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THE ROLE OF THE COVID-19 PANDEMIC IN ADVANCING DIGITAL TRANSFORMATION INFRASTRUCTURE IN EGYPT AND HOW IT AFFECTS VALUE CREATION FOR BUSINESSES AND THEIR CUSTOMERS

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Abstract. Technology greatly facilitated remote purchases, transactions, and communication among individuals during the COVID-19 pandemic. Consequently, the COVID-19 pandemic impacted the manner and rate of digital technology adoption in Egypt. This study intends to investigate the impact of the COVID-19 pandemic on the Egyptian government's acceleration of the adoption of digital transformation, which produced value for businesses and their customers. The quantitative method is used in this study to examine and analyze digital transformation data from the Egyptian Ministry of Communications and Information Technology. According to this study's findings, the COVID-19 pandemic compelled the Egyptian government to develop the digital infrastructure required for digital transformation. Telephone subscription rates and Internet user numbers have increased over the past three years, reflecting progress in infrastructure. As a result of this improvement in digital infrastructure, businesses now have an outstanding chance to undergo digital transformation, discover their digital customers, and deliver value to them. This study contributes to the digital transformation literature by increasing understanding of Egypt's current level of digital transformation and its influence on value creation for Egyptian businesses and their customers.

Keywords: digital transformation; value creation; COVID-19 pandemic; customer value; internet.

JEL Codes: L86; O32; F20.

Introduction

Digital transformation is the activities taken to integrate digital technology into all areas of business, which leads to a fundamental change in how organizations deliver value to customers and improve business processes [Matarazzo, Penco, Profumo, Quaglia, 2021]. The COVID-19 epidemic has impacted the Egyptian government and private sector activities, which has prompted the development of the Egyptian digital infrastructure to bring about quick technological improvements that encourage businesses to use digital technology widely [Elsafty, Elzeftawy, 2021]. Thus, the COVID-19 pandemic was an excellent opportunity to promote and accelerate Egypt's establishment of the infrastructure needed for digital transformation [Sindakis, Aggarwal, 2022]. For example, they increased the speed of fixed and antenna Internet and the number of mobile phone subscriptions. For businesses, when digital transformation occurs slowly, the gap between businesses and their customers widens, the quantity of required modifications increases, competition rises, and losses rise [Van Veldhoven, Vanthienen, 2022]. Thus, businesses responded to these changes with a high degree of adaptability. Additionally, the number of remote employees has increased the urgency businesses must carry out digital transformations [Gigauri, 2020]. The spread of the COVID-19 pandemic also contributed to accelerating the digital transformation process within various sectors (e.g., education, health, restaurants, and banking), spreading cultural awareness of customers and encouraging them to deal with digital platforms via the Internet [Aptikasheva, Mishura, 2021].

Organizations anticipate that adopting digital transformation will boost their productivity and efficiency and provide them a competitive advantage over rivals in the market [Kretschmer, Khashabi, 2020]. Organizations should establish flexible visions and plans to swiftly and smoothly accept new digital technologies to facilitate digital transformation [Li, Wu, Cao, Wang, 2021]. Technology cannot be applied without sufficient financial resources, so organizations should set aside funds to implement the necessary technologies [Cao, Law, Samad, Mohamad, Wang, Yang, 2022]. Whereas work change is a result of digital transformation, this rearrangement of work ultimately alters how people work. Hence, organizations should encourage staff to use technology while working in novel ways with increased autonomy [Cai, Lysova, Khapova, Bossink, 2018]. As a result, organizations can benefit from digital transformation by developing new values that enhance the workplace, such as speed in completing tasks, lowering employment, minimizing errors, remaining competitive, enhancing the quality of services and products, and communicating with customers quickly [Albukhitan, 2020].

