), and mobile broadband subscribers (4G and 5G markets) (I6), with respective results of -29%, -143%, and -12%. As per the analysis findings, seven of the 14 countries examined demonstrate exponential growth in the average calculation of all seven digital/ICT indicators, which shows 50% of countries within the regional analysis. Even more excitingly, Thailand is the only nation with growth rates across all indicators except I6. Figure 4 provides a schematic representation of the behavioral patterns of seven digital/ICT indicators and their geographic focus.

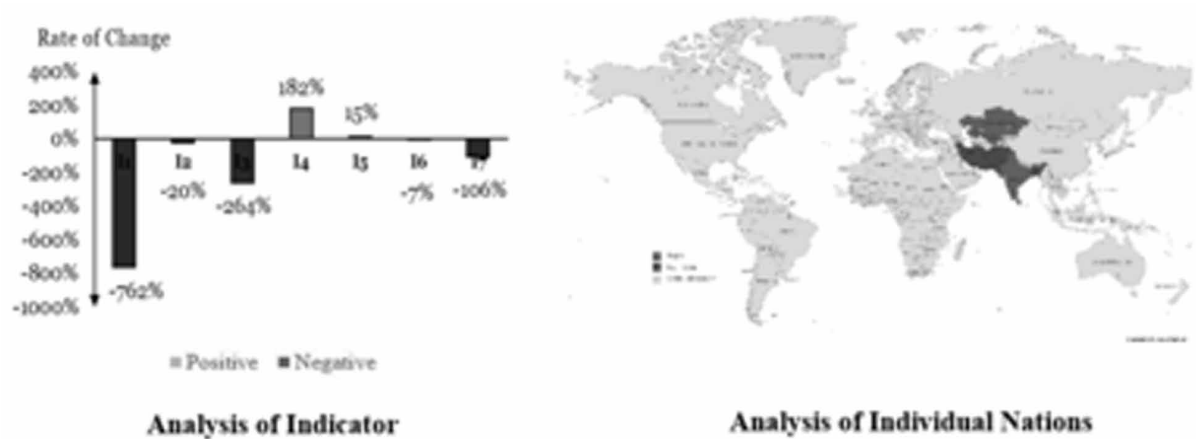
**“Is It Hype or Reality?”**

*Figure 4. Rate of Change in Eastern and South-Eastern Asia*  
 Image source: MapChart (2022)



**Central and Southern Asia:** Both the households with internet access at home (I4) and the individuals using the internet (I5) in Central and Southern Asia region has increased exponentially by 182% and 15%, respectively. I4 has grown mostly as a result of Uzbekistan’s 1553% I4 growth rate. The remaining indicators, such as active mobile broadband subscriptions (I1), digital/technological skills (I2), fixed broadband subscriptions (I3), mobile broadband subscribers (I6), and secure internet servers (I7), on the other hand, show negative results with -762%, -20%, -264%, -7%, and -106%, respectively. The negative result of -7058% for I1 in Sri Lanka had the most adverse effect, amounting to -762%. Four of the region’s nine classified countries have positive growth rates when the average of the seven digital/ICT indicators is calculated. Figure 5 shows an illustration of the behavioral patterns of seven digital/ICT indicators as well as geographical understanding.

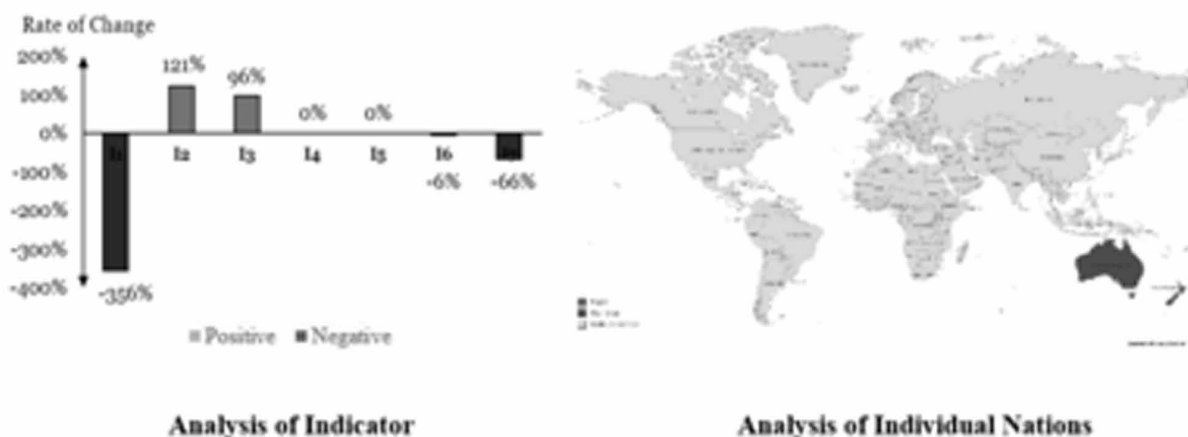
*Figure 5. Rate of Change in Central and Southern Asia*  
 Image source: MapChart (2022)





**Oceania:** Oceania does have 121% and 96% exponential growth rates in two indicators: digital/technological skills (I2) and fixed broadband subscriptions (I3). According to the data analysis from 2018 to 2020, all the remaining indicators produced negative results. Active mobile broadband subscriptions (I1), mobile broadband subscribers (I6), and secure internet servers (I7) display, respectively, -356%, -6%, and -66%. Due to the lack of data in all six of the classifiable nations, the results for the households with home internet access at home (I4) and the individuals using the internet (I5) both indicate 0%. Despite the insufficient data, two nations exhibit exponential growth when the average of all seven indicators is calculated. In light of various aspects, half of the countries in the regional classification indicate positive growth rates in I1, I2, I3, and I7. Figure 6 shows a schematic diagram of both the behavioral patterns of seven digital/ICT indicators and geographical insight.

