

The Role of Digital Transformation in Sustainable Development in Egypt

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Abstract: - Digital transformation is gradually transforming governments and businesses, and making them more competitive, as well as it offers several opportunities for economic growth and prosperity, as it enables countries to including, more diversified educational opportunities, universal access to the internet and a comprehensive and conducive environment to development. This paper discusses highlights the concept of the sustainable development and how the Communication and Information Technology industry contributes to achieving the sustainable development; therefore, this paper reviews the 17 SDGs (sustainable development goals) and explains how information technology has affect each goal and then it displays the endeavors of Egypt's government to utilize ICT in achieving sustainable development. These endeavors are represented in the digital projects and initiatives that were launched by the Ministry of communication and information technology (MCIT) in collaboration with other partners whether government entities or the private sector. In this context, this paper consists of five parts. The first part is the introduction. The second one presents the relationship between information technology and sustainable development as well as the contribution of digital transformation in achieving sustainable development goals. While the third part reviews the digital transformation in Egypt and its contribution to achieving sustainable development in Egypt. In addition, the fourth part displays the conclusion of the study, and the fifth one presented the recommendations. From the literature review, it clears that Egypt has taken tremendous steps forward the digital transformation and utilizing it in sustainable development.

Key-Words: Sustainable Development Goals, Sustainable development in Egypt, Digital transformation, ICT in SDGs, Egypt's 2030 vision, Egypt's 2030 strategy.

1. Introduction:

In view of responding to the fast-paced shifts in the global technology, population and consumption patterns, there is a growing consensus that the sustainable development is the only way to avert the social and environmental disasters. Consequently, in 2015, the United Nations Member States committed to the achievable 2030 Agenda for Sustainable Development, in addition to chart a new path of balance for both humanity and the planet ^[1]. This 2030 sustainable development agenda consists of 17 SDGs including 169 targets and 304 indicators, which cover a broad range of development-related issues ^[2], such as water, poverty, education, energy, gender equality, biodiversity, economy, climate action and many more ^[3]. The successful

implementation of 2030 Agenda for Sustainable Development relies on the collaboration of the private sector, civil society, governments, institutions, and agencies across various sectors, levels, locations and borders. In addition to, their engagement and understanding of the scientific realities that underpin the relations between the natural world and human activity ^[1].

Additionally , achieving the Sustainable Development Goals (SDGs) need data, ^[1], as data revolution created a new and unprecedented age of information and statistics and an unprecedented high demand for many diversified packages of statistics, data, and indicators; which are characterized with quality, comprehensiveness, comparability, integrity,

and creditability at all levels from global to local ^[2]. As well as, data represents a national asset and a tool to create sustainability, wealth and value to enhance competitiveness, and direct contribution to create knowledge and digital economies across the world. As well as, it carries many promising capabilities and opportunities that contribute to human activities and all life aspects development on the global level, in addition to, support decision making at different levels ^[4]. Furthermore, the new technologies for collecting data for evaluation and monitoring purposes offer real-time, cheap data and potentially increase the participation and engagement of citizens in the decision-making process, while the classic methods are often time-consuming and expensive ^[5].

Consequently, digital transformation supports achieving SDGs through inclusive data collection and analyze it by computational techniques to unveil patterns and trends on environment, human behaviors and experiences that help policy makers to establish the proper development programs, monitor progress, and dynamic improvement ^[2]. Therefore, digital transformation becomes a mandate for governments to shape the future, as government officials, business leaders and policymakers are more aware of the technology value and its importance for achieving the desired socioeconomic development ^[6].

In this context, the Egyptian Government committed to achieving the Sustainable Development Goals (SDGs) in the framework of its first-ever sustainable development strategy, "Sustainable Development Strategy: Egypt Vision 2030", which was launched in February 2016. This strategy aligned with the 17 SDGs, reflects the sustainable development dimensions: social, economic and environmental, and involves programs and projects that will be implemented until 2030 ^[7]. As well as, the emerging and new data communities in Egypt are positively interacted with developments of data revolution and internet to develop its community and development roles ^[4].