The infrastructure for digital transformation is established in Egypt, allowing both public and private sector businesses to interact with their current customers and offer products and services [Elsafty, Elzeftawy, 2021]. This advancement in the digital transformation implementation created new value for customers (e.g., functional value, experience value, pleasure value, price value, and quality value) [Matarazzo, Penco, Profumo, Quaglia, 2021]. For instance, restaurants can digitally promote their services and products on numerous platforms using digital transformation practices [Hussain, 2021]. Customers can readily and cheaply access the restaurant's products and services anywhere and receive functional value [Helal, 2022; Tantawy, Abbas, Ibrahim, 2016]. Additionally, customers who use the mobile restaurant application from home can gain experiential value through independence and privacy when developing their food preferences while taking the necessary time [Chotigo, Kadono, 2021].

Researchers in Egypt have paid attention to studies of the COVID-19 epidemic and digital transformation in different sectors [Abd-Elhafiez, Amin, 2021; El-Sayad, Saad, Thurasamy, 2021; Elsafty, Elzeftawy, 2021; Ewiss, 2020; Salem, Elkhwesky, Ramkissoon, 2022]. However, to our knowledge, no study has looked at the Egyptian infrastructure for digital transformation during the COVID-19 pandemic. Moreover, how these new digital transformation infrastructures generate value for businesses and their customers. Therefore, the current study will analyze the digital transformation infrastructure in Egypt during the COVID-19 pandemic and its impact on generating value for businesses and their customers.

This study contributes to the literature in a variety of ways. First, this study adds to the body of knowledge on Egypt's digital transformation by assessing how far along Egypt's digital transformation was during the COVID-19 pandemic. Second, this study fills a research gap in understanding how digital transformation creates new value for Egyptian businesses. Thirdly, this study fills a knowledge gap on how Egyptian businesses may benefit from digital transformation by offering customers value. From a practical standpoint, this research provides a fresh perspective for businesses by examining the current state of Egyptian infrastructure for digital transformation and how businesses might benefit from it.

1. Literature review

1.1. COVID-19 and digital transformation infrastructure in Egypt

Digital transformation is the process of modifying an organization's work system to become primarily dependent on modern technology to support the development and innovation processes to enhance the quality of the products and services they offer and thereby increase their competitiveness [Cichosz, Wallenburg, Knemeyer, 2020]. Therefore, it is believed that digital transformation will shift

the focus of governments and organizations from physical transactions to the use and investment of information and communication technology to achieve new opportunities and diverse capabilities that contribute to the institution's access to the highest levels of progress and development [Bai, Quayson, Sarkis, 2021]. In addition, digital transformation entails using digital technologies to effect substantial organizational business model changes [Hanelt, Bohnsack, Marz, Antunes Marante, 2021].

COVID-19 has advanced the digital transformation of governments, organizations, and entire industries, such as retail, restaurants, and education [Setyoko, Kurniasih, 2022]. For instance, although online food ordering existed before the pandemic, the COVID-19 pandemic has accelerated and increased the digital transformation of restaurants because it is the only method for restaurants to continue operations under lockdown [Soto-Acosta, 2020]. Consequently, Egypt has taken consistent steps toward digital transformation [Abdallah, Shehab, Al-Ashaab, 2022]. The Ministry of Communications and Information Technology (MCIT) published the National ICT Strategy for Digital Egypt following Egypt's Vision 2030. The strategy aims to position Egypt to profit from the digital economy by providing universal, equitable, and cheap access to ICT tools and applications to impact Egyptian lives and livelihoods and establish a competitive, inventive, and adaptable ICT industry [Shahin, Meligy, 2021].

Digital transformation is gradually digitizing governments and businesses, increasing their competitiveness [Mergel, Edelmann, Haug, 2019]. Through ubiquitous Internet connections, digital transformation provides numerous chances for economic expansion and prosperity [Chawla, Goyal, 2022]. Thus, digital transformation contributes to the reduction of costs and efforts, the enhancement of operational efficiency, the simplification of procedures used to provide services to beneficiaries, and the creation of an environment conducive to the delivery of innovative services outside of traditional methods [Chen, He, Shen, Wang, Chen, 2022]. In addition, for an economy and enterprises to remain adaptable and handle the rise in the usage of digital platforms, it is essential to establish and continually update the information and infrastructure required for digital transformation [Ulas, 2019]. Digital infrastructure is essential to the ecosystem of the digital economy, which includes digital aspects of competitiveness, production factors and industries, production processes, the supply of digital services, and the proliferation of digital households [Qosimova, Ko'chimov, 2022].