Figure 6. Rate of Change in Oceania  
Image source: MapChart (2022)



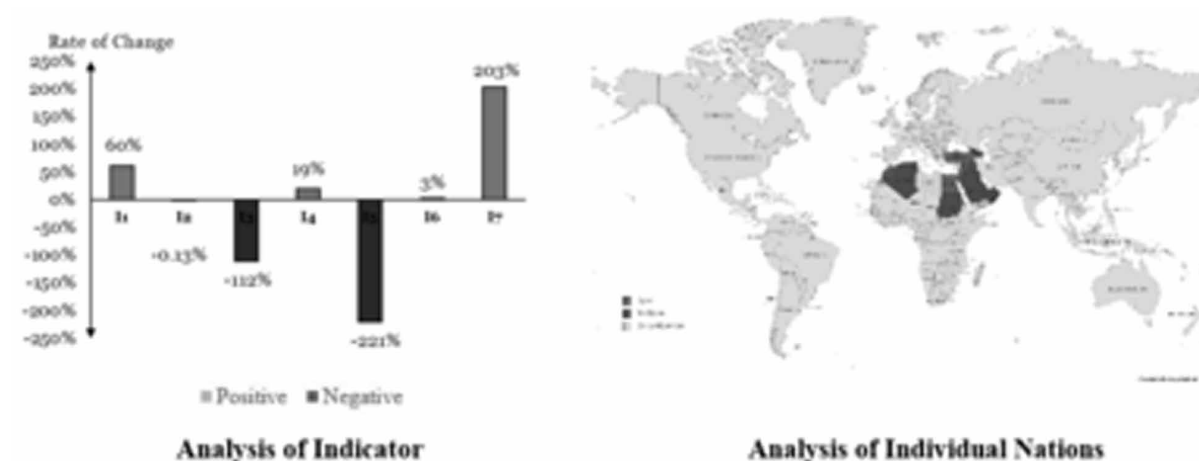
**Northern Africa and Western Asia:** Digital/ICT indicators of active mobile broadband subscriptions (I1), households with internet access at home (I4), mobile broadband subscribers (I6), and secure internet servers (I7) in Northern Africa and Western Asia all reflect exponential growth in the rate of change from 2018 to 2020, with respective parameters of 60%, 19%, 3%, and 203%. Digital/technological skills (I2) fixed broadband subscriptions (I3) and the individuals using the internet (I5), on the other hand, indicate weak results of -0.13%, -112% and -221%, respectively. The majority of the countries in the region have reported I1 and I7 growth rates that have led to overall exponential growth. Furthermore, 9 of the 22 countries have reported an exponential growth rate for the rate of change calculation, which considers all 7 indicators. Figure 7 provides a visual representation of 7 digital/ICT indicators' behavior patterns and geographical awareness.

**Sub-Saharan Africa:** Sub-Saharan Africa, like Europe and North America, is a major cluster. According to the data availability within the selection criteria, the researchers used 33 countries for the analysis. Although several countries were considered, only active mobile broadband subscriptions (I1) exhibit an exponential growth during the period with a 1028% growth. Zimbabwe recorded a significant increase in I1, which strengthened the indicator as a region. All the other remaining indicators were reported negative results, digital/technological skills (I2) with -19%, fixed broadband subscriptions (I3) with -131%, households with internet access at home (I4) with -0.06%, individuals using the internet (I5)

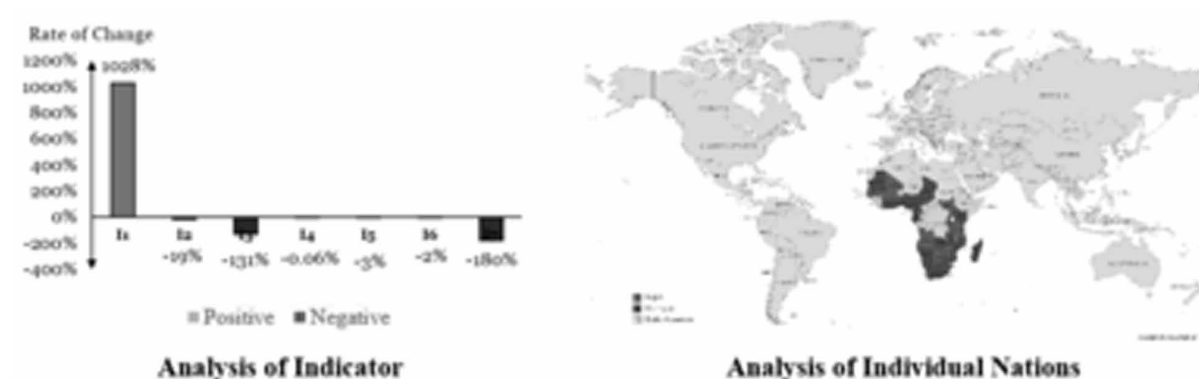
*“Is It Hype or Reality?”*

with -3%, mobile broadband subscribers (I6) with -2% and secure internet servers (I7) with -180%. Out of 33 countries, only 11 exhibit exponential growth according to the average calculation. Due to the absence of data, as shown in Figure 6, the researchers were unable to acknowledge important geographic places, including Niger, Ethiopia, and the Democratic Republic of the Congo. Figure 8 provides a graphical representation of the behavioral patterns of seven digital/ICT indicators and geographic location insight.

*Figure 7. Rate of Change in Northern Africa and Western Asia*  
Image source: MapChart (2022)



*Figure 8. Rate of Change in Sub-Saharan Africa*  
Image source: MapChart (2022)



Additionally, it is apparent that 61 out of 157 countries assessed provided the fixed broadband subscriptions (I3) significant attention. With a total of 44 countries, I7, which is the secured internet servers, has received the second-largest amount of attention. Surprisingly, no growth impact has been observed by any of the countries in the Central and Southern Asia region. Thirdly, 40 countries are paying much attention towards active mobile broadband subscriptions (I1). Then, it became evident that 30 countries had individuals using the internet (I5), 25 countries had households with internet access at home (I4), 24 countries had mobile broadband subscribers (I6), and 13 countries had digital/technological skills

(I2). Oceania exhibits zero results in all I4, I5, and I6 since there was not enough data to show results. Table 3. presents the nations below that have a favorable effect on the rate of digitization.



*Table 3. Number of Countries Making a Favorable Effect on the Rate of Change*

Region	Indicator						
	I1	I2	I3	I4	I5	I6	I7
Europe and Northern America (45)	9	5	22	12	15	14	10
Latin American and Caribbean (28)	3	2	13	5	4	5	11
Eastern and South-Eastern Asia (14)	3	3	3	2	3	2	3
Central and Southern Asia (09)	3	-	5	2	2	-	-
Oceania (06)	1	1	1	-	-	-	1
Northern Africa and Western Asia (22)	9	2	7	4	5	3	10
Sub-Saharan Africa (33)	12	-	10	-	1	-	9
<b>Total</b>	<b>40</b>	<b>13</b>	<b>61</b>	<b>25</b>	<b>30</b>	<b>24</b>	<b>44</b>

