



# The Impact of Innovation and Digitalization on Service Sector at Post-pandemic era

Muhammad Balbaa  
Tashkent State University of  
Economics, Tashkent, Uzbekistan;  
Email:  
m.balbaa@tsue.uz

Nilufar Ismailova  
Tashkent State University of  
Economics, Tashkent, Uzbekistan;  
Email:  
nilufar.ismoilova@tsue.uz

Zebo Kuldashaeva  
Tashkent State University of  
Economics, Tashkent, Uzbekistan;  
Email:  
z.kuldashaeva@tsue.uz

## ABSTRACT

This study aims to investigate the economic impact of the COVID-19 on service sector companies. During this international pandemic, the economic losses are so destructive that world economies are eyeing future recessions. Poverty and unemployment and are always low, and the assist of IT is needed to eliminate the harmful results. This paper also identified the industries which have been strongly impacted at the pandemic time and are in need of comprehensive reform. Just some few industries are showing less losses or operating well during that pandemic. The research aims to show the effect of COVID-19 on different industries while identifying the most affected industry. This study also explains the role of Innovation, Digitalization, and IT during COVID-19 and how they can assist humans and businesses deal with exacerbating situations all-over the world.

## CCS CONCEPTS

• **Keywords:** Digitalization, COVID-19 Pandemic, Business Sustainability, Economic Growth, Service Sector, Innovation, Information Technology.;

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## 1 INTRODUCTION

Technology made it possible for high growth in almost every human interaction field in the past few decades. Information & Communication Technology has allowed the globe to become interconnected. This has made a long time impression on the global market. The world market is affecting most people, boosting the economy and the individual standards of living. The use of IT by consumers is very important in today's global market age.

The COVID-19 affected the global economy too hard, and has not left the industry unaffected. In this paper, we try to discuss

the gaps in literature on economics and enhance future research to concentrate on explaining well-being, especially in response to pandemic decline. Increased protectionism became worse during the pandemic, which increased the economic decline. It impacts the entire economy, norms, and values, turning them to produce a completely new value chains. Safety, human protection and social distancing are becoming more important than speed and good management. Relocations and shutdowns of companies and supply chains are shown in nearly every industry, local governments put their economies aside and stockpiled basic necessities. This pandemic has led, not only to social distancing, but also to economic distancing and endangerment of the world economy.

In such a severe situation, IT is the only way to maintain the economy operating. All countries are searching for their own technical specialists to come out and do their task in maintaining economy in the right track. The collapse of different industries at the pandemic time is showing disturbing repercussions. At the pandemic time, the worldwide lockdown has cut supplies to nearly zero, also the mobility of essentials has fallen by more than one-fourth. The main industries hard impacted by the shutdown are retail, entertainment, manufacturing, public services, media, tourism, and transportation industry. IT played a significant role in introducing cumulative, reliable and accurate connectivity. Information Technology provides economic benefits to access information; Moreover, IT appears the single method during the shutdown, to offset the companies' financial loss. The economic gains of it in this scenario are worldwide spread, because of speedy communication and new compensation methods. The financial sector is strongly affected by the fluctuations of the markets' risks. At the same time, besides exchange rates also interest rates show little involvement in the fluctuations of bank returns. The outbreak of the epidemic affected the daily operations of life, also stocks' markets were negatively impacted by the same reason for the reason that the change in the psychological behavior of the investor (R.K.Kushwaha, RamPravesh. 2020) [1].

This paper targets the analysis the economic impact of COVID-19 on companies that work in services sector. At the time of this international pandemic, also financial losses are very destructive that world economies are eyeing future recessions. Poverty and unemployment are always low, and the assist of IT is crucial to eliminate the drastic consequences. This paper also identified industries which strongly impacted at the time of the epidemic while in need of comprehensive reforms. There's some few industries are showing less losses or operating well at the epidemic time. The paper targets show how COVID-19 affected different industries while identifying the most affected industry. The current paper

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also assures the importance of Innovation and IT during COVID-19 and how they can assist individuals and companies deal with exacerbating situations all-over the world.

