

Determinants of Digital Transformation in the Post-Covid-19 Business World

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Abstract:

Digital technologies are playing a major role in overcoming the impact of the Covid-19 pandemic in business and society. In other words, the pandemic also brings a significant opportunity for digital technologies. Organizations are focusing on managing and adopting strategies for business resiliency and recovery in the post-Covid-19 situation through digital transformation. Business resilience needs processes and people to maintain unremitting business operations. Digital transformation ensures business continuity and helps in running core business operations with resiliency and disaster recovery. This study develops a conceptual framework to understand the determinants of digital transformation in the post-Covid-19 business world. The determinants are categorized based on human, organizational and technology-related factors. These are employee health and safety, virtual collaboration, remote working, business resilience and recovery, business process automation, technology readiness and, cybersecurity risks. This study contributes to applying a conceptual framework of digital transformation in the business during the post-Covid-19 period based on the inclusion of human, organizational and technological factors.

Keywords: *Digital Transformation, Business Continuity, Covid-19, Resiliency, Business Process Automation*

1. Introduction

The Covid-19 virus was first detected and reported on December 31, 2019, in Wuhan, China. This virus has influenced the personal lives as well the entire economies, nations, and industries (Muthuraman and Haziazi, 2020). Digital technology becomes the hot topic of discussion in the current economic development argument due to its extensive usage during the Covid-19 epidemic. Digital technology is the division of scientific or engineering knowledge that deals with the formation and application of computerized devices, methods and, systems. Digital technology helps in transferring the message or communication between two devices in the form of binary code. Binary code comprises all ones and zeros and can be read by the devices that utilize digital technology. Digital technology comprises physical components and an embedded system (Broy, 2010). The physical components are mechanical and electronic. The embedded systems consist of software systems, targeted interfaces for the interaction with the environments, such as, sensors and actuators, and are linked into digital networks (Lee and Seshia; 2012). Digital technologies can alter operations, business models, products, services and, the competitive environment of an organization (Chanas et al., 2019).

According to Salesforce.com (2020), digital transformation is the practice of deploying digital technologies to generate new or transform current business processes, culture, and customer experiences to fulfill varying business and market needs. According to Vial (2019), digital transformation is a process of improving an entity by activating substantial modifications to its assets via groupings of information or data, communication, computing, and connectivity technologies.

The Covid-19 pandemic intensifies the adoption of digital technologies in the organization such as industrial robots and artificial intelligence for automation. The digital technologies that change and improve the lifestyle of the people are digital education, E-gaming, videoconferencing, Internet streaming, cashless payment, and, E-commerce during the pandemic. These technologies have a long-lasting impact on business and society in the post-Covid-19 era (Livari et al., 2020). In the post-Covid-19 era, each organization has had to innovate to deal with the new normal of digital transformation. Therefore, data analytics, ML, and AI are supporting the organizations to become leaders in their segments (Doyle and Conboy, 2020). All the industries including government, manufacturing, healthcare, education, airlines, etc. are impacted by the Covid-19 pandemic. The pandemic has compelled business operations to go virtually and therefore organizations have moved on to digital transformation successfully in a short timeframe (Kim, 2020). The employees will need to be geared up to maintain this change in the post-Covid-19 period. The industries that are moving on to digital transformation are mainly healthcare, manufacturing, retail / E-commerce, IT and, education (Wuest et al., 2020).

2. Literature Review

Industries impacted by Covid-19 outbreak

The Covid-19 pandemic has affected numerous industries. Service is the most affected industry during the pandemic that includes travel and tourism (airlines, hotels, and cruises), entertainment (theme parks and movie theatres), and hospitality (coffee shops and restaurants). The second most affected industries are manufacturing and supply chain (Wuest et al., 2020). The automobile, electronics, pharmaceutical manufacturing industries have large global supply chains. Service sectors like an airline, retail suppliers, and transportations also have a large global supply chain. These sectors are significantly impacted by Covid-19 because of their high reliance on global supply chain partners over the past two decades (Belhadi et al., 2021).

The pharmaceuticals are highly regulated industry because it relies on global suppliers. This industry has been rigorously influenced by the Corona outbreak due to regulations on testing at International, national, and regional levels as well as due to modified compliance. Agriculture and food processing is a labor-intensive industry. The industry experiences a scarcity of seasonal workers with a hike in demand at the same time during the Corona outbreak because customers purchased food items in bulk quantity. The lack of food-picking laborers is influenced by travel restrictions, quarantines, social-distancing practices, and progressively more, illness among workers (Dressler, 2020).