1.1. Study Purpose:

This paper is conducted with the aim of reviewing the role of digital transformation in achieving sustainable development in Egypt, through illustrating the digital transformation importance in the economic sectors and then determining the current ICT initiatives in Egypt, in the context of achieving Sustainable Development Goals. This

paper consists of three parts; the first one highlights the importance of digital transformation in achieving sustainable development in general and presents the sustainable development pillars and goals. While the second part demonstrates the Egyptian efforts toward achieving sustainable development through presenting the ICT initiatives and projects in several fields. Finally, the third part presents the discussion and conclusion.

1.2. Methodology:

This paper aims to present an overview of the digital transformation role in achieving sustainable development in Egypt, so, the required information was collected from various researches, reports and websites in order to synthesize a comprehensive approach of Egypt's endeavors to achieve the sustainable development through the digital transformation.

2. Digital Transformation in Sustainable Development:

Digital transformation is a consistent networking of all economic sectors where actors have to adapt to new circumstances of the digital economy ^[8]. Digital transformation is defined as "a way to rebuild business models following the needs of customers by using new technologies" ^[9]. Or "new ways of working with stakeholders, building new frameworks of service delivery and creating new forms of relationships" ^[10]. It also is defined as "the profound transformation of business and organizational activities, processes, competencies and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way, with present and future shifts in mind" ^[11].

From the previous definitions, it clears that digital transformation is mostly associated with the use of new technologies such as; virtual reality (VR) and augmented reality (AR), additive manufacturing (AM), deep learning and automated decision-making systems. As well as, artificial intelligence (AI), robotics, Internet of Things (IoT), and big data ^[12], to stay competitive in the internet age, ^[13]. This means that digital transformation changes the way people life through reshaping work, behavior, leisure, education, and governance, which have positive impacts on labor, resources, energy, and carbon

productivity, as well as, it contributes to expand access to services, lower production costs, dematerialize production ^[12]. Also, it raise productivity, expand access, improve resource efficiencies and support the circular economy ^[14].

These technologies are the powerful tools for supporting transformation processes in all areas of society and economy ^[15]. As they are increasingly being used in planning processes, building better decision through multiple perspectives, and improving the cognitive capacity to understand the implications of decisions in complex socio-ecological systems ^[16]. As well as, by processing enormous volumes of data, artificial intelligence promises to bring a new generation of sustainable development solutions ^[1]. As it can steer production processes; financial flows and traffic, revolutionize medical diagnostics and treatments, generate behavioral forecasts for groups and individuals, change the way companies make decisions ^[17], make decision documents available to governments and parliaments ^[12], and seeks to realize a proper balance between people's privacy and human dignity and technological progress ^[1]. Therefore, digital transformation becomes a key driving force in the transformation towards sustainability ^[18], as technological change is essential for economic growth and sustainable development ^[19]. In addition to change the interpretation of the sustainability paradigm itself ^[20] and brings huge benefits for all 17 SDGs, which is considered as mid-points toward achieving sustainable development ^[19].

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" ^[21]. Or "Sustainable development is a way for people to use resources without the resources running out" ^[22]. It cares for the common good and debates on the civilization challenges connected with the transformations of society and economies ^[23]. Furthermore, these definitions clear that sustainable development based on three interdependent dimensions; social, environmental and economic systems in which should be transformed and interlinked with each other to ensure societal health, human well-being, and limited the environmental impact ^[1, 24].

The Sustainable Development Goals -in 2030 Agenda- cover all aspects of development and human life including education, environment, health,

security, peace, equality, and justice ^[1]. So, achieving the SDGs requires transformations in six fundamental hubs; (i) Human well-being and capabilities, (ii) Sustainable and just economies, (iii) Sustainable food systems and healthy nutrition patterns, (iv) Decarbonization and Energy, (v) Smart cities, (vi) Securing the global environmental commons ^[1, 12, 14]. Where the stakeholders' focus and collaborative action can accelerate progress towards the Goals. As well as, the combinations between, individual and collective action, economy and finance, governance, and science and technology through the six fundamental hubs create integrative pathways to transformation and achieve the sustainable development ^[1].