So, IT applications is the primary and most important base on which world economies depend and reduce the negative impact of COVID-19. In our digital globe, Information & Communication Technology has a major turn in the fighting against the epidemic. It is clear that technological fields such as cloud computing, AI, and the science of data are the sole factors that have continued to operate fully during this crises. As COVID-19 has affected nearly all the economic sectors all-over the world. Therefore, these techniques are executed in resources allocation and tracking carriers. Also it is executed by many economies to help their corporations in addressing their social problems and activities during lockdown. Digital technology appears to support businesses with technological infrastructures, which duly operate offline or online.

Furthermore, companies that were late in integrating IT, faced many challenges. The social distancing policies and stay-at-home restrictions have caused offline businesses to be the most affected. However, many companies which weren't working on-line before the epidemic quietly could manage to transform their online businesses to fight the economic catastrophe of the epidemic. Educational institutions besides off-line enterprises have been closed to reduce the virus spreading, also a lot are still operating online. This increases the on-line studying apps demand and office solutions for remote work.

Besides, there is two industries which hit the hardest at the epidemic time: which are tourism and health. Health care systems in some nations have been partially or completely disrupted. Altogether the high-technology sphere, the industry of healthcare has been dealt a devastating blow by the increasing of people infected by COVID 19 and the shortage of healthcare workforce, maintaining humans with routinely health challenges outside the medical institutions. The healthcare industry has actively moved towards telemedicine solutions for tele-health. This move appears to be more efficient in assuring that routinely patients staying at home, also that hospital resources are allocated toward dedicated COVID-19 wards. Sudden and strict closures in urban or rural areas brought traffic to a standstill and, consequently, a global reduction in the flow of emergency road-related patients. Video surveillance in which the patient participates and automated intervention to provide medicines directly to patients' beds have kept healthcare staff safe from facing the virus.

In contrast, the sector that was hit hardest was tourism. Restrictions on public grouping and flight cancelation operations around the globe have got a bad effect on the sector. Travel, hospitality, tourism and related services also had the same level of tension. Many companies located in tourist hotspots have got to close their doors to keep humans away from tourist spots.

Both industries show a mixture of both these extremes of getting technological infrastructure or have no internet or online communication infrastructure. This research will show the influence of COVID-19 on these two types of business to see how technological infrastructure helps corporations sustain their economic operations during such kind of situations.

## 2 COVID-19 ACCELERATES DIGITAL HEALTHCARE SECTOR INNOVATION

As we know the industry of healthcare provides ethical services to people, so, its importance is evident in its demonstrated capability to enhance the economy besides job classifications. The industry of healthcare comes at the first after emergencies and personnel. The sector of health is the primary to face a crises. Digital technologies had become a significant aspect of the industry of health. Technological developments such as telemedicine, online consultations by doctors, applications of pharmacies and other related programs play crucial role in introducing better health services (WHO, 2020) [2].

During this COVID-19 outbreak, AI and other related technological infrastructure can assist health providers in different methods. In some areas, mobile applications have been provided to observe the status of spreading the COVID-19, besides collecting location-based data for people suspected of being infected. Call centers with medical specialists have also been set up to assist patients who have severe symptoms. IT also played a crucial role in introducing updated information and training and guiding health experts. That can assist with service management, quality control, and remote areas transparency (Keesara et al., 2020) [3].

The industry of health is the most affected sector by the epidemic; Health care workers suffer from a shortage of Personal Protective Equipment and faced infections. There was a shortage of beds and some medical tools, and ventilators. Technological advances play a crucial role in leveling the rise in proved cases and decreasing the flow of patients towards medical institutions (Smiths et al, 2020) [4].

Table 2: this table shows that remote work may be stay for a long time, and could even become the norm in a few key industries.