Therefore, Egypt should consistently invest in its IT infrastructure to optimize its digital transformation chances [Elsafty, Elzeftawy, 2021]. Firstly, ensuring that all Egyptians have affordable access to the Internet and contemporary technology [Elgohary, 2022]. Secondly, human capital, the economy's most valuable asset, must be digitally prepared, with refined skills and capacities revamped to face future difficulties such as working, learning, and conducting business online [Klein, Todesco,

2021]. Finally, governance is the checks and balances of the legal and regulatory settings that can build trust, foster openness, and facilitate inclusivity [Alalwan, Baabdullah, Dwivedi, Rana, Lal, Raman, 2021].

1.2. Value creation and digital transformation

Value is abstract since it lacks a precise definition [Ibrahim, 2022]. Value can be defined as the predicted total benefits of something's application [Doeim, Hassan, Helal, Saleh, Salem, Elsayed, 2022]. This study is consistent with this concept, as digital transformation benefits businesses and their customers [Chen, Lin, Chen, Chao, Pandia, 2021]. Consequently, value can be defined in this study as the benefits and advantages obtained by businesses and their customers through digital transformation. There must be fundamental factors in adopting digital transformation for the organization to attain values (e.g., the country's technological infrastructure, the business's technological infrastructure, and human capabilities to use digital technologies, whether employees or customers [Matarazzo, Penco, Profumo, Quaglia, 2021]).

The technological infrastructure of a country refers to the availability of telephone networks and high-speed Internet for businesses and households, in addition to providing technology items, including computers, cellphones, operating systems, and replacement parts [Abdallah, Shehab, Al-Ashaab, 2022; Agu, Stewart, McFarlane-Stewart, Rae, 2021]. With the availability of infrastructure in countries, it is easier for businesses to subscribe to and connect to networks and employ digital transformation procedures. Digitally qualified humans will utilize digital gadgets for digital customer production and communication [Snow, Fjeldstad, Langer, 2017]. Digital customers are individuals with the ability to interact digitally and the ability to undertake digital transactions [Kopalle, Kumar, Subramaniam, 2020].

The value of a business's digital transformation can be defined as the total benefits from adopting digital transformation that exceed the costs [Ibrahim, 2022]. Organizational digital transformation implementation has multiple values (e.g., functional and financial value). Functional values are the advantages of enhancing the organization's internal and external work environment (e.g., reducing production time, improving work efficiency, improving communication with customers, and reducing the number of employees) [Helal, 2022]. When an organization does digital transformation, it uses the most advanced digital technology systems to make operations and production more efficient [Brock, Von Wangenheim, 2019]. This advanced digital technology reduces mistakes, saves time and resources, and speeds up operations and production [Albukhitan, 2020].

In addition, digital technologies for customer communication streamline marketing activities, for instance, marketing on social media, where customers of all ages and groups can be found [Yu, Shenglong, 2021; Zahay, 2021]. Additionally, current digital technologies can replace many workers, particularly in areas that need extreme accuracy [Kane, Palmer, Phillips, Kiron, 2015]. Some automobile manufacturers, for instance, are already replacing humans with robots due to their benefits, such as accuracy, speed, large output, and cost savings [Javaid, Haleem, Singh, Suman, 2021; Michalos, Makris, Papakostas, Mourtzis, Chryssolouris, 2010]. The financial values are the return on investment from the business's digital transformation, which indicates the time frame for producing profits [Mallory, Holm, Parker, 2020].