Moreover, in order to encourage the widespread adoption, facilitate progress and accelerate the implementation of SDGs, a detailed science, technology and innovation roadmap should be built and implemented at both, local and global levels ^[1]. Thus, technology must be made available, accessible and sufficiently attractive ^[25, 26]. Accordingly, each country seeking real sustainable development and progress must have a strong ICT sector in place to drive the necessary change, as well as building on ten pillars across the three dimensions of the sustainable development. Those pillars are as shown in table 1 ^[27]:

Table 1 The Main Sustainable Development Pillars

Dimension	Corresponding Pillars
Economic	Economic development
	Transparency and efficiency of governmental institutions
	Energy
	Knowledge, innovation and scientific research.
Social	Social justice
	Health
	Education and training
	Culture
Environmental	Environment
	Urban development

Source: By author dependent of Ministry of Planning, Monitoring and Administrative Reform 2016

2.1.Digital transformation contributions to Sustainable Development Goals:

New technologies hold the potential for delivering great benefits in achieving sustainable development as they change the way people live, work, interact, move and experience in countless ways, by prioritizing equity, inclusion, accessibility, international collaboration, human dignity and

sustainability in a comprehensive and far-sighted manner ^[27]. So digital transformation contribute to the SDGs as according to ^[29] report, the ICT development and the progress on the SDGs are complementary and there is high correlation between them with ($R^2=0.86$). Table 2, presents the digital transformation contribution to the SDGs ^[22, 30]:

Table 2 The Digital Transformation Contributions To Sustainable Development Goals

Goal	Description	Digital transformation contributions
SDG 1: No poverty	End poverty everywhere, in all its forms	There are more than 2 billion people all over the world don't have bank accounts. New technologies provide access to finance ^[31] and facilitate the financial inclusion that can help in lifting people out of poverty by enabling mobile access to digital financial services for those unbanked people ^[32] .
SDG 2: Zero hunger	End hunger, improve nutrition, achieve food security and promote sustainable agriculture	ICT-enabled solutions such as satellite and remote sensing technology make agricultural practices more data-driven and efficient and help farmers increase their business productivity by reducing the use of energy, as well as, access to market updates and weather forecasts ^[33] .
SDG 3: Good health and well-being	Promote well-being and ensure healthy lives for all people at all ages	Digital technologies expanding the scope of health care, helping to manage epidemics and infectious disease and strengthen the delivery of public health care services, by supporting the universal access to health care facilities ^[34] . It also, can develop low-price and high-volume models to expand access to pharmaceuticals, vaccines, supplements, diagnostic tests, and family planning in low- and middle-income countries ^[35] . As, e-health applications such as Be He@lthy and Be Mobile help governments to introduce health care services for non-communicable diseases in their countries through mobile phones, as well as, the better connectivity can improve direct patient interaction, health informatics and telemedicine ^[30] . For example; in Tanzania, Rwanda, and elsewhere, the drone technologies are being used to transport medicines and lifesaving blood to remote areas ^[1] . As well as, china uses AI technology, big data, and other applications to detect COVID-19 disease, uses drone and reports to achieve isolation zones, and uses G5 technology to connect doctors with patients to facilitate the diagnosis process ^[36] .
SDG 4: Quality education	Promoting lifelong learning opportunities and ensuring equitable and inclusive quality education for all	E-learning provide access to knowledge to all people no matter where they live and how much they earn. It also Improve the quality of life of disabled persons and those in rural areas. ^[37, 38] .
SDG 5: Gender equality	Empower girls and women to achieve gender equality	There are two hundred fifty million fewer women are online than men. ICTs are the essential pathway to close the digital gender gap and achieve the gender equality and empowerment. There are number of gender equality initiatives to improve women's access to technology, as well as, build relevant digital and other skills, and promote female