The automotive industry has been badly impacted by Covid-19 as the entire plants closed down due to security concerns as well as deteriorating demand (Dressler, 2020). Some automobile factories replaced the tools and operations and shifted to the manufacturing of medical components and parts. The medical apparatus industry faces an unpredicted rush in demand and therefore puts great effort to increase production with demand. The industry faces supply disruptions of vital components from international and local suppliers.

The paper and toilet product manufacturers experienced a shift from stable consumer demand and business products to mainly consumer deviations. Both manufacturers struggle to maintain the balance with the demand for these indispensable products. The aircraft industry experiences a sheer drop in demand. Aircraft manufacturers have closed down their operations at several amenities. The logistics industry depends on the global supply networks and hence this industry is highly influenced by swiftly changing regulations, such as trade bans and demand shocks. Labors in the logistics industry are at high risk of contaminating with the Covid-19 virus while offering necessary services to society.

The IT industry experiences an unpredictable and fast demand growth for their services. Digital video-conferencing tools are widely adopted and used by universities to deliver lectures. These tools are used by organizations to virtually conduct business. Distance learning programs and collaboration technologies platforms used by universities and organizations at large extent to hold huge online traffic and users. Organizations are using Software-as-a-service (SaaS) cloud service model and Industrial Internet (II) platform for scalable infrastructure, easy sign-up, and negligible hurdle for new users. The system integrators are setting up gateways and hardware to help remote access and data exchange between the organizations (Dressler, 2020).

Need of digital transformation in the post Covid-19 era

Digital transformation helps in offsetting the uncertainty in a dynamic business environment due to the coronavirus outbreak. To deal with the Covid-19 outbreak, people are restricted to their homes and adopt new behavior to fulfill the necessities (Cohen and Kupferschmidt, 2020). Collaboration technologies like Zoom, Google Meet, and Teams have kept people associated around the world. Schools, businesses, and healthcare providers have become more digital-savvy (Livari et al., 2020). Schools and colleges and universities have switched to online and digital education formats. Remote forms of teaching and learning have become popular among teachers and students in the Covid-19 situation (Bogdandy et al., 2020). Online shopping including grocery items, clothes, and other accessories has become more prevalent during lock-down. The e-commerce business grows up with the pandemic. For example, online grocery firm, Big Basket has experienced an 84 % rise in the number of new customers, along with 50 % higher retention rates in the post-Covid-19 era. Digital technologies used in the workplace have changed from basic distinct office applications to linked digital platforms (Leonardi et al., 2013) with essentials of automation and implanted AI-powered self-learning competencies (Lyytinen et al., 2020).

Workplace technologies denote a range of digital services that facilitate work within organizations. These technologies range from enterprise applications to integrated SMAC technologies (Attaran et al., 2020). SMAC technologies include social media, mobile technology, big data analytics, and cloud technology. Organizations are gradually using more advanced digital technologies like IoT (Internet of things), machine learning (ML) and artificial intelligence (AI), robots, and self-learning algorithms. Early workplace technologies were based on

individual office applications and gradually shifted to collaboration and social technologies such as email, intranets, collaboration technologies, and social media. Currently, during the post-Covid-19 period, complex workplace technologies like sensing devices, AI and cognitive knowledge and collaboration systems, robotic process automation, etc are used by the organizations (Kane, 2017).

IDC (2020) predicted that digital technologies such as collaborative applications, security solutions, and AI are used by organizations in the post-Covid-19 situation allows the organizations to assist their customers innovatively through customized, collective, and related experiences. Under the digital transformation plan, businesses are switching to virtual collaboration and a remote working environment in the post-Covid-19 era. All the organizations related to retail, hospital, manufacturing, IT, service sectors are adopting digital platforms to ensure business continuity. Digital solutions such as virtual collaboration tools and smart tracking apps are used by organizations for virtual meetings and remote working. IT industry plays a vital role in helping organizations in their journey of digital transformation. Businesses that have incorporated digital transformation are more profitable than their competitors and experience a higher market valuation.

Covid-19 has determined businesses to pick up the pace of digital transformation efforts. Digital transformation begins with the use of digital technologies that help in reducing face-to-face interactions and safeguard employee and customer's health and safety. Digital technologies comprise C2B e-commerce applications such as food and grocery delivery services, B2B e-commerce applications, and videoconferencing applications that appear to have entered the consumer, business worlds.