Customer value is the general judgment by customers of the expected benefit from the products or services a business provides in exchange for the money and effort expended to get them [Doeim, Hassan, Helal, Saleh, Salem, Elsayed, 2022]. Thus, businesses leverage customer value to achieve customer satisfaction, and as value is realized, customer satisfaction increases (Helal, 2022). Various digital values that increase customer satisfaction can be offered through digital transformation [Matarazzo, Penco, Profumo, Quaglia, 2021]. Digital transformation brings new digital values to customers (e.g., digital functional value, digital hedonic value, digital experiential value). Customers can reduce the time and effort spent obtaining products and services from businesses, which contributes to the creation of digital functional value due to digital transformation [Saarikko, Westergren, Blomquist, 2020]. For instance, customers can shop at digital retailers from their homes at any time. The digital experiential value is demonstrated by eliminating errors and giving customers more freedom since they may read the information, choose from multiple alternatives, make decisions, and pay in various ways [Suseno, Laurell, Sick, 2018]. Digital hedonic value manifests itself in the interactive and aesthetically pleasing presentations of digital products and services on the digital platforms of businesses [Matarazzo, Penco, Profumo, Quaglia, 2021].

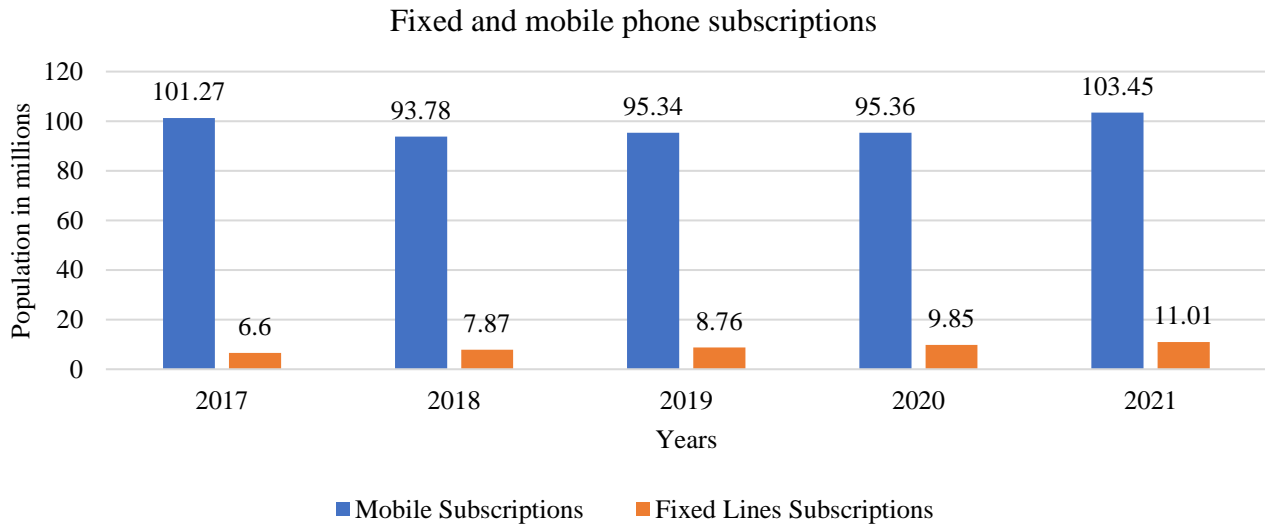
2. Methodology - Data source and data analysis

This study depends on Egyptian technical infrastructure statistics. Egypt's MCIT and Statista databases are used in this study as data sources for 2017–2022 [Ministry of Communications and Information Technology, 2022; Statista, 2022]. The study's data set includes information on (i.e., fixed and mobile phone subscriptions, the proportion of individuals using the Internet, Internet broadband, Internet activities by individuals, and Internet download speed). The study's data were also analyzed using Microsoft Excel 365 software.