		leadership in the tech sector ^[30] .
SDG 6: Clean water and sanitation	Ensure sustainable management and availability of water and sanitation for all people.	ICTs facilitate smart water management systems, sanitation and hygiene. As new technologies offer water recycling and purification by using smaller and more portable equipment ^[39] .
SDG7: Affordable and clean energy	Ensure access to sustainable, affordable, and modern energy for all	Using smart grids, green standards and technology help in building more controllable and efficient energy systems and reduce carbon emissions ^[30] .
SDG 8: Decent work and economic growth	Promote inclusive and sustainable economic growth, decent work and productive and full employment for all	Promoting the digital economic, entrepreneurship, tech-SMEs, e-commerce and cyber trust. As well as providing new earning possibilities for people through online labor platforms, provided they have adequate connectivity and the right skills ^[40] .
SDG 9: Infrastructure, Industrialization, Innovation	Build resilient infrastructure, encourage innovation and enhance inclusive and sustainable industrialization	The specific target of this goal is to increase access to information and communications technology and affordable and universal access to the internet in least developed countries by 2020 ^[3] . ICTs are essential for a resilient 21 st century infrastructure and access to services and application, as it provide universal and affordable access to the internet ^[30] .
SDG 10: Reduced inequalities	Reduce inequality within and among countries	Enabling the disadvantaged segments of society to access technologies and knowledge help to narrow the digital divide, empower communities, and reduce inequality within and between populations, communities and countries ^[30] .
SDG 11: Sustainable cities and communities	Make cities safe, inclusive, sustainable and resilient	Smart sustainable cities, intelligent transport systems, 5G and the internet of things ^[30] .
SDG 12: Responsible consumption and production	Ensure the sustainable consumption and production patterns	ICTs enable sustainable production and consumption through smart grids, smart metering and cloud computing. As it ensures cheaper and quicker service delivery ^[19] .
SDG 13: Climate change action	Take urgent action to combat the climate change and its impacts	ICTs and new technologies generate better data, which support greener lifestyles, climate monitoring, forecast and early warning systems. Moreover, generating better data help to achieving SDG 14 and SDG 15 ^[1] .
SDG 14: Life below water	Conserve the oceans, seas and marine resources and sustainably use them for sustainable development	Using radio-frequency spectrum and satellite orbits allowing satellite observations and monitoring that increase scientific knowledge of the oceans ^[30] .
SDG 15: Life on land	Protect and restore terrestrial ecosystems, and promote the sustainable use of them.	Using radio-frequency spectrum and satellite orbits allowing satellite observations and monitoring of terrestrial ecosystems help to protect biodiversity ^[30] .
SDG 16: Peace, justice and strong institutions	Promoting inclusive and peaceful societies for sustainable development, providing access to justice for all people and building effective, inclusive and	The open data increases transparency, empowers citizens through their work on smart sustainable cities, drives economic growth and key performance indicators that measure social inclusion, for instance, voter participation, and the number of government services delivered through electronic means. Also, countries can deploy broadband

	accountable institutions at all levels	connectivity and develop ICT applications to facilitate the provision of free or low-cost digital access for hospitals, schools and underserved populations ^[30] .
SDG 17: The power of partnerships	Strengthen the means of implementation and revitalize the Global Partnership for sustainable development.	ICTs integrate and facilitate all SDGs through innovative collaboration and scaled up capacity building. Public-private partnerships are key to bringing ICTs to all peoples, nations and communities. As these partnerships are needed to build the physical infrastructure that required to deliver the internet services to currently disadvantaged populations and in hard-to-reach areas, as well as to facilitate innovation, inclusion and investment required by the SDGs ^[30] .

Source: By author dependent on [22, 30]

3. Digital transformation in Egypt:

In the digital transformation era, access to many services, such as education and health services, requires access to internet and mobile phones ^[41]. Therefore, in alignment with Egypt's endeavors to achieve sustainable development goals (SDGs) according to 2030 Agenda, MCIT seeks to accelerate digital transformation across Egypt, with the aim of achieving digital society and building a strong digital economy ^[42] through using ICT tools to provide freedom, prosperity and social equity for all ^[43]. As, ICT can fight poverty, improve the everyday lives of community members, and advance the development and growth agenda of different societies ^[44].