According to the findings, Sub-Saharan Africa, in comparison to all other regions, reports a significant growth (99%) in the rate of digitization from 2018 to 2020. Similar results are seen for the rate of change in overall digital/ICT indicators in Latin America and the Caribbean (56%) and Eastern and South-Eastern Asia (61%) regions. Moreover, I7 (1028%), which is the secure internet servers, played a significant role in the apparent rapid growth of Sub-Saharan Africa. Contrarily, the rate of change in digitization from 2018 to 2020 is negatively impacted in Europe and North America (-43%) as well as Central and Southern Asia (-137%), Oceania (-30%), Northern Africa, and Western Asia (-7%). Despite the fact that the overall results are negative, each one has exploited digitization in a unique way by demonstrating a growth rate in at least one indicator. The majority of digital/ICT indicators are favorable and have also been incorporated by Latin America and the Caribbean, Northern Africa, and Eastern and South-Eastern Asia. With the exception of active mobile broadband subscriptions (I1), all of the indicators have been adopted in Latin America and the Caribbean, which has also experienced exponential growth in the rate of digitization. In contrast, the least adapted indicators, yet, reported exponential growth rates are I2, which is digital/technological skills, I4 which is households with internet access at home, and I7, which is secure internet servers with the overall percentage value of indicators as 19%, 17%, and 117% respectively. Surprisingly, the average rating for the 157 countries considered was a negative value of -1% for all 7 regions.

The world map is shown in Figure 9 below is based on the examination of the rate of change in digitization using annual panel data from 2018 to 2020. It is evident from the graphical display that the majority of the countries were unable to demonstrate an exponential growth in the rate of change according to the digital/ICT indicators. In addition, 61 countries embraced digital adaptations, whilst 96 lagged far behind out of 157 countries in the world.

Figure 9. The World Map  
Image source: MapChart (2022)



## DATA COMPLETENESS

Out of the seven digital/ICT indicators, the researchers have chosen countries where there are at least two data points during the period from 2018 to 2020. Data for every and every indicator was published in detail in 44 countries. Most of them were from Europe and Northern America. Out of 45 countries, 28, which is 62% as a percentage, had completed data. The countries are, Denmark, Norway, Sweden, Finland, Iceland, United Kingdom, Lithuania, Latvia, Estonia, Ireland, Croatia, Greece, Spain, Portugal, Slovenia, Hungary, Poland, Romania, Bulgaria, Czech Republic, Slovak Republic, Ukraine, Belgium, Germany, Austria, Netherlands, Luxembourg, and Canada. Similar to this, completed data points from 5 countries in Latin America and the Caribbean, 6 countries in Eastern and South-Eastern Asia, and 4 countries in Northern Africa and Western Asia were presented. The minimum criteria, which is to have two data points, was met by 35 countries. They are, Andorra, San Marino, Russia, Slovakia, Uruguay, Venezuela, Belize, El Salvador, Barbados, British Virgin Islands, Dominica, Dominican Republic, Grenada, Haiti, Puerto Rico, Viet Nam, Myanmar, Timor-Leste, Iran, Fiji, Solomon Islands, Vanuatu, Lebanon, South Sudan, Sudan, Burundi, Comoros, Madagascar, Malawi, Mozambique, Uganda, Equatorial Guinea, Cote d’Ivoire, Guinea-Bissau, and Nigeria. Additionally, most of the countries are in Latin America and the Caribbean, and I2, I3, I4, I5, and I6 were the most frequently reported indicators to have missing data.

Out of all 157 countries, 100 countries had with missing data in digital/technological skills (I2), 98 in mobile broadband subscriptions- 4G & 5G market (I6), 88 in individuals using the Internet (I5), 87 in households with Internet access at home (I4), 35 in fixed broadband subscriptions (I3), 11 in active mobile broadband subscriptions (I1) and 5 in secure Internet servers (I7).

## SOLUTIONS AND RECOMMENDATIONS



This study will contribute to a better understanding and assessment of digitalization and the rate of change in countries, regions, and the world in general. This will include better explanations of different types of digital measurements that are most important and least important for the economic growth of a country, region, and world. When the rate of digitalization is low, it does not contribute to development, economic growth, bringing people together, or allowing for better resource utilization. Digitization has the potential to increase productivity, create new jobs, and improve societal quality of life. On a broader level, these outcomes will be relevant for critical government decisions about national, and regional policies about the practice of digitalization in industries and sectors.

## FUTURE RESEARCH DIRECTIONS

While the current findings are heartening, the researchers acknowledge that the seven indicators may be limited in their scope that they do not capture the full magnitude of digitalization. There may be nuanced indicators of digitalization and geographically sensitive indicators that might further highlight trends of digitalization. Therefore, further analysis will reveal more precisely what makes nations to adopt more digital technologies and what made them not during COVID-19. Additionally, an analysis can be presented through a separate indicator assessment based on the market and production digitalization indicators along with the economic performance indicators to get a holistic understanding about the role of digitalization.

## CONCLUSION

The status of digitalization for enlightening business processes, economic growth, and gaining competitive advantage and strategic benefit has never been superior. With the COVID-19 pandemic, digital adaptation and usage have improved rapidly. Yet, 'Is there evidence of exponential growth of digitalization universally visible as a result of COVID-19?' remains an open research question. In this paper, the researchers have presented a research study that investigates this query by adopting an event study approach with an annual panel data analysis using 7 regions with 157 countries. These results although only preliminary, suggest that the different nations in the world have utilized digitalization in various aspects, which the researchers have presented through digital/ICT indicators. The quick analysis of three different time periods from 2018 to 2020, which was mainly based on COVID-19, revealed an interesting result with positive and negative growth in rate of digitalization. The adoption and use of digital technology did not increase as anticipated, despite this being true in certain other countries. Even though we expected that the digital adaptation and usage will go up as evident in some countries, it did not show growth as it is.

There are only three digital/ICT indicators that show a positive effect, and the rest is not adequate to come to an end decision to say that there is an exponential growth in the rate of change in digitalization. Overall, this study shows a completely contradictory view of digitalization. Largely, businesses are planning their digital strategy based on the assumption that there is a global digital revolution. Yet, the results cannot see such growth as per the preliminary results of the present study. One of the reasons would be that the organizations and individuals must be cautioned in their strategy formation. Further, this study will contribute to a better understanding and assessment of digitalization and the rate of change

in nations, regions, and the world in general. This will include better explanations of different types of digital measurements that are most important and least important for the economic growth of a nation, region, and world. On a broader level, these outcomes will be relevant for critical government decisions about national, and regional policies about the practice of digitalization in industries and sectors.

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## KEY TERMS AND DEFINITIONS

**Digitalization:** Digitalization is the adaptation of digital technologies to reshape a business model and generate new revenue and significance opportunities.