3. Results and discussion

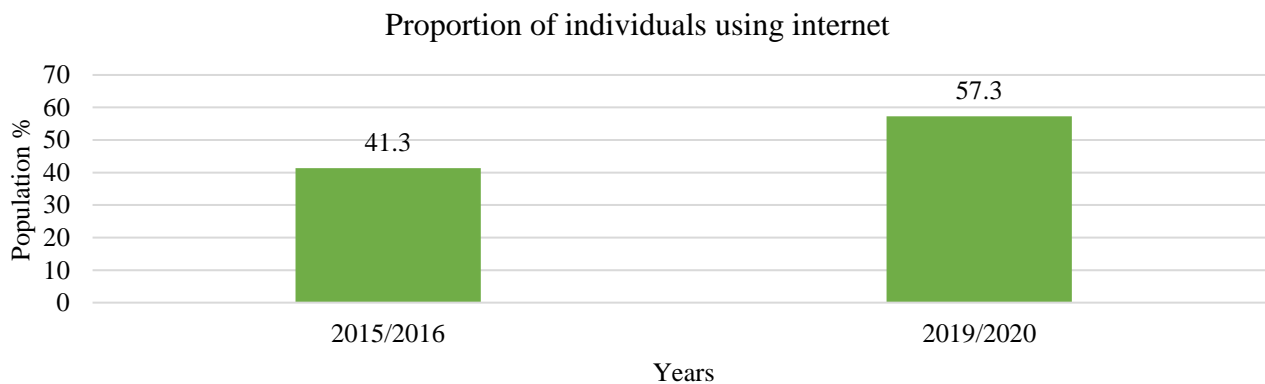
Figure one depicts the proportion of Egyptians who subscribe to mobile and fixed telephone services. The graph illustrates that the number of Egyptians subscribing to mobile lines has climbed by 2.18 million over the past five years.

Fig. 1: Fixed and mobile phone subscriptions¹



However, the number of Egyptians subscribing to fixed telephone lines has increased by 4.41 million. This finding can be explained by the fact that the increase in fixed-line subscriptions was more considerable since it was utilized to connect to the inexpensive and fast Internet [Fanta, Makina, 2019].

Fig. 2: The proportion of individuals using the Internet²

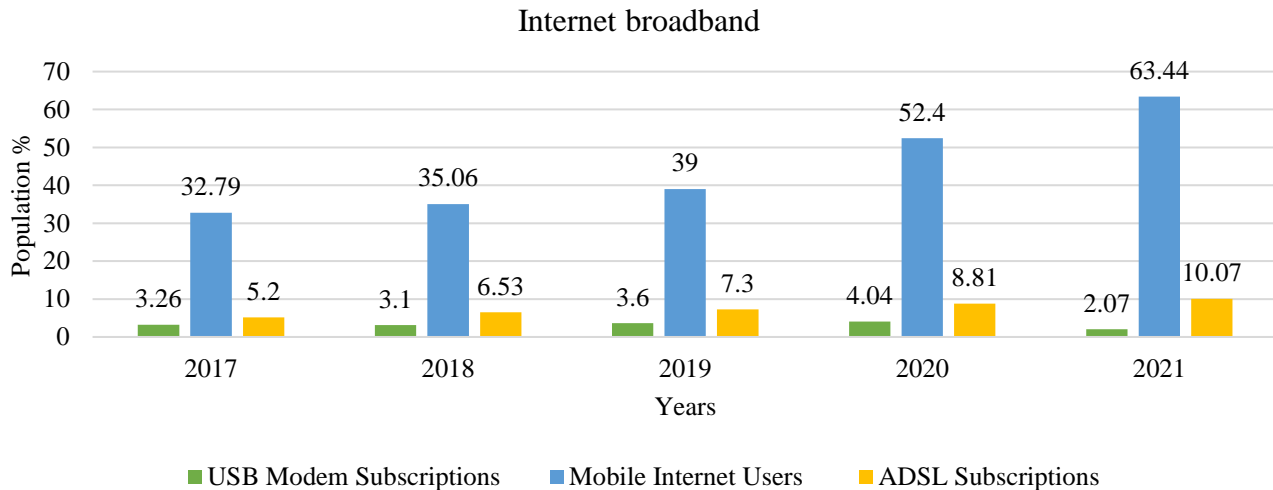


¹ MCIT (2022).