## 3 EFFECTS OF COVID-19 ON DIGITALIZING THE SECTOR OF TOURISM

Since corona was announced as an international pandemic, and it had a remarkable effect on just about everything, even activities and social movement. Global and local administrations forced various levels and penalties on residents and citizens, like preventing travel, restrictions on gatherings, stay-at-home orders, self-quarantine, other companies closing and time restrictions. Countries whose economy depends on hospitality faced a severe negative effect on the economy like tourism, hospitality, travel, and some other services like aviation.

The industry most affected is tourism, hospitality and travel due to partial and complete lockdowns all-over the globe. This industry besides the other related sectors have declined to a fraction of their contribution in the pre-COVID-19 period. As other sectors begin to reopen after applying the COVID-19 Standard Operating Procedures SOPs, the industry of tourism, hospitality and travel remains stalled because of its vulnerability to the freak of the disease. Besides, other sectors are changing their activities to digital platforms to different degrees depending on the flexibility. That sector got a lot of obstacles in customizing with tourism in the digital form: lack of technological advances, technological infrastructure, besides limited implementation of technology-based tourism.

**Table 1: The Continued Rise of Remote Jobs from Sep. 2020 to Sep. 2021. Data Source (LinkedIn's Canadian Workforce Report) [5].**

Industry	% Remote (Sept 2020)	% Remote (Sept 2021)	Change (p.p.)
Software & IT Services	12.5%	30.0%	17.5
Media & Communications	12.5%	21.3%	8.8
Wellness & Fitness	3.3%	21.2%	17.9
Healthcare	3.2%	14.4%	11.2
Nonprofit	4.6%	14.1%	9.5
Hardware & Networking	2.2%	12.9%	10.7
Corporate Services	5.2%	9.5%	4.3
Education	9.4%	8.8%	-0.6
Entertainment	3.0%	7.7%	4.7
Finance	1.8%	6.5%	4.7
Consumer Goods	2.2%	6.0%	3.8
Recreation & Travel	0.2%	3.7%	3.5
Manufacturing	1.4%	3.0%	1.6
Energy & Mining	1.0%	2.7%	1.7
Retail	0.5%	0.7%	0.2

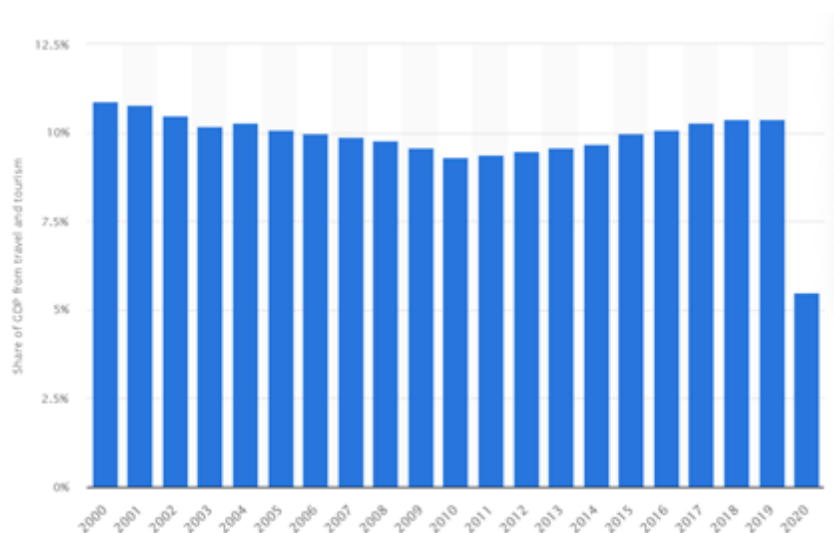
**Figure 1: The Share of total (GDP) that generated by tourism, hospitality and travel sector all-over the world since 2000 till 2020. Source: (Statista) [10]**

Figure 1 The tourism, hospitality and travel sector's total GDP accounted for 5.5% of world GDP in 2020. This figure witnessed a huge fall over the last year because of the coronavirus (COVID-19) pandemic which affected travel decline all-over the world.

Relatively, the industry of tourism, hospitality and travel acting in a different way depending on its nature. Although it is under discussion by academics, E-Tourism still not performed to the extent that may show flexibility and combat such epidemics. There has always been a difficult relationship between IT and tourism (Werthner and Klein, 2015) [7].