**Global Pandemic:** The spread of a new illness globally.

**Global Study:** A study of the entire globe.

**Hype of Digitalization:** The overall influence of digital technologies' extensive use and its effects on society.

**ICT/Digital Indicators:** Data on information and communication technology that is globally comparable for use in strategic decision making.

**Information Technologies:** Data-generating, data-storage, and data-processing electronic tools, systems, devices, and resources.

**Rate of Digitalization:** Engagement in some form of digital initiative which can assesses through the process and time.

## APPENDIX: RATE OF CHANGE CALCULATION

Figure 10. Rate of Change Calculation

World regions of the United Nations	Category	Source	ITU					World Digital Competitiveness Ranking					World Bank					ITU											
			Country	Active mobile-broadband subscriptions per 100 inhabitants			Rate of Change (%)	Digital/Technological skills are readily available			Rate of Change (%)	Fixed Broadband Subscriptions (per 100 people)			Rate of Change (%)	Households with Internet access at home (%)			Rate of Change (%)										
				Year	Year	Year		Year	Year	Year		Year	Year	Year		Year	Year	Year											
				2018	2019	2020		2018	2019	2020		2018	2019	2020		2018	2019	2020		2018	2019	2020							
Europe and Northern America (43)	Northern Europe	Denmark	140.00	138.03	138.67	-1.97	0.65	-132.99	8.13	7.97	8.59	-0.16	0.63	-493.75	44.09	43.95	44.40	-0.14	0.45	-423.37	92.66	95.43	92.54	2.77	-2.90	-204.56			
		Norway	99.18	101.71	103.71	2.53	2.00	-20.95	7.97	7.95	8.14	-0.03	0.19	-733.33	41.32	42.03	44.04	0.70	2.02	188.67	96.00	98.00	96.12	2.00	-1.88	-193.87			
		Sweden	126.94	128.78	128.99	1.84	0.21	-88.59	7.97	8.03	8.75	0.06	0.73	1,110.67	39.53	40.24	40.61	0.71	0.37	-47.89	92.00	96.06	94.00	4.06	-2.06	-150.75			
		Finland	154.46	154.91	155.76	0.46	0.84	82.61	8.32	8.71	8.60	0.38	-0.11	-128.95	31.45	32.48	33.32	1.03	0.83	-19.42	88.95	89.04	89.45	0.09	0.42	-366.67			
		Iceland	121.45	123.23	122.85	1.79	-0.38	-121.23	8.24	8.55	8.88	0.31	0.33	6.45	40.98	41.07	41.56	0.09	0.49	444.41	99.00	98.00	98.00	-1.00	-	-100.00			
		United Kingdom	98.54	103.78	107.68	5.24	3.89	-25.78	7.28	7.09	7.55	-0.17	0.47	-376.47	39.60	39.79	40.49	0.19	0.70	268.42	90.20	92.89	95.24	2.69	2.35	-12.64			
		Lithuania	98.55	105.73	117.20	7.17	11.48	-60.11	8.82	8.86	8.71	0.04	-0.15	-475.00	28.16	28.69	29.27	0.51	0.58	-7.41	78.38	81.52	82.13	3.14	0.61	-80.57			
		Latvia	130.23	132.83	141.28	2.60	8.45	-225.00	7.33	7.67	7.39	-0.33	-0.38	-215.15	27.28	26.69	26.71	-0.59	0.02	-103.39	81.25	85.45	89.73	3.97	4.28	-10.59			
		Estonia	145.72	157.62	165.06	10.90	7.45	-31.59	6.84	6.10	6.47	-0.71	0.37	-149.39	33.35	32.53	33.31	-0.82	-1.20	46.97	90.50	90.40	90.00	-0.10	-0.40	-298.91			
		Ireland	103.80	105.30	103.82	1.49	-1.48	-199.33	7.38	7.35	7.94	-0.01	0.31	3,000.00	29.64	29.95	30.71	0.28	0.75	167.86	89.00	91.00	92.00	2.00	1.00	-20.00			
	Albania	62.79	62.10	60.45	-0.68	7.34	-1,170.41							12.56	15.14	17.68	2.59	2.54	-1.93	32.92	82.20	83.28	49.27	1.08	-97.81				
	Azores	60.44	66.11	66.89	5.67	3.78	-33.33																						
	Bosnia and Herzegovina	55.38	47.27	49.49	-8.11	2.22	-127.37								21.55	22.60	23.49	1.04	0.89	-14.42	69.19	72.03	72.84	2.83	0.81	-71.38			
	Montenegro	73.16	80.50	85.91	7.34	5.41	-38.29								25.33	28.47	29.32	3.14	0.86	-72.61	72.18	80.26	80.26	2.97	6.01	190.34			
	San Marino	120.74	131.45	131.60	1.19	1.20	-1.84																						
	Serbia	83.45	90.28	94.79	6.84	4.53	-33.48								22.29	23.44	25.09	1.15	1.65	43.48	79.84	80.14	80.56	0.23	0.81	-88.80			
	Malta	85.09	87.99	96.50	2.89	8.51	194.46								43.67	45.99	48.33	2.31	2.35	1.73	84.14	86.08	90.36	1.94	4.28	120.62			
	Croatia	79.45	82.10	105.67	2.64	23.58	793.18	5.71	5.35	6.23	-0.35	0.87	-348.57	27.15	27.96	25.11	0.81	-2.85	-451.85	81.52	82.52	85.00	1.00	4.48	-548.00				