² MCIT (2022).

The percentage of Egyptians who utilize the Internet is depicted in Figure two. This graph depicts the development of Internet usage in Egypt, which stood at 41.3% in 2016/2017 and rose by 16% to reach 57.3% three years later. This data demonstrates the rise in Internet usage caused by the COVID-19 epidemic [Masaeli, Farhadi, 2021].

Fig. 3: Internet broadband³

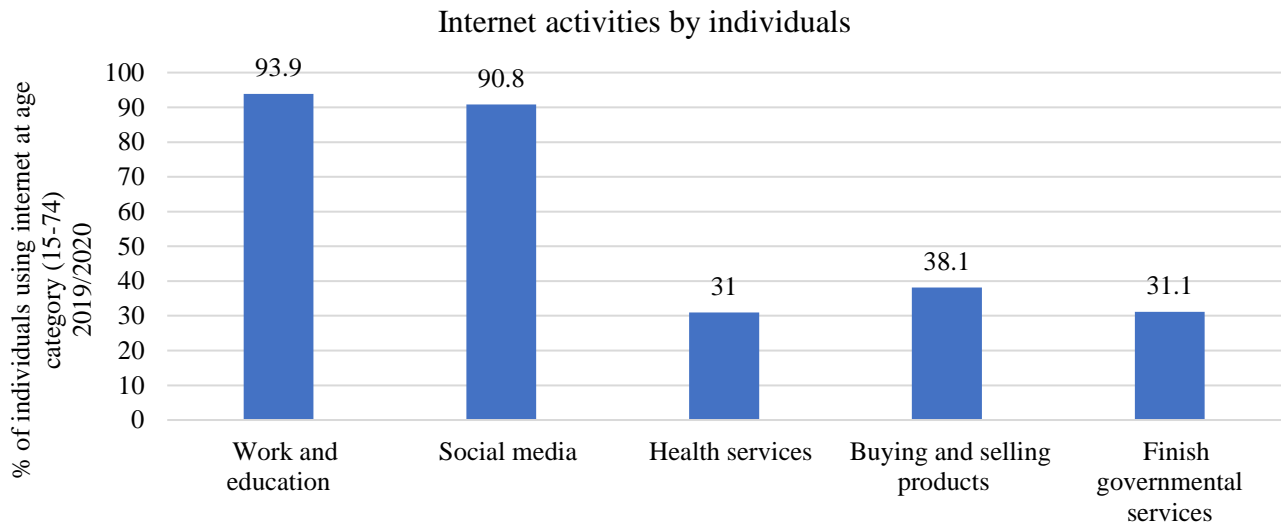


The third diagram depicts a comparison of the three Egyptian Internet sources. The first source is the Egyptians' USB modem subscriptions, which fluctuated between 3% and 4% in 2021 because of high internet fees. The second source is that the number of Egyptians who subscribe to the Internet via their phone has increased by 49.4% over the past five years. The third source is ADSL, which is connected to the fixed telephone line, and has expanded by 48.3% over the past five years. This result shows that the number of people using the Internet has grown by 31.92% over the last three years during the COVID-19 period [Shahin, Meligy, 2021].

Figure four shows how Egyptians used the Internet in 2019/2020. More than 90% of Egypt's Internet users have used the Internet for work and education. This rise can be traced to COVID-19, which made it easier for people to work from home or in a combination of places. The figure also demonstrates a shift in Egyptians' online purchasing and selling habits, with a rate of more than 38% of Internet users. Also, there is a significant chance for businesses to sell their services on social media, as more than 90% of Internet users are using these platforms. The number of online government and health services for Egyptians has increased by 30%.