According to Morgan Stanley's report (2020), Covid-19 has created the latest necessity for digital tools to alleviate pandemic interruption. The technologies that emerged as key areas of focus are hyper connectivity and 5G-powered applications, cloud computing, E-commerce, AI, and cyber-security. For example, during the Covid-19 pandemic, airlines hired a DX (Digital transformation) consultant to design, employ and combine automated identity screening, airport logistics, and IoT applications to reduce human contacts and assist contact tracing. During a pandemic, banking firms invested in an internal-DX to initiate a cloud-based digital offering. This internal DX could integrate software as a service (SaaS) vendors and AI to measure credit risk and one-to-one marketing. Business spending on digital transformation accelerates due to increasing in hyper-connectivity and 5G-networks based applications such as Internet streaming, IoT, augmented and virtual reality.

3. Determinants of digital transformation in in the post Covid-19 era

Organizations are moving on to digital transformation due to different factors in the post-Covid-19 era. These factors are categorized based on human, organizational, and technology-related factors. The human or individual factors are employee health and safety, remote working, and virtual collaboration. The organizational factors are financial stability, business resiliency and recovery and, business process automation. The technological factor are technology readiness and cyber security risks.

1) Employee Health and Safety

Employee health and safety are the most important necessity for sustaining business continuity and operations in the post-Covid-19 era (Papagiannidis et al., 2020). Employees are at risk from Coronavirus if they come in close contact with an infected person or contaminated objects in the workplace. In the healthcare and hospitality sectors, health and safety laws should apply to the doctors, nurses, other staff including cleaners, care workers who come in direct contact with corona-infected people. Appropriate risk assessment and preventative measures for the employees should be implemented in the organization.

Big data analytics and digital technologies for tracking and tracing can be used to keep employees safe during the global pandemic (Daniel C. Malyszko, 2020). Employees keep an organization going and without them, there cannot be any continuity. Similarly, having to worry about their health and that of their families can place immense psychological pressure that is likely to impact their performance and productivity. Appropriate measures can reassure staff and make them feel valuable, which can only have a positive impact on the organization (Papagiannidis et al., 2020).

2) Remote Working

The pandemic is compelling many jobs to be executed remotely. Digital technologies allow teleworking and are already available. In the post-Covid-19 period, the adoption and implementation of digital technology have accelerated (Soto-Acosta, 2020). Many digital transformation projects have been started by businesses for remote working. For example, Zoom has developed as one of the most widely used applications for the virtual meeting.

Zoom comes with various features like higher quality calls, usability, record meetings, and share content over calls that have made its business model far apart from its competitors (Soto-Acosta, 2020).

The importance of workplaces has reduced and work from home has abruptly become compulsory. Working from home culture brings digital transformation of the workforce and also the development of the working environment at an unparalleled speed. Telecommuting or remote working has been widely adopted by the business since the coronavirus outbreak (DobricaSavić, 2020). It requires a change in the management and assignment of the staff. Different communication and management styles are adopted by the managers to lead and confirm the essential level of productivity of remote staff. It is believed by the employees that a digital form of work is a secure source of income because of the COVID-19 pandemic (Nagel, 2020).

3) Virtual Collaboration

Frick et al. (2021) highlighted that digital transformation promotes virtual collaboration among clinicians during the Covid-19 pandemic in the health care sector. Organizations are adopting digital technologies for remote collaboration and improve their performance and capabilities. IT-enabled business processes such as video conferencing, telemedicine, online purchasing, E-learning, electronic trading, video streaming, and online marketing are the results of digital transformation. Traditional work practices are replaced by IT-enabled processes in the Covid-19 period. Organizations that have boosted their IT competencies and remotely collaborate with the employees not only survive in the post-Covid-19 period but also overcome the unavoidable challenges that occur due to the pandemic (Dobrica Savić, 2020).

Anthony and Petersen (2020) stated that Virtual Enterprises (VE) is the way of leading the business in which organizations collaborate to share their core competencies to survive in a pandemic situation. During the pandemic, businesses are gradually moving on to digital transformation to break market boundaries. For that, businesses collaborate digitally as VEs to realize new prospects to share resources, capabilities, and knowledge to achieve competitive advantage (Verhoef et al. 2019).