The mission of the MCIT is "enabling the development of a strong digital economy and a knowledge-based society relying on affordable and equitable access to digital free, knowledge, and the development of a competitive and innovative national ICT industry" ^[43]. Subsequently, the Egypt's digital transformation strategy focuses on developing infrastructure, investing in human capital, creating a conducive business environment, supporting digital entrepreneurship especially by women and creating smart cities and communities with the aim of promoting innovative technologies and digital transformation ^[45]. Therefore, Egypt has heavily invested in building its national infrastructure and technology infrastructure to be able to effectively use ICT for economy's development and growth, as well as, expand the economy's disposition in both global and regional economies.

According to ^[29] report, Egypt is in the early stages of ICT infrastructure build-out as its score is below 60 (52.6 out of 100), as well as it has lower levels of the targeted ICT investment that focused on

areas relevant to the SDGs. The status of ICT sector in Egypt is as follows:

- The ICT sector has achieved the highest rate of growth in gross domestic product (GDP) 16.7% at the level of all sectors in 2019, which exceeded the target rate for the same year by about 7%. This is due to the efforts of the state towards financial inclusion. In addition, the sectoral share of investment in the information and communications technology sector reached 5.44% in 2018/2019 ^[36].
- The number of internet users in Egypt in Dec 2019 are 49,231,493 ^[46], which is about 48%, while the global rate of the internet users is 53.6%. 42.30 million of the Egyptian internet users, use mobile internet, with an annual growth rate of 23.93% ^[47].
- High-speed Internet (ADSL) was introduced in 2530 public schools (high school) across Egypt. There are about 25.8% of school students using internet for educational purposes, and 27.4% of teachers using internet in preparing educational content and searching for information in 2018/2019 ^[47].
- The average of the fixed internet speed in Egypt is 27 MB, and the mobile internet speed is 17.7 MB, compared to 60 MB for the global average of the fixed internet speed and 30MB for the mobile internet speed ^[48].
- The number of IT companies reached 1199 in the year of 2019 ^[48], as well as, the number of graduates whom are qualified to work in information technology services annually is more than 500 thousand graduates from Egyptian universities ^[49].

3.1. Digital Transformation contributions in the Sustainable Development in Egypt:

In the context of Egypt's commitment to achieve the United Nations Sustainable Development Goals, Egypt must be made a safe competitor country that attracts investors from all over the world, by adopting an open market policy, constructing mega infrastructure projects, deregulating the state's currency and easing regulations and hurdles for foreign investors ^[50]. Therefore, the Egyptian strategy to achieve sustainable development is to "possess a competitive, balanced, and diversified economy, depending on knowledge and innovation, and based on social integration, justice, and participation. As well as, it characterized by a balanced and varied ecosystem, using the ingenuity of the place and humans in order to achieve sustainable development and improve the quality of citizens' life" ^[7]. This strategy aims to position Egypt among the top 30 countries in the world, in terms of fighting corruption, economic development, market competitiveness, human development, and quality of life ^[51]. Furthermore, the strategy takes into account the optimal use of resources and supporting the fairness of their usage, the principles of equal opportunities, ensuring the rights of the next generations and bridging some development gaps ^[7].

Since, digital transformation plays an important role in achieving SDGs and makes the government's services delivery more efficient ^[42]. One of the major elements that help to transform Egypt into a digital society and enable the digital workforce of the future is the inclusion, engagement and participation of the younger generation that represents an invaluable and unique opportunity for Egypt. Thus, Egypt must invest in the human capital and provide them with the information and communication technology skillset and knowhow ^[52]. Therefore, the Ministry of Communications and Information Technology (MCIT) is launching several projects and initiatives in collaboration with the other Ministries, government agencies and other private partners to promote transformations in the sustainable development and achieving the SDGs ^[42], including seven major tracks; e-Readiness, e-Learning, e-Government, e-Business, e-Health, e-Culture and ICT export initiative ^[53].