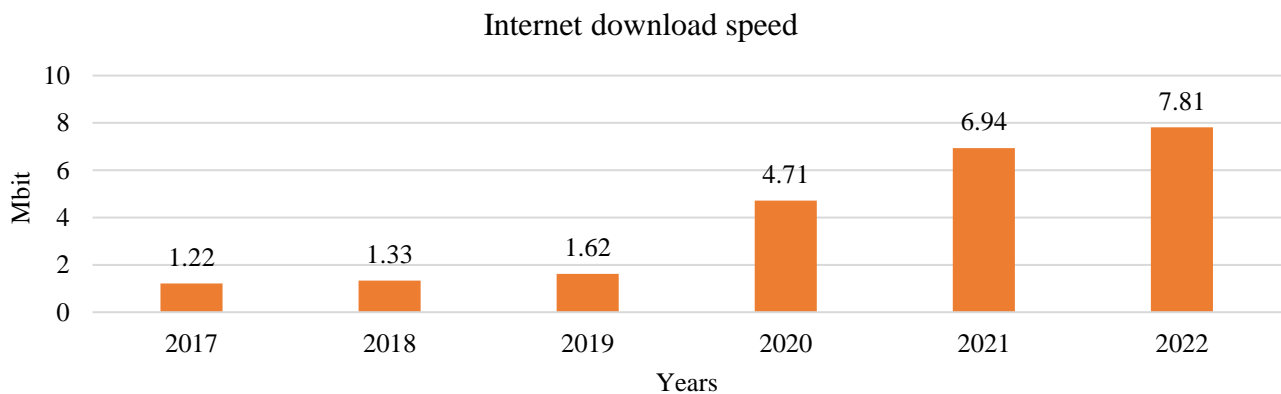
³ MCIT (2022).

Fig. 4: Internet activities by individuals⁴



The fifth figure depicts the evolution of Internet download speeds in Egypt. Egypt's Internet download speed increased from 1.22 Mbps in 2017 to 7.81 Mbps in 2022. This remarkable development may result from the COVID-19 epidemic [Masaeli, Farhadi, 2021].

Fig. 5: Internet download speed⁵



Conclusion

Theoretical implications

The findings of this study contribute in various ways to the growth of the literature on digital transformation and value creation in Egypt. In recent years, the spread of the COVID-19 epidemic among Egyptians has prompted the Egyptian government to accelerate the establishment of the infrastructure

⁴ MCIT (2022).

⁵ Statista (2022).

for digital transformation. Thus, the availability of the fundamental infrastructure required for digital transformation has enabled businesses to produce value for themselves and their customers. Therefore, this study aims to close the research gap by assessing Egypt's recent technological advances required for digital transformation during the COVID-19 period. In addition, the current study sheds light on how businesses benefit from the availability of the basic infrastructure required for digital transformation by producing value for themselves and their consumers.

This study advances knowledge by analyzing statistics related to digital transformation in Egypt during the COVID-19 epidemic. This study discovered increased mobile and fixed-line subscriptions, leading to increased Internet users. This study also discovered an increase in low-cost ADSL subscribers and internet speeds, particularly during the COVID-19 epidemic. In 2019/2020, the most exciting outcome was that more than 90% of Internet users in Egypt used it for remote work and study. These results demonstrate that COVID-19 has accelerated the development of Egypt's digital transformation infrastructure [Masaeli, Farhadi, 2021]. Therefore, businesses must take advantage of this significant transformation in infrastructure and work behavior to create value for themselves and match customer expectations [Zahay, 2021].

This study contributes to the literature on the business and customer value created by digital transformation. This study demonstrated the existence of the essential infrastructure for digital transformation in Egypt, as well as the alteration of customer behavior to boost Internet subscriptions and usage [Mildon, Sellen, 2019]. This result demonstrates the availability of an excellent opportunity for Egyptian businesses to transform digitally, which provides them with numerous advantages, including the simplification of internal work procedures, the reduction of the number of employees, the improvement of quality, the elimination of difficult work obstacles, and the reduction of errors [Khams, 2022]. There is also a chance to meet new customers' values through online communication [Helal, 2022]. For example, businesses can use social media to interact with customers, promote their products or services, or collect information about them using "big data" programs to offer more personalized products and services [Appel, Grewal, Hadi, Stephen, 2020].