4) Financial Stability

The Corona pandemic reduces economic activity and financial stability worldwide (Didier et al., 2021). Digital financial inclusion plays a vital role in mitigating the social and economic impact of the Covid-19 pandemic (Sahay et al., 2020). The financial stability challenge that arises due to the pandemic can be mitigated through the development of the latest financial technologies referred to as FinTech. The digitization of financial services is required in the areas of payment systems, lending, and deposits, insurance, investment management, financial trading, etc in the post-Covid-19 era (Pantielieieva et al., 2018). Digital financial services are providing cashless and contactless transactions during the Covid-19 health crisis (Sahay et al., 2020).

Digital financial services are faster, more efficient, and relatively cheaper than traditional financial services, hence these services are increasingly reaching low-income households and small and medium-sized firms during and post Covid-19 period. Government support measures are quickly and efficiently implemented by digital financial services to help the people and firms affected by the pandemic (Sahay et al., 2020). Fast-tracking growth of digital financial services during and post Covid-19 help in increasing financial inclusion that includes affordable cross-border payments or remittances, mobile money transactions, digital savings, digital lending/credit, smooth access to government electronic systems and, insurance. During the Corona outbreak, mobile money services under Fintech help people and firms to maintain and increasing access to financial services, reopening of businesses, provide contactless and cashless transactions (Sahay et al., 2020). The financial inclusion under digital financial services helps in improving the economic growth of the organizations as well as the countries.

5) Business Resilience and Recovery

According to the BSI group (2020), organizational resilience is the organizational capability to predict, get ready, react and acclimatize to incremental change and unexpected disruption for survival and growth (ISO, 2017). Digital transformation begins with adopting resiliency and recovery business strategies through digital technology. Business resilience strategy focuses not only on risk management but also on business success and performance. The Covid-19 pandemic carried exceptional crises to the world therefore, organizations have already moved towards digital transformation. Employees started working from remote locations to avoid the virus spread and also to maintain business continuity, abruptly contributing to virtual human resource development.

Organizations are adopting resiliency and recovery business strategies to cope up with the current challenges and plan for future interruption (Bennett and McWhorter, 2021). In this process, online business applications became important for guaranteeing continuity of personal and business services in the post-Covid-19 period (Papagiannidis et al., 2020). IT support team helps the employees to work from home with proper IT infrastructure during the COVID-19 lockdown. This requirement becomes more difficult when it becomes a part of daily routine business IT operations with security agreements in the post-COVID-19 period (Ramamoorthy, 2020).

Organizations are determined on overseeing the influence of the Covid-19 pandemic and adopting new business practices to guarantee business resiliency now and at some point in the event of future disruptions. Resiliency can be two types business and IT resilience. Business resilience needs people and procedures for business continuity during data center outages and future disruptions. IT resilience entails people, procedures, and technology to retain accessibility of business applications. IT resilience is necessary for maintaining business resiliency, disaster recovery, and running main business operations (Ramamoorthy, 2020). It is important to formulate hands-on business continuity and resiliency strategy for digital transformation in a firm. This helps in building robust resiliency into the IT and business infrastructure and reduces downtime and related costs.

Digital technologies like the Internet of things, blockchain technology, and digital twin are used by manufacturing firms to increase supply chain resilience through high connectivity, precision, and transparency (Belhadi et al., 2021).

6) Business Process Automation

According to Ramamoorthy (2020), artificial intelligence (AI) enabled tools are used for anomaly detection and business process automation. Artificial intelligence (AI) enabled systems to provide dashboards, anomaly detection, predictive monitoring, and metric correlation features to help the IT support team to find out abnormal behaviors and implement required actions, which brings self-healing ability and recovers resiliency of systems. AI-enabled tools maintain 100% accessibility of mission-critical applications for the business.

As per Forrester's report (2020), firms are investing more in artificial intelligence-enabled devices like industrial robots, service robots for business process automation in the post-covid-19 situation. The coronavirus pandemic has made automation important for business continuity plans and handling new risks. Governments and organizations are investing heavily in AI-powered technologies such as synthetic biology, robotics, and drones. The effect of these investments will continue to grow in the post-Covid-19 situation.

The digital transformation through AI addresses product lifecycle concerns, including issues of manufacturing, design, resilience, and, sustainability (Wuest et al., 2020). It also addresses the influence of Covid-19 on the supply chain (Wuest et al., 2020). AI-powered digital transformation allows the organization to shift towards digital supply networks and alleviate numerous existing challenges of manufacturing and supply networks (Sinha et al. 2020).