	Greece	81.38	87.10	88.57	5.72	1.46	-74.48	7.30	6.91	6.78	-0.39	-0.13	-66.67	37.65	39.25	40.84	1.60	1.59	-0.63	76.49	78.54	80.38	2.05	1.84	-10.24				
	Italy	89.89	92.20	93.17	2.31	0.97	-37.87	6.19	5.91	6.27	-0.28	0.36	-226.55	28.30	28.83	29.53	0.55	0.68	-22.05	75.12	76.15	79.05	1.03	2.90	181.11				
	Spain	98.48	102.94	105.30	4.46	2.36	-47.10	6.67	7.08	6.91	0.41	0.17	-141.32	32.50	33.41	33.90	0.91	0.49	-46.48	86.40	91.44	95.38	5.04	3.94	-21.70				
	Portugal	72.84	79.06	78.95	5.22	-0.11	-102.09	8.02	7.92	7.90	-0.11	-0.01	-88.90	36.90	38.80	40.81	1.90	2.01	-5.74	79.43	80.94	84.49	1.51	3.55	134.85				
	Slovenia	77.67	84.07	87.81	6.40	3.74	-41.56	7.45	7.81	7.42	-0.37	-0.39	-205.41	29.49	30.21	31.34	0.72	1.13	56.04	86.68	88.96	89.97	2.28	1.01	-55.70				
	Hungary	67.81	71.89	73.77	4.99	1.88	-54.03	5.34	4.99	5.50	-0.55	0.59	-242.86	31.72	32.94	33.80	1.21	0.87	-28.10	83.31	86.20	87.61	2.89	1.43	-50.52				
	Poland	171.70	185.78	197.43	14.08	11.65	-17.26	7.04	6.42	6.69	-0.62	0.27	-143.55	20.70	20.54	21.70	-0.16	1.16	-825.00	84.19	86.75	90.38	2.56	3.63	41.80				
	Romania	86.23	87.69	92.01	1.46	4.32	-195.89	7.93	7.47	7.49	-0.46	0.02	-104.35	26.09	27.25	29.55	1.16	2.30	98.28	80.89	83.64	86.24	2.73	2.63	-3.66				
	Bulgaria	101.01	105.61	106.37	4.60	0.77	-83.28	7.20	7.02	7.47	-0.18	0.45	-350.00	27.00	28.78	30.68	1.78	1.90	-6.74	72.13	75.07	78.85	2.94	3.78	-28.57				
	Russia						-125.24	7.12	6.51	6.63	-0.60	0.11	-118.33									80.84	82.19	85.78	1.35	3.59	165.03		
	Slovakia	85.98	89.15	88.35	3.17	-0.80	-102.04								15.38	16.58	17.82	1.21	1.24	2.48	54.21	60.76	64.61	6.85	3.86	-41.07			
	Belarus	86.34	89.47	91.58	3.14	2.11	-32.80								33.87	34.01	34.45	0.14	0.44	214.29	72.45	78.59	76.99	6.14	-1.60	-126.06			
	Moldova	53.51	58.89	58.78	5.38	-0.11	-102.04																						
	Czech Republic	87.98	92.51	94.40	4.53	1.89	-38.28	6.85	6.71	6.83	-0.14	0.12	-185.71	30.22	31.98	35.51	4.77	0.52	-89.10	80.48	81.13	81.67	0.64	0.55	-14.06				
	Slovak Republic	84.40	86.10	86.80	1.70	0.70	-31.84	7.15	7.32	6.93	0.18	-0.40	-322.22	27.65	29.26	31.77	1.60	1.91	19.38	81.00	80.00	80.00	0.00	1.00	-87.50				
	Ukraine	47.16	77.30	85.30	30.14	8.00	-73.45	7.01	6.70	7.22	-0.32	0.52	-262.50	12.80	16.16	18.62	3.36	2.46	-26.79	61.88	65.78	79.25	3.90	13.47	245.38				
	Belgium	75.78	86.98	89.20	11.20	2.22	-80.18	6.78	6.87	7.08	0.09	0.21	-133.33	30.22	30.78	40.85	0.57	1.07	87.72	80.95	89.73	90.86	8.98	1.13	-87.13				
	Germany	82.56	86.52	90.69	3.96	4.17	-5.30	5.80	5.64	5.89	-0.16	0.25	-256.25	41.09	41.99	43.02	0.91	1.02	-12.09	99.80	90.80	92.08	0.90	1.28	-42.22				
	Austria	103.37	107.38	107.02	4.01	-0.36	-108.08	6.27	6.46	6.83	0.19	0.37	94.74	28.35	28.13	28.93	-0.23	0.81	-452.17	88.78	89.91	90.40	1.13	0.49	-56.64				
	Netherlands	125.03	128.38	125.28	3.35	-3.10	-192.54	8.15	8.41	8.15	0.26	-0.26	-200.00	43.42	43.63	43.92	0.21	0.29	-38.10	94.94	96.20	93.75	1.27	-2.45	-292.91				
	Luxembourg	104.56	121.76	117.80	20.19	-3.95	-119.55	6.97	6.77	6.86	-0.20	0.09	-145.00	37.12	37.37	37.57	0.25	0.20	-20.00	92.99	95.20	93.60	2.21	-1.60	-172.40				
	Liechtenstein	129.96	125.59	125.72	-4.38	0.13	-102.97								44.08	45.17	47.37	1.09	2.21	102.75									
	Switzerland	99.37	100.43	101.48	1.06	1.05	-1.21	7.56	7.77	7.82	0.21	0.05	-77.32	45.56	46.82	46.48	1.27	-0.34	-126.61										
	France	91.37	96.99	99.26	5.63	2.27	-59.56	7.59	7.30	7.94	-0.49	-0.66	-86.85	44.28	45.69	46.92	0.82	1.23	-33.78	82.38	84.01		1.63	-64.01	-5,250.00				
	Monaco	84.15	86.37	89.44	2.22	3.08	-38.74								50.89	52.55	53.20	1.66	0.65	-60.84									
	Canada	76.39	82.71	72.18	6.31	-10.53	-266.88	8.08	7.68	8.16	-0.40	0.49	-222.50	38.66	40.83	41.80	1.86	0.97	-47.85	86.58	90.99	94.00	4.41	3.01	-31.75				
	United States	141.28	149.79	152.71	8.21	6.93	-15.59								33.86	34.73	36.41	0.86	1.69	96.51	85.35	86.61	85.50	1.26	-1.11	188.10			
Bolivia						-216.84								4.44	6.49	7.98	2.05												