Managerial implication

Theoretical discussions and statistical findings demonstrate the significance of this study in explaining the extent of digital transformation in Egypt and its effect on the provision of company values and the satisfaction of their customers. Therefore, this study suggests ways for businesses to generate value for themselves and their customers. First, the findings of this study demonstrated that Egypt

possesses an acceptable degree of digital infrastructure. Thus, businesses can establish their fundamental digital transformation infrastructure, including subscriptions to government technical services and acquiring technology gadgets [Nosova, Kolodnyaya, Novikova, Medvedeva, Makarenko, 2019].

Second, businesses must train their employees on digital devices and new systems to take advantage of the opportunities presented by these various digital technologies [Lee, Lee, 2020]. Third, the results of this study have already demonstrated a considerable shift in Egyptians' attitudes toward Internet usage. Therefore, businesses must expand the display of their products and services on their digital platforms (e.g., social media, websites, and mobile applications) or even their digital services that exist in their exhibition or shops' such as a self-service kiosk [Appel, Grewal, Hadi, Stephen, 2020]. Finally, customers are the basis of businesses' existence [Helal, 2022]; thus, organizations must aim to deliver essential digital values such as functional value (e.g., saving time, effort, and money) [Saarikko, Westergren, Blomquist, 2020]. Therefore, when businesses implement a digital transformation, it will result in numerous advantages for their continued competitiveness, customer retention, and customer acquisition.

Limitations and further research

This study has limitations that present opportunities for future investigation. This study assessed the development of Egypt's digital transformation infrastructure over the past few years using a simple statistical analysis. Future research could employ a more complex statistical technique, such as panel research, and a more extended period to establish the extent of change across a time series. In addition, figures from the Egyptian MCIT were utilized for this study. Future research may employ quantitative or qualitative methods, such as a questionnaire or in-person interviews with Egyptians from various firms or company executives, to assess the actual level of infrastructure required for digital transformation and their needs. In addition, this study's scope was limited to measuring the development of the infrastructure required for digital transformation in Egypt, unlike other nations within the same period. Therefore, future research might compare multiple nations to define Egypt's actual level and propose additional development suggestions.

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РОЛЬ ПАНДЕМИИ COVID-19 В РАЗВИТИИ ИНФРАСТРУКТУРЫ ЦИФРОВОЙ ТРАНСФОРМАЦИИ В ЕГИПТЕ И КАК ЭТО ВЛИЯЕТ НА СОЗДАНИЕ ЦЕННОСТИ ДЛЯ БИЗНЕСА И КЛИЕНТОВ

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Аннотация. Технология значительно облегчила дистанционные покупки, транзакции и общение между отдельными лицами во время пандемии COVID-19. Следовательно, пандемия COVID-19 повлияла на способ и темпы продвижения цифровых технологий в Египте. Целью этого исследования является изучение влияния пандемии COVID-19 на ускорение правительством Египта внедрения цифровой трансформации, которая принесла ценности бизнесу и клиентам. Количественный метод используется в данном исследовании для рассмотрения и анализа данных о цифровой трансформации, полученных от Министерства связи и информационных технологий Египта. Согласно результатам данного исследования, пандемия COVID-19 вынудила правительство Египта развивать цифровую инфраструктуру, необходимую для цифровой трансформации. Тарифы мобильной связи и количество пользователей интернета увеличились за последние три года, что, в свою очередь, отражает прогресс в развитии инфраструктуры. Ощутимое улучшение цифровой инфраструктуры служило для компаний фантастическим шансом пройти цифровую трансформацию, найти своих цифровых клиентов и принести им

ценности. Это исследование вносит свой вклад в литературу по цифровой трансформации (экономике), расширяя понимание текущего уровня цифровой трансформации в Египте и ее влияния на создание ценности для египетских предприятий и их клиентов.

Ключевые слова: цифровая трансформация; создание ценности; пандемия COVID-19; потребительская ценность; интернет.

JEL коды: L86; O32; F20.

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