Furthermore, the public-private partnerships (PPP) is introduced in the reform process of several economic sectors such as education, security, health, housing, government and environment issues. It

targets both intra and inter digital divides with the aim of promoting social inclusion, in addition to, its contribution to achieve SDGs ^[53]. In this context, our opportunity is digital initiative was launched with the aim of establishing partnership between public and private sectors and contribute to implementing digital transformation projects in governmental entities. Which in turn improve the work environment that lead to enhance the work performance at governmental institutions, raise the efficiency and improve the quality of services provided to citizens ^[54].

As well as, the Ministry of Planning, Monitoring and Administrative Reform launched a mobile application, "Sharek", as a digital platform to allow citizens; particularly the youth to participate in the review process. In addition to raise the awareness of sustainable development ^[7].

In the following section, the author displays the initiatives and projects of MCIT and other partners that contributing to achieve the SDGs in Egypt.

3.1.1. Education and Training:

Out of Egypt's commitment to achieve SDGs, the government has adopted an e-learning approach at the higher and pre-university education that clearly improving the individuals' lives, through transforming the lives of thousands, regardless of their social level, occupation or age ^[48].

Hence, the Ministry of Education and Technical Education tend to transform the educational system in Egypt, with a budget of \$500 million to support the strategy of education reform. This strategy aims to adopt technologies such as; interactive smart boards, online simulations, tablets and a digital library, to transform the educational system gradually to digital learning materials rather depending on textbooks. This transformation provides access to education for all, create a quality and relevant educational system in accordance with the international standards, improve the quality of learning, and develop enthusiastic and passionate teachers and pupils who learn, think and innovate. Through this project, the digital learning resources will be provided to 1.5 million teachers and students over a period of five years (2018-2022) ^[42]. Additionally, the government implemented several education platforms such as, Egyptian Knowledge Bank (www.ekb.eg) and Edmodo Egypt (www.edmodo.com), which including several digital materials for higher and pre-university education,

and creating a virtual community that simulate class rooms. While, the Egyptian Knowledge Bank provides -in addition to the higher and pre-university education- a community for researchers and university students that including several scientific resources such as; universal journals and books.

Furthermore, within the public-private partnership role in supporting the overall education reform efforts in Egypt, the World Economic Forum's IT members community launched the Egyptian Education Initiative (EEI) in cooperation with the Egyptian government. This project is an inclusive model as it is centered around four key work tracks; namely, Higher Education, Pre-university Education, ICT Industry Development and Lifelong Learning as well as, brings parents, students, teachers, community leaders, business, international organizations and government together.

All of these projects enhance the e-education process as they provide virtual classes and labs, thinking in 3D, drama based learning and interactive e-book ^[48].

Moreover, concerning to training process, there are many programs and initiatives are launching by MCIT in collaboration with other Ministries in this purpose. These programs are provided to citizens to raise Egyptian calibers' competitiveness and improve their skills and knowledge, thereby empowering youth to overcome workforce shortages, find job opportunities and meet the labor market demands locally and internationally, in addition to achieve gender equality ^[42, 54, 55]. These programs are as follows:

- **Gender equality:**

Various programs are launched by both MCIT and the private sector - Google and Microsoft - to support, qualify and empower Egyptian women using the various tools of ICT in all life aspects to bridge the growing gap between the workforce and the required skills in the labor market. Such as; Qodwa-Tech initiative, Maharat training program, Hack4Girls initiative and Aspire Woman that has since reached almost 60,000 young Egyptian women and provided economic opportunities for over 2,000 women through job placement opportunities, freelance work and micro-entrepreneurship ^[42, 54].

- **Decent work and economic growth:**

MCIT launched several training programs in collaboration with ITIDA, Information Technology

Institute (ITI), Palo Alto and other partners to build on human capacity, qualify youth on the future skills and jobs and , create a wide range of job opportunities for young Egyptians. These training programs are provided through several platforms including ^[54]: Future work is digital, Freelancing and Remote Work Initiative, Next Technology Leader (NTL), Mahara-Tech, Wazeefa-Tech, African App Launchpad

In addition, there are six technology innovation clusters inside a number of regional universities including, Mansoura, Aswan, Sohag, Minya, Menoufia and South Valley. Each cluster contains specialized technology labs in electronic design, software, business incubators, integrated systems and shared workspaces for startups. As well as, halls for specialized training in various fields, such as, artificial intelligence (AI), data security, and data science.