Figure 12. Rate of Change Calculation

World regions of the United Nations	Source	Category	Country	ITU					World Digital Competitiveness Ranking					World Bank					ITU					Rate of Change (%)									
				Active mobile-broadband subscriptions per 100 inhabitants					Rate of Change (%)	Digital/Technological skills Digital/Technological skills are readily available					Rate of Change (%)	Fixed Broadband Subscriptions (per 100 people)					Rate of Change (%)	Households with Internet access at home (%)											
				Year	Year	Year	Difference	Year		Year	Year	Year	Year	Year		Year	Year	Year	Year	Year		Year	Year		Year	Year							
																											2018	2019	2020	2018-2019	2019-2020	2018	2019
Eastern and South-Eastern Asia (44)	Eastern Asia	Korea Rep.	113.60	113.80	115.60	0.20	1.80	800.00	7.24	7.57	7.64	0.03	0.37	1,133.33	41.20	42.40	42.60	1.20	0.20	-	83.33	99.48	99.69	99.75	0.21	0.06	-	71.43					
		Mongolia	83.72	111.76	109.20	28.03	- 2.56	-	109.13	5.64	5.59	5.59	-0.05	0.01	-	120.00	9.66	9.84	9.57	0.18	-0.47	-	361.81	43.30	46.72	46.82	3.42	0.10	-	97.68			
		Japan	193.28	202.97	202.25	9.69	- 0.72	-	107.43	6.17	4.99	4.88	-1.17	-0.11	-	90.60	32.62	33.50	34.50	0.88	1.00	-	13.04	96.80	96.85	97.32	0.05	0.47	-	840.00			
		Hong Kong	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		China	93.46	96.72	94.83	3.26	- 1.89	-	157.68	7.77	7.84	7.97	0.06	0.13	116.67	28.54	31.34	33.60	2.80	2.26	-	19.29	-	-	-	-	-	-	-	-	-	-	
		Viet Nam	71.89	72.46	80.23	0.56	7.78	-	1,280.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Brunei Darussalam	130.01	148.11	124.60	18.10	-23.51	-	229.89	-	-	-	-	-	-	11.53	12.51	16.25	0.98	3.74	281.63	-	-	-	-	-	-	-	-	-	-	-	
	South-Eastern Asia	Myanmar	92.69	120.84	131.55	28.15	10.71	61.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Timor-Leste	31.61	31.00	30.40	- 0.61	- 0.60	-	1.64	-	-	-	-	-	-	0.00	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Singapore	148.23	155.65	144.35	6.83	-11.30	-	265.53	7.79	8.11	8.21	0.32	0.11	-	67.14	25.91	25.91	-0.03	0.03	-	195.17	97.73	98.43	98.44	0.70	0.01	-	98.48				
		Cambodia	82.82	95.41	98.84	13.62	3.42	-	82.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Indonesia	87.15	81.21	104.19	- 5.94	22.99	-	486.84	5.93	6.61	6.65	0.68	0.04	-	93.74	3.32	3.80	3.92	0.48	0.12	-	75.98	66.22	73.75	78.18	7.53	4.43	-	41.19			
		Philippines	-	-	-	-	-	-	-	6.04	6.16	6.27	0.12	0.10	-	16.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Thailand	83.62	86.68	90.34	3.06	3.67	-	19.93	3.85	6.16	6.64	0.31	0.48	54.84	13.24	14.52	16.62	1.28	2.10	64.06	67.71	71.56	85.20	6.85	10.64	-	55.33					
Central and Southern Asia (60)	Central Asia	Kazakhstan	73.58	90.34	94.90	16.76	4.56	-	72.78	6.34	6.10	6.04	-0.24	-0.06	-	74.82	13.44	13.55	13.93	0.11	0.39	248.61	87.59	90.34	92.40	2.75	2.06	-	25.05				
		Uzbekistan	62.36	79.38	93.71	17.02	14.33	-	15.80	-	-	-	-	-	-	12.70	13.91	14.40	1.24	0.46	62.90	80.40	81.15	93.55	0.75	12.40	-	1,533.33					
		Pakistan	37.50	47.04	52.54	9.55	5.50	-	-	7.02	7.50	7.48	0.48	-0.02	-	104.17	1.34	1.40	1.62	0.06	0.21	250.00	-	-	-	-	-	-	-	-	-		
		Afghanistan	18.82	19.22	19.07	0.39	- 0.15	-	138.16	-	-	-	-	-	-	-	0.04	0.05	0.07	0.01	0.02	100.00	-	-	-	-	-	-	-	-	-		
		Bangladesh	41.27	52.79	59.09	11.51	6.30	-	45.26	-	-	-	-	-	-	4.99	4.96	5.78	-0.03	0.82	-2,813.33	-	-	-	-	-	-	-	-	-	-		
		Bhutan	101.64	99.00	89.29	- 1.74	-10.61	-	309.77	-	-	-	-	-	-	1.43	1.15	0.41	-0.28	-0.74	164.29	-	-	-	-	-	-	-	-	-	-		
		Iran (Islamic Republic of)	29.03	35.06	41.33	6.03	6.27	-	3.98	-	-	-	-	-	-	0.99	0.94	1.10	-0.05	0.16	420.00	-	-	-	-	-	-	-	-	-	-		
	Southern Asia	Sri Lanka	65.04	64.92	73.27	- 0.12	8.35	-	7,058.33	-	-	-	-	-	-	7.27	7.81	9.30	0.54	1.49	175.93	41.80	45.20	52.80	3.40	7.60	-	123.53					
		Australia	129.6	129.02	124.19	- 0.58	- 5.73	-	1,890.63	6.47	6.5	6.8	0.03	0.30	900.00	13.85	14.54	15.05	0.69	0.51	26.09	-	-	-	-	-	-	-	-	-	-		
		Fiji	69.95	72.16	78.44	2.21	6.29	-	184.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Kiribati	12.10	39.08	43.52	26.98	4.44	-	83.54	-	-	-	-	-	-	0.08	0.09	0.15	0.01	0.07	600.00	-	-	-	-	-	-	-	-	-	-		
		Solomon Islands	17.50	19.25	18.63	1.75	- 0.62	-	133.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Vanuatu	65.07	337.07	344.59	172.00	107.49	-	37.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		New Zealand	92.19	107.10	101.43	7.90	- 5.66	-	171.65	6.05	6.88	6.27	0.83	0.61	-	174.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Northern Africa and Western Asia (54)	Western Asia	Armenia	72.93	78.80	79.22	5.87	0.42	92.84	-	-	-	-	-	-	11.77	13.04	14.52	1.27	1.48	16.54	67.58	76.39	87.21	8.80	10.82	-	22.05						
		Azerbaijan	59.59	62.06	69.57	2.46	7.51	205.28	-	-	-	-	-	-	19.04	19.37	19.72	0.33	0.34	3.03	78.20	79.10	84.80	0.90	5.70	-	533.33						
		Georgia	73.68	79.80	81.60	6.12	1.80	-	70.59	-	-	-	-	-	21.54	23.56	25.01	2.02	1.45	-	28.22	75.80	79.26	83.84	3.46	4.59	-	32.66					
		Syrian Arab Republic	16.50	11.50	10.12	- 5.00	- 1.38	-	72.40	-	-	-	-	-	-	7.84	8.73	8.85	0.89	0.12	-	86.52	-	-	-	-	-	-	-	-			
		Turkey	74.20	74.80	77.82	0.61	3.01	391.44	6.85	6.74	7.13	-0.11	0.39	-	454.53	16.28	17.06	19.84	0.78	2.78	256.41	83.79	88.29	90.73	4.50	2.44	-	45.78					
		Cyprus	109.72	115.22	118.22	5.51	2.70	-	53.53	6.39	6.51	7.22	0.12	0.70	483.33	35.79	36.78	37.40	0.99	0.62	-	37.37	86.17	89.61	92.78	3.44	3.16	-	8.14				
		Israel	113.34	115.03	121.31	1.69	6.28	271.60	8.75	8.49	7.61	-0.26	-0.88	-	238.46	29.05	29.12	30.06	0.07	0.94	1,242.86	74.94	75.93	82.47	0.99	6.54	-	356.61					
	Northern Africa	Qatar	125.928	124.82	120.31	- 1.12	- 4.51	302.68	8.04	8.19	8.21	0.15	0.02	-	86.67	9.61	10.05	10.28	0.42	0.23	-	45.24	89.99	93.58	95.01	0.43	1.45	-	437.21				
		Bahrain	129.57	122.58	109.38	- 6.99	-13.19	88.70	-	-	-	-	-	-	-	8.05	8.59	8.73	0.54	0.14	-	74.07	98.64	99.70	99.54	1.06	- 0.16	-	115.09				
		Kuwait	131.06	132.74	127.44	1.68	- 5.30	-	415.48	-	-	-	-	-	-	2.51	2.01	1.73	-0.50	-0.28	-	44.00	-	-	-	-	-	-	-	-			
		Lebanon	45.25	42.81	63.71	- 2.44	20.90	959.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
		Oman	89.39	109.11	114.85	19.73	5.73	70.95	-	-	-	-	-	-	-	9.17	10.24	10.85	1.07	0.61	-	42.99	-	-	-	-	-	-	-	-			
		United Arab Emirates	250.04	239.89	224.24	- 10.15	-15.65	54.19	-	-	-	-	-	-	-	31.40	31.17	32.81	-0.23	1.64	813.04	98.40	99.10	99.80	0.70	0.70	-	-					
		Iraq	39.83	42.06	45.89	2.22	3.84	72.07	11.69	11.60	13.56	-0.09	1.96	-	-	-	-	-	-	-	-	2,277.78	-	-	-	-	-	-	-	-			
Sub-Saharan Africa (34)	Eastern Africa	Jordan	87.62	77.00	68.49	- 10.62	- 8.52	19.78	7.77	7.11	7.19	-0.66	0.07	-	111.27	4.01	4.53	6.13	0.52	1.60	208.86	-	-	-	-	-	-	-	-	-			
		Saudi Arabia	111.51	115.03	121.31	1.69	6.28	271.60	8.75	8.49	7.61	-0.26	-0.88	-	238.46	29.05	29.12	30.06	0.07	0.94	1,242.86	74.94	75.93	82.47	0.99	6.54	-	356.61					
		Morocco	59.09	64.92	75.16	5.83	10.24	75.54	-	-	-	-	-	-	-	4.31	4.80																

Figure 13. Rate of Change Calculation

World regions of the United Nations	Source		ITU/ World Bank					Rate of Change (%)	World Digital Competitiveness Ranking					Rate of Change (%)	World Bank					Rate of Change (%)		
	Category	Country	Individuals Using the Internet (% of population)						Mobile Broadband subscribers (DIGITAL)-4G & 5G market, % of mobile market						Secure Internet Servers (per 1 million people)							
			Year			Difference			Year			Difference			Year			Difference				
			2018	2019	2020	2018-2019	2019-2020		2018	2019	2020	2018-2019	2019-2020		2018	2019	2020	2018-2019	2019-2020			
Eastern and South-Eastern Asia (14)	Eastern Asia	Korea Rep.	113.60	113.80	115.60	0.20	1.80	800.00	7.24	7.27	7.64	0.03	0.37	1,133.33	41.20	42.40	42.60	1.20	0.20	-	83.33	
		Mongolia	83.72	111.76	109.20	28.03	- 2.56	- 109.13	5.64	5.59	5.59	- 0.05	0.01	- 120.00	9.66	9.84	9.37	0.18	- 0.47	-	361.11	
		Japan	193.28	202.97	202.25	9.69	- 0.72	- 107.43	6.17	4.99	4.88	- 1.17	- 0.11	- 90.60	32.62	33.50	34.50	0.88	1.00	-	13.64	
		Hong Kong													36.83	37.72	38.30	0.89	0.58	-	34.83	
	South-Eastern Asia	China	93.46	96.72	94.83	3.26	- 1.89	- 157.98	7.77	7.84	7.97	0.06	0.13	116.67	28.54	31.34	33.60	2.80	2.26	-	19.29	
		Viet Nam	71.89	72.46	80.23	0.56	7.78	1,289.29							11.53	12.51	16.25	0.98	3.74	-	281.63	
		Brunei Darussalam	130.01	148.11	124.60	18.10	- 23.51	- 229.89														
		Myanmar	92.69	120.84	131.55	28.15	10.71	- 61.95														
		Timor-Leste	31.61	31.00	30.40	- 0.61	- 0.60	- 1.04								0.00	0.01	0.01	-	-	-	-
		Singapore	148.82	155.65	144.35	6.83	- 11.30	- 265.55	7.79	8.11	8.21	0.32	0.11	- 67.14	25.94	25.91	25.94	- 0.03	0.03	-	- 195.17	
		Cambodia	82.82	96.44	98.81	13.62	2.37	- 82.58														
		Indonesia	87.15	81.21	104.19	- 5.94	22.99	- 486.84	5.93	6.61	6.65	0.68	0.04	- 93.74	3.32	3.80	3.92	0.48	0.12	-	75.98	
		Philippines																				
		Thailand	83.62	86.68	90.34	3.06	3.67	19.93	5.85	6.16	6.64	0.31	0.48	54.84	13.24	14.52	16.62	1.28	2.10	-	64.06	
Central and Southern Asia (09)	Central Asia	Kazakhstan	73.58	90.34	94.90	16.76	4.56	- 72.78	6.34	6.10	6.04	- 0.24	- 0.06	- 74.82	13.44	13.55	13.93	0.11	0.39	-	248.61	
		Uzbekistan	62.36	79.38	93.71	17.02	14.33	- 15.80							12.70	13.94	14.40	1.24	0.46	-	62.90	
		India	37.50	47.04	52.54	9.55	5.50	- 42.41	7.02	7.50	7.48	0.48	- 0.02	- 104.17	1.34	1.40	1.62	0.06	0.21	-	250.00	
		Afghanistan	18.82	19.22	19.07	0.39	- 0.15	- 138.46							0.04	0.05	0.07	0.01	0.02	-	100.00	
	Southern Asia	Bangladesh	41.27	52.79	59.09	11.51	6.30	- 45.26							4.99	4.96	5.78	- 0.03	0.82	-	2,833.33	
		Bhutan	101.64	99.90	89.29	- 1.74	- 10.61	509.77							1.43	1.15	0.41	- 0.28	- 0.74	-	164.29	
		Pakistan	29.03	35.06	41.33	6.03	6.27	3.98							0.99	0.94	1.10	- 0.05	0.16	-	420.00	
		Iran	68.21	80.24	92.52	12.04	12.27	1.91														
		Sri Lanka	65.04	64.92	73.27	- 0.12	8.35	- 7,058.33								7.27	7.81	9.30	0.54	1.49	-	175.93
		Australia	129.6	129.92	124.19	0.32	- 5.73	- 1,890.63	6.46	6.5	6.80	0.03	0.30	900.00	33.85	34.54	35.05	0.69	0.51	-	26.09	
		Fiji	69.95	72.16	78.44	2.21	6.29	184.62														
		Kiribati	12.10	39.08	43.52	26.98	4.44	- 83.54								0.08	0.09	0.15	0.01	0.07	-	600.00
		Solomon Islands	17.50	19.25	18.63	1.75	- 0.62	- 135.43														
		Vanuatu	65.07	237.07	344.56	172.00	107.49	- 37.51														
New Zealand	99.19	107.10	104.43	7.90	- 5.66	- 171.65	6.04	6.88	6.27	0.83	- 0.61	- 173.49										
Northern Africa and Western Asia (14)	Western Asia	Armenia	72.93	78.80	79.22	5.87	0.42	- 92.84														
		Azerbaijan	59.59	62.06	69.57	2.46	7.51	205.28														
		Georgia	73.68	79.80	81.60	6.12	1.80	- 70.59														
		Syrian Arab Republic	16.50	11.50	10.12	- 5.00	- 1.38	- 72.40														
		Turkey	74.20	74.80	77.82	0.61	3.01	393.44	6.85	6.74	7.13	- 0.11	0.39	- 454.55	16.28	17.06	19.84	0.78	2.78	-	256.41	
		Cyprus	109.72	115.52	118.22	5.81	2.70	- 53.53	6.39	6.51	7.22	0.12	0.70	483.33	35.79	36.78	37.40	0.99	0.62	-	37.37	
		Israel	113.34	115.03	121.31	1.69	6.28	271.60	8.75	8.49	7.61	- 0.26	- 0.88	238.46	29.05	29.12	30.06	0.07	0.94	-	1,242.86	
		Qatar	125.94	124.82	120.31	- 1.12	- 4.51	302.68	8.04	8.19	8.21	0.15	0.02	- 86.67	9.63	10.05	10.28	0.42	0.23	-	45.24	
		Bahrain	129.57	122.58	109.38	- 6.99	- 13.19	88.70								8.05	8.59	8.73	0.54	0.14	-	74.07
		Kuwait	131.06	132.74	127.44	1.68	- 5.30	- 415.48								2.51	2.01	1.73	- 0.50	- 0.28	-	44.00
		Lebanon	45.25	42.81	63.71	- 2.44	20.90	- 956.56														
		Oman	89.39	109.11	114.85	19.73	5.73	70.96								9.17	10.24	10.85	1.07	0.61	-	42.99
		United Arab Emirates	250.04	239.89	224.24	- 10.15	- 15.65	54.19								31.40	31.17	32.81	- 0.23	1.64	-	813.04
		Iraq	39.83	42.06	45.89	2.22	3.84	72.97								11.69	11.60	13.56	- 0.09	1.96	-	2,277.78
	Jordan	87.62	77.00	68.49	- 10.62	- 8.52	- 19.78	7.77	7.11	7.19	- 0.66	0.07	- 111.27	4.01	4.53	6.13	0.52	1.60	-	208.86		
	Saudi Arabia	111.09	116.88	118.86	5.79	1.98	- 65.80	6.39	7.53	7.86	1.15	0.32	- 72.17	20.24	19.85	22.66	- 0.39	2.82	-	823.08		
	Northern Africa	Morocco	59.09	64.92	75.16	5.83	10.24	75.64							4.31	4.80	5.70	0.49	0.89	-	81.63	
		Tunisia	76.08	77.79	76.05	1.71	- 1.74	- 201.75							8.77	10.19	11.29	1.42	1.10	-	22.54	
		South Sudan	6.00	5.95	4.91	- 0.05	- 1.04	1,980.00							0.08	0.08	0.07	-	-	-	0.01	
		Sudan	32.43	37.93	42.34	5.50	4.40	- 20.00							0.08	0.08	0.07	-	-	-	0.01	
		Algeria	81.65	89.82	90.63	8.17	0.81	- 90.09							7.26	8.32	8.64	1.06	0.32	-	69.81	
		Egypt													6.73	7.57	9.14	0.84	1.57	-	86.90	
		Burundi	11.44	11.14	10.96	- 0.30	- 0.18	- 40.00							0.18	0.15	0.10	- 0.04	- 0.04	-	-	
		Comoros													0.72	0.93	1.25	0.21	0.32	-	52.38	
Sub-Saharan Africa (34)		Eastern Africa	Kenya	41.92	41.08	46.76	- 0.84	5.69	- 777.38													
			Madagascar	15.60	18.77	22.30	3.16	3.54	12.03													
	Malawi		27.21	31.85	35.66	4.64	3.82	- 17.67														
	Mauritius		79.02	87.39	97.94	8.37	10.56	26.16								0.06	0.06	0.06	-	-	-	
	Mozambique		15.07	17.67	16.75	2.60	- 0.92	- 135.38								21.68	24.20	25.33	2.52	1.13	-	55.16
	Rwanda		39.01	42.30	42.84	3.29	0.54	- 83.59								0.06	0.07	0.14	0.01	0.07	-	600.00
	Seychelles		80.52	91.98	85.45	11.46	- 6.53	- 156.68								20.28	27.60	35.55	7.32	7.96	-	8.74
	Tanzania		9.10	9.79	14.31	0.69	4.52	555.07								1.53	1.79	1.82	0.26	0.02	-	92.31
	Uganda		33.61	38.34	43.98	4.73	5.64	19.24														
	Zimbabwe		51.67	51.69	58.50	0.02	6.82	34,000.00								1.41	1.40	1.37	- 0.01	- 0.03	-	200.00
	Djibouti		20.60	23.62	24.41	3.03	0.79	- 73.93								2.66	2.51	2.54	- 0.15	0.03	-	120.00
	Zambia		56.63	51.07	55.59	- 5.56	4.52	- 181.29								0.42	0.50	0.45	0.08	- 0.05	-	162.50
	Angola																					