During the post-COVID-19 time, the industry of tourism is expected not to be as it was in the pre-COVID-19 period. The situation

of the industry of tourism must be approached tactically to restore socioeconomic stability after COVID-19. Sub-sectors of tourism were also badly hit, including the aviation, road transport, leisure, food supply-chain industries and hotels. The digitization of the sector of tourism is also suggesting reforms in these sub-sectors on a massive scale. Solutions that are based on innovation besides technology suggested for passenger protection and hygiene. The modern socioeconomic system is relying on the industry of hospitality and tourism, with many countries changing their economy to tourism instead of natural resources. While crises closely affect the industry, they can alternate to a severe recession. The sector of

tourism is facing a different nature from other industries as technology can't do a lot with it except to speed up the process of booking, searching for destinations, process of recommending a destination etc. We had to customize to an innovative and strong technological infrastructure besides the use more technology tools. As it's expected the tourism future to rely on digital and Technological innovations (Rao and Krantz, 2020) [8]. Chat-bots, online reservations, and trip planners already exist. However, this industry is now expected to implement Robot-based services, Virtual Tourism, Sentiment Monitoring, and the Internet-of-Things IoT. This will show tourism in an entirely different way. Many hotels are already applying robots to introduce hotel services and housekeeping activities to ease human interaction (Kwok et al, 2020) [9].

Many researchers come up with new ideas for decreasing human direct contact in the sector of travel and tourism to reduce losses. New standards for cleaning rooms, operations of elevators, locks, keys, also other strategies will be organized and reworked. Some academics studying contact-free receptions besides write complaints and suggestions to customers. Other IT technologies such as, deep learning, AI, and machine-learning going to forecast customer needs, behaviors and mobility patterns. Recreational venues in which social distancing can't be effectively implemented and places hosting a lot of humans, using virtual reality tours, will be also digitized (Chirisa et al, 2020) [10].

Some researchers have proposed virtual reality technologies for unparalleled travel experiences. Barriers on the mobility of frequent tourists and travelers confine them home; Travel is not allowed now, and no one knows how long it will last. Hereafter, Travelers will find VR apps to choose the destinations of their choice. VR based travel applications are as useful in daily life as in covid-19 period. Passengers can check their 3D destination before their arrival to get far from the struggle of tickets, holiday organization and airport needs (Bhuiyan et al, 2020) [10]; (Sigala, 2020) [10].

#### 4 FUTURE DIGITALIZATION OF EDUCATION AFTER COVID-19

The WHO declared, March 2020, COVID-19 a world disease. April 2020, schools and universities were closed in most countries. The aim of closing educational institutions was for reducing the COVID-19 spread by maintaining people home and far from public gatherings. This encouraged online and learning in distance by technology, 91.4 % of students and about 63M instructors and administrative staff were affected. To meet the growing educational challenges of schools' closing, schools have embraced technology, demonstrating its importance in introducing digital learning based on platforms that may reduce education loss. Instructors and college students display flexibility and adapting for using platforms based on technology for on-line studying as an alternate to the traditional lecture rooms style (Chick et al., 2020) [10].

Technology is also helping to maintain teacher wages and in-person training through using digital tools as humans move their teaching operations to distance learning. During transferring the education style into a totally new digital sphere and technology-based education, instructors need digital and technological capacities. Some other on-going studies in several countries provide awareness about how on-line and remote learning tools through

digitalization can assist either developed or developing countries to manage their own responsive policies at a pandemic (Verawardina et al., 2020) [10].

Figure 2 shows Zoom massive rise in its revenue throughout the fiscal year ending January 31, 2021. Zoom's revenue was \$2.65 billion, compared to just \$623 million a year earlier.