3.1.2. FinTech:

Financial technology (FinTech) plays an essential role in achieving digital economy ^[42]. Digital financial services are faster, cheaper, and more efficient than the traditional financial services, as well as, they are associated with the higher GDP growth ^[56]. Consequently, Egypt's government seeks to extend the use of financial technology (fintech) to facilitate the services obtaining process as it lead to ^[57]:

1. Promote and achieve the financial inclusion and thus, the inclusive growth through reaching small- and medium-sized enterprises (SMEs) and the lower-income households.
2. Improve the financial services' convenience, speed and efficiency.
3. Provide affordable financial services for unbanked populations and underserved small and medium enterprises (SMEs).
4. Reduce corruption and enhance the transparency and efficiency of government operations that facilitate humanitarian and social transfers.
5. Reduce costs and delays in the cross-border remittances.
6. Provide solutions for many challenges such as; corruption, unbanked people, informal transfers and large remittance markets, undiversified economies, vulnerabilities to terrorism, large income disparities and large displaced populations.

7. Enable existing banks to develop new business models.
8. Enable non-financial corporations such as; e-commerce companies (Amazon, Apple, Alibaba), large retail networks, mobile network operators (MNOs) and mobile transfer companies (MTOs) to offer digital financial services, such as; online payment and online lending solutions

Therefore, in the last two years, several government and startups initiatives, as well as, applications for different financial transactions were launched to solve different financial challenges that face businesses and individuals in Egypt ^[58].

Furthermore, startups play an important role in this field as they target the low-income segments as their primary customers and provide several applications for payment and different lending modes such as; Kashat, ValU and Qasatly, Raseedi, Capiter, and Creditgo. Additionally, they transform the HR and payroll space through several platforms that provide lending options and payment systems for employees such as; Dopay, Paynas, NowPay. and Khazna ^[59].

According to CBE, number of banks that offer online banking services has increased in 2018 to reach 32 banks out of 38 banks ^[60]. As well as, the number of fintech tools has witnessed a great leap between 2016 and 2019 as shown in table 3: ^[61]

Table 3. Number of fintech tools

Fintech Tools	2019	2016
No. of Debit Cards	17,323,753	12,082,513
No. of Prepaid Cards	16,266,169	8,648,033
No. of Credit Cards	3,375,117	3,859,554
No. of ATM machines	13,331	9,832
No. of POS	88,380	62,764

Source: CBE, 2019

In addition, CBE has given a priority to payment solutions including ATMs, online banking services, POS, and mobile banking services such as mobile

wallets which witnessed a growth rate of 32% by 2018 as its subscribers reached 11 million with more than 2 million transactions monthly ^[60].

MCIT seeks to offer a new set of training, workshops and camps, in all financial value chain aspects, to empower the potentials of entrepreneurs and banking human resources in this field. Therefore, ITI started several programs in cooperation with Egyptian Banking Institute (EBI) including “Computer Networks Administration and Security” to qualify the banking sector staff in the latest technologies in that field such as Artificial intelligence (AI), Data Analysis, Information Security, Data Science and Data Visualization. These programs targeting the graduates of ICT specializations faculties. As well as, collaborate in holding specialized competition and conferences to exchange knowledge and innovation experiences ^[62].

3.1.3. Health:

MCIT is collaborating with the Ministry of Health to advance the sector by automating procedures, building capacities for both administrative and medical staff, and creating developed networks to improve and transfer communication, data collection. In addition to bridging the health gap in remote areas as it contributes to deliver better healthcare to remote regions, raises physicians' expertise and knowledge, harnesses ICT infrastructure in medical services provision, creates multi-partnership business model and spreads e-Health culture. Hence, the health sector adopting an integrated approach targeting