AI-based digital technologies can maintain the lights on in the factories; allow remote control of the shop floor activities. AI-enabled technologies adoption results in improved connectivity, transparency, and visibility across digital supply networks. AI-based smart factories function with a skeleton crew with their digital twins, process automation, and robotics. During the Corona outbreak, smart factories maintain output and efficiency. Moreover, the manufacturing resiliency practices allow for retooling the factory to manufacture repurposed, high-demand products like ventilators in automotive factories (Kusiak, 2019). Another component that helps in mitigating the challenges caused by Covid-19 to manufacturing and supply chains are automated material and transportation systems. These include driverless trucks, cars, and robotics in factories, warehouses, and highways. These components create the factories and roads less jam-packed and therefore naturally sustain social distancing measures while assuring operations of the integrated digital supply networks.

In pharmaceutical manufacturing firms, AI is suitable for the automated design of new drugs and vaccines. It also helps in predictive maintenance in the manufacturing firms by offering insights into probability and timeframe-related issues. AI-enabled remote condition monitoring solutions are rising in the manufacturing industry. The position of equipment is remotely assessed, and actions such as scheduled replacement of parts and maintenance operations are created. This also decreases the travel needs of maintenance experts to measure manufacturing assets. Such solutions are required during travel bans, supply shortages, and stay-at-home orders.

7) Technology Readiness

During the Corona outbreak, students are exposed to digital learning platforms by the universities. Students and employees require technical equipment, appropriate skills, and tools for interacting virtually with their lecturers and peers. (Hendel et al., 2020).

Several countries are still struggling with the expansion of their digital economies. It requires the construction and maturation of digital infrastructures such as optical fiber networks, wireless-based ICT, digital technologies (AI, big data, cloud computing, etc), and software that would guarantee and help a 24/7 online real-time connectivity.

Organizations are required a certain level of awareness regarding the importance of digital transformation and the improvement of employees' skills. This would result in a better understanding of the changes currently occurring in the global business environment and in a significant increase in companies' ability to embrace and use digital technologies i.e. digital or technology readiness.

Organizations are required to contribute to end-users digital literacy and readiness by escalating their readiness to accept Internet-based services and providing them with new resources of knowledge, which will allow a better understanding of digital transformation and help close the digital divide (Nachit and Belhcen, 2020).

Digital transformation is becoming a vital priority for several businesses and public service providers, which focus on the digital readiness of governments, companies, and most essentially, customers. Nachit and Belhcen (2020) highlighted that digital transformation is influenced by three main factors that are global digital infrastructure, companies' digital readiness, and customer's digital readiness.

Organizations must improve their digital maturity because less digitally mature organizations are more fragile, and organizations with higher levels of digital maturity are generally more flexible (Fletcher and Griffiths, 2020). Chou (2019) highlighted that organizations with digital readiness will get benefit from digital transformation. Covid-19 has made digital transformation mandatory for all businesses and all sectors. Digital maturity is an important agenda for the organization to rebuild a post-pandemic business, maintain business agility and competitiveness.

8) Cyber Security Risk

Relocation of many operations and services online for remote work has become predictable, and technologies, such as cloud computing, robots, drones, AI, chatbots, virtual private networks, virtual dashboards, autonomous systems, and the Internet assist this digital transformation. IT plays a vital role in each business operation belong to different industries like healthcare, manufacturing, education, governance, judiciary, community service, etc. The Covid-19 epidemic influenced information technology positively by promoting the IT industry and IT professionals. There are negative impacts of IT, such as increasing cybersecurity threats and risks. IT industry has tackled the performance issues that occur due to significantly increased workloads and business continuity satisfactorily (Weil and Murugesan, 2020).