#### 5 PUBLIC AND GOVERNMENTAL SERVICES AT THE PANDEMIC

Corona pandemic is by far the worst disaster the globe has seen in modern history. It had huge effect on the systems of healthcare all-over the globe, the international economy, besides community at large. To a large extent to cope with the fighting, the countries of the globe, at the invitation of WHO with the Secretary-General of the United Nations, moved quickly towards combating this epidemic, as the public services was put in the forefront in this current situation. Public services sections that remain social distancing for maintaining the public safety got reduced their operations. Nonetheless, they also introduce public services either online or remotely using technology. COVID-19 considered the 1st pandemic in people time within which social media and IT are being used to protect people while they are isolated. The most public services departments affected in are health industry, transportation and media. Airports and some entertainment events, among other services involving huge gatherings have been suspended until further notice. In such circumstances, IT is the sole way to provide up-to-date information, monitoring and functionality that is currently difficult to implement. Examples including operating remotely at home besides monitoring human's mobility to reduce the virus spread.

Besides medical and research experts, public service employees also contributed in preventing the virus spread. Throughout this epidemic, many employees worked remotely using technology that their departments have. Public service employees have also been working on containing COVID-19, also technology assisted them to accomplish their work to decrease social direct contact by introducing essential services online. Despite, in some states, not all sections have used IT due to shortage of technological infrastructure. So, they spread the platforms that already exists on-line or reduce their activities to decrease personal contact. Countries that have high-tech sphere have shifted their public services, including education and health, online and thought of approaches to assure that e-governments can preserve their technical capabilities. IT has the ability to facilitate health and social worries as well (Michael E. Milakovich, 2021) [10].

Table 3 presents a selection of the services created, along with the time taken to create them (from concrete identification of the need to the time they became accessible) and the times they had been used as of end- August 2020.

#### 6 FOOD RETAIL INNOVATION HBVBVDURING COVID-19

The severe coronavirus epidemic has caused a demand spike for some commodities for the reason of panic purchasing. For some goods the demand has frantically fallen for the reason of fall in use. Nielsen and CBA have mentioned that the demand increase for basic



Figure 2: Quarterly revenue of Zoom Video Communications, 2021. Source (Statista) [10].

Table 2: Examples of New Digital Services Created at the Pandemic, 2021. Data Source (IDB) [17]

Country	Service	Days taken to develop	Number of times used (from mid/end/March to August 2020)
Bahamas	Contact tracing app for health officials	5	Daily use by a team of 100 contact tracers
Brazil	Emergency assistance request	20	67 million+
Chile	Temporary travel permits during lockdown	7	108 million+
El Salvador	Directory of economic assistance for citizens	4	2 million+
Guatemala	Temporary employment suspension	45	100,000
Paraguay	Economic assistance program	14	1.5 million+
Peru	Official coronavirus website	3	450 million+

products such as rice, toilet paper beside many other foodstuffs was more than last year (Lobach, 2020) [10].

While China is recovering from COVID-19, SMEs are suffering to reopen, and medium-sized businesses will be hit hardest, as they don't have any alternative arrangements such as technological tools or e-commerce (Buck, 2020) [10]. These companies frequently lack protection nets when employees get sick. Information technology infrastructure were used for addressing health measures and prevent a pandemic. This includes self-checkouts to reduce direct contact among employees, reduce cash purchases, add counter guards, and restock shelves with schedules. There found

a 0.9% change in workforce in Australian food services industry since March 2019 till March 2020 (Vandenbroek, 2020) [10].

Figure 3 explains that while many companies had to cut jobs to fight COVID-19 epidemic, Amazon has driven an unprecedented hiring spree in 2020. According to its latest earnings release, the e-commerce giant created 500,000 new jobs in 2020, already adding to its large work force "1.3 million employees".

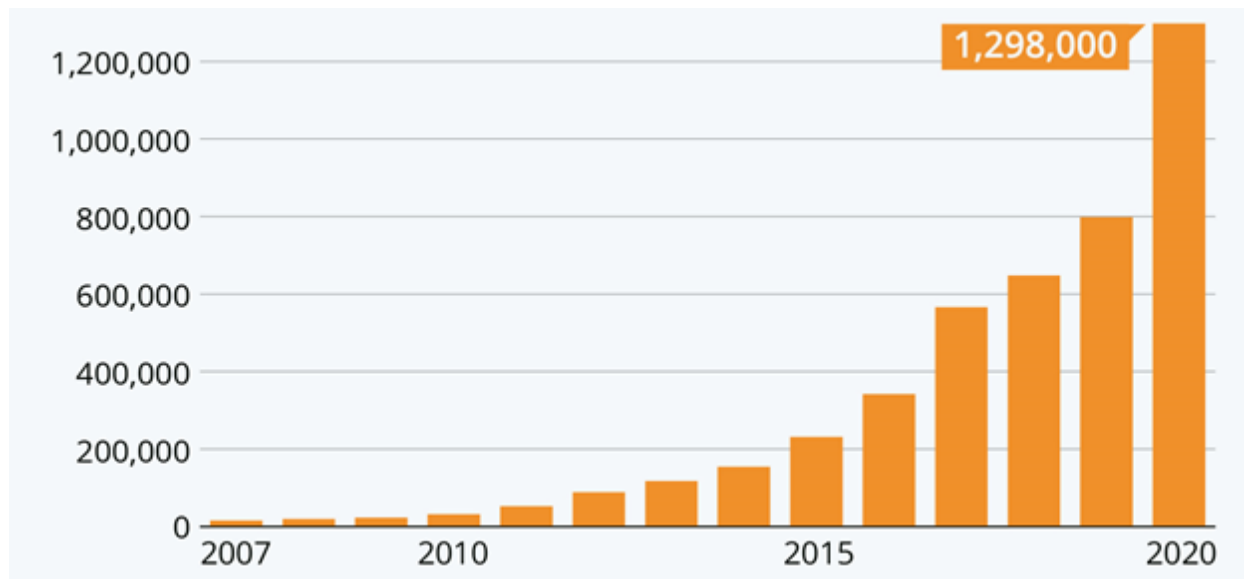


Figure 3: The rapid growth of Amazon's global workforce, 2020. Source (statista) [21].

## 7 EMERGING TECHNOLOGIES IN THE INDUSTRY OF ENTERTAINMENT

Latest shutdown has highlighted the significance in the sector of Media, as it performs a crucial role in increasing public morale. At the epidemic, humans had been directed to keep staying home, so accordingly they turned out recreational, cultural instructional and activities, which in turn have burdened live broadcasts and other on-line services. Simultaneously, it was difficult for producers to continue operating their activities, as recording the shows and the live broadcasts became more difficult because of social distancing. Because of the epidemic, this sector has additionally confronted unemployment and lack of manufacturing. Job losses with declining profits got worse by the extended volatility of entertainment during the epidemic. For the reason of the shutdown of the industry of entertainment, the losses in media revenues were around \$10B. (Hall, 2020) [10].

During the state of social distancing and the lockdown, 79.7 % of entertainment workers have misplaced and lost jobs or been forced to take vacations in the UK (Mangan, 2020) [10, 23]. A comparable scenario is seen in the entertainment industries in the US. According to the US BLS in its new Survey for Employment Statistics, there was 52% down in the motion picture sector. The also broadcasting sector has fell 9 % at this shutdown in May 2020 (stats, 2020) [104]. Moreover, a significant expansion of business happened, the influence of which was evident in the live and also the recorded broadcasts as well. The workforce in the sector of media has been transferred to different sectors to assure employment and the supply of services in the public health field; In Georgia, photographic workers were relocated to help in building hospitals.

In the industry of media, numerous sectors have used technology, such as live broadcasting and recorded production, to gain advantage of technology to make their productions profitable. Despite, live broadcasts cannot make much use of technology to remain

the quality of their engagement with the audience. But, recorded programs using set music with other audio-visual contents have shown significant enhancement regarding broadcasting and the associated technological infrastructure. Accordingly, at some point of the epidemic, the technological infrastructure became at a quick paced production. As many online applications and platforms do their role in bringing creative content together with the copyright issue.

Technological infrastructure and IT are also assisting producers to remain social distancing. For example, the replacement of add-ons beside robots and visuals with augmented reality. Maintaining a social distance among actors also means providing tools that lets in actors to photograph themselves. Likewise, those who work with voice-over and dubbing are furnished with device to record their voice or sent to rent automobiles with device on board near their homes so they be able work in distance. So, it's clear that COVID-19 pandemic harmed the industry of media. The inclusion of IT in that sector make it possible for the business to start operating, but it is not easy without adequate IT services. So, it is suggested that the diffusion of IT services is often a precious tool for integration into current systems. Film makers are using a robot's camera to make videos (Vesely, 2021) [10].

Figure 4 Shows that The Disney Company stated (Disney+) got 116 million subscribers globally for its third quarter of 2021. This considered a boom within the subscriber service's base of about ninety millions from the beginning of the financial year 2020. The service started in Nov. 2019 and with the company's 1st financial quarter of 2020 already collected more than 26.5 M. subscribers.



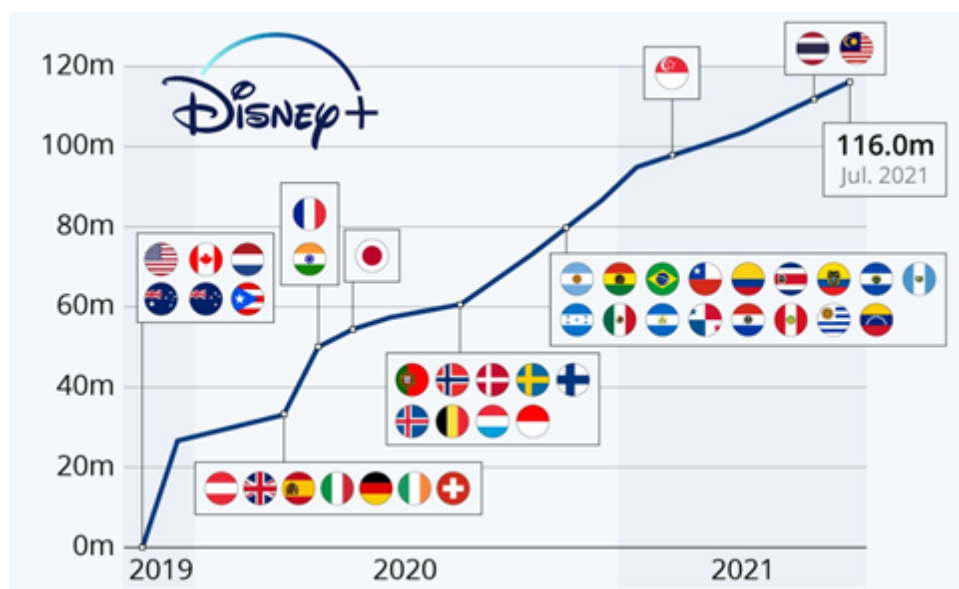


Figure 4: Worldwide paid subscribers and availability of Disney+, 2021. Source (statista) [10].

Table 3: UberEats Revenues and Users comparison Pre and Post Pandemic, 2020. Data Source (Business of Apps).

Uber Eats revenue		Uber Eats users	
Year	Revenue	Year	Users
2017	\$0.6 billion	2017	9 million
2018	\$1.5 billion	2018	15 million
2019	\$1.9 billion	2019	21 million
2020	\$4.8 billion	2020	66 million

## 8 IMPACTS OF COVID-19 TO DIGITAL TRANSFORMATION IN THE TRANSPORTATION SECTOR

The movement of people is developing with the assistance of technologies and digitalization. Despite, the COVID pandemic may probably stop the wheels moving. Technology can accelerate rather than prevent transportation, particularly with digitization of urban transportation. According to some researchers, urban transportation considered the best option to adopt new technologies. So, it is crucial to open the industry of transportation again, with putting safety for publics in mind. That's why, they examine the transferring techniques of humans to discover wherein they move around and the method to do this at the domestic levels. Data from IT Apps should be carefully considered to update humans in real-time about traffic on roads or malls and parks, etc. (Gössling et al, 2020) [10].

During the coronavirus epidemic, the load on corporations has modified from transporting humans to preserving a simple crewed transportation gadget to make sure the continued motion of cargo and crucial personnel. In the pre-COVID-19 era, technology was not widely utilized in transportation. Finding the road via navigators considered a tremendously old concept, however, the usage of it to remain social distancing could be a modern idea. An outdoor kiosk

is also installed to handle crowded situations, and lots of those were carried out touch-less screens. Monitoring people movement can reduce the COVID-19 spread, but it could trigger privacy matters (Hutchinson, 2020) [10].

Table 3 shows that in 2020, UberEats has become valuable to maintaining their business, while Uber's journey hailing platform noticed 50 percentage much less sales than a 12 months ago. Eats has creates extra sales than its movement segment since Q2 2020 [10].

## 9 CONCLUSION AND RECOMMENDATIONS

The most affected industries from the current pandemic – economically and financially - are Education, Health, Public Services and Tourism. Also, the aviation industry locked up because of flights' cancelation due to passengers' lack of demand and worldwide movement control in a lot countries, as the amount of passengers decreased so fast because of fear from spreading the virus. Businesses face a lot of obstacles all over the world. That's why IT can play a significant role in business growth. Besides, entrepreneurs and SMEs should be supported by governments.

It is expected that the epidemic situation and lockdown will continue for some time unless full treatment plays its part. Because of the heavy losses inflicted on many industries, all-over the globe,

business managers encouraged to act for developing counter strategies to make their business survive, and this can be achieved by taking additional measures. Experts suggested using ICT to avoid this challenge.

The COVID recession requires major reforms to the traditional work industry of the entertainment industry. A possible way for the entertainment sector to maintain companies surviving and avoid the financial and economic losses may not be pleasant for free viewers. Local channels have to use paywall for their media content by cooperating with other platforms to share profits. Content monetization could be outstanding solution to maintain business and also attract good donors.

Maintaining levels of social distance is in parallel with people movement restrictions, made digitalization is the transportation future. Besides automated vehicle transportation, Artificial Intelligence could be applicable in this sector by using predictive analytic transportation techniques.

The influence of COVID-19 on the sector of education is more beyond student learning. School closures put the educational industry at unemployment risk and closing the entire school. So, it needs a digital revolution in the sector of education to keep the industry surviving and contribute in educating people, the international economy and employment. Despite, Education Revolution 4.0 and is already providing the sector of education with IT and new learning methods, a new trend the pandemic rises to be included in the Education revolution 4.0 scenario, and the vitality of distance learning is more recognized. A lot of solutions have been put forward by researchers and educators. Global libraries and interactive learning are some applications that supports all the stakeholders in the hereafter of education, and they must be taken seriously.

It's a matter of fact that COVID-19 shutdown has brought the industries of restaurants and hospitality to a standstill. Despite these challenges, the service of online ordering kept companies surviving to some extent. The shortage of technological infrastructures and limited use of digital technology is a serious threats to this. This requirement leads experts to call for digitizing the industry of hospitality. Reinventing the sector of food according to data-mining techniques in order to understand customer wants can boost confidence. In a global situation in which the consumer is forbidden to move around and eat in restaurants, operators must upgrade themselves technologically. For example, robotic waiter service, AI and CCTV for crowd monitoring, and remote table reservation can turn the challenge into opportunity.

The sector of tourism is on fire to start post-pandemic recovery, in the past 10 months, this sector is on the brink of collapse. Economies that are based on tourism face the greatest challenge. Efforts are being put towards restoring the sector of tourism, besides keeping social distancing strategies and the safety of tourists. Virtual Reality is a good solution for the tourism sector, only it can speed the resurgence of the industry of travel, hospitality and tourism. These technologies offer solutions to get the better of the challenge of the beginning, and also maintain tourists' attraction to travel within a virtual sphere and keep them safe from being attacked by the virus.

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