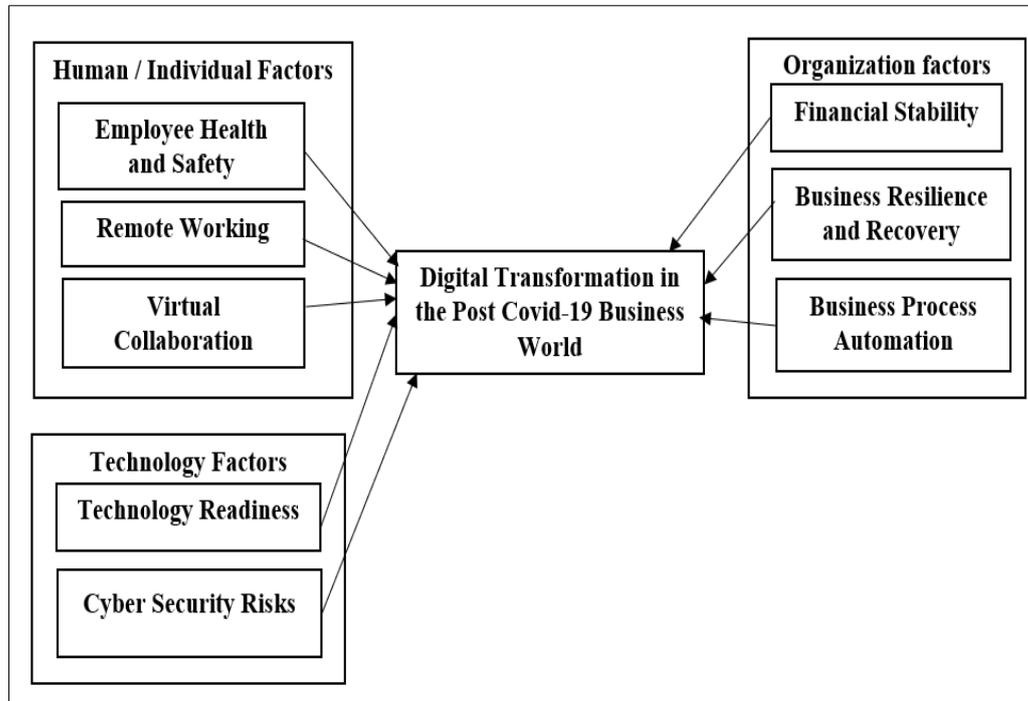
As digital technology infiltrates the economy and society, its risks also increase (Almeida et al., 2020). It is very important to protect cyberspace from events, malevolent activity, and exploitation. According to Martins (2020), cybersecurity problems that cause fear in the new digital technologies adoption by organizations can be arranged in three major categories. These are awareness and knowledge on the subject, integration of old technologies with emerging technologies and, time and resources requirement in cybersecurity investment.

In a post-Covid-19 world, it is expected that there will be significant changes in the awareness of companies about cybersecurity. Organizations are concerned about cybersecurity risks and demand technologically innovative solutions that safeguard their data (Dwivedi et al., 2020). According to Sahay et al. (2020), digital financial services also bring financial stability risks if their supervision and regulation do not progress at the same speed. Regulators are cautious about cybersecurity risks and improper lending practices caused by under-regulated financial institutions as these could endanger trust. The safe use of innovative digital technologies ensures the balance between regulations and risks. This also helps Fintech firms to remain competitive in the post-Covid-19 era Sahay et al. (2020).

Cybersecurity professionals are now reacting to increased cyber threats through their information security and privacy management capabilities (Weil and Murugesan, 2020). Security and privacy risks take place in videoconferencing software that permits hackers to interrupt authentication ID and insert offensive contents such as pornographic materials and aggressive images into apparently protected collaborative online meetings. During the pandemic, malware named Corona Trojan was used by the hackers to overwrite master boot records and hinders hard disk storage space (Weil and Murugesan, 2020). Information managers face problems in imposing

security policies and controls on the remote devices used by the employees. During the corona outbreak, many organizations were allowed their employees to work from home and granted access to enterprise applications through their digital devices. This is extremely unsafe because it allows users to access corporate data without stringent security mechanisms and it is also a susceptible area for hacking (Dwivedi et al., 2020).

4. Conceptual Framework



5. Conclusion and future implications

This study identified the factors that influence digital transformations in organizations in the post-Covid-19 period. The factors are then categorized into individual/human, organization, and technology-related factors. The conceptual framework is the main contribution of the study that helps an organization to identify the possible factors required for digital transformation in the post-Covid-19 era. The need for digital transformation in different industries is also discussed in the study.

Cybersecurity emerges as a negative factor that has an impact on the digital transformation journey of organizations during and posts the Covid-19 period. All the industries including government, manufacturing, healthcare, education, airlines, etc are impacted by the Covid-19 pandemic. The pandemic has compelled business operations to go virtually and therefore organizations have moved on to digital transformation successfully in a short timeframe (Kim, 2020). The pandemic has also compelled various industries like technology, manufacturing, automotive, aerospace, etc to utilize information and communication technologies to boost the efficiency of their operations and speed up the modification or diversification of business models to sustain in pandemic situations (Argüelles et al., 2021).

Future research will focus on identifying some more new factors that influence digital transformation and verification of these factors will be done by empirically testing the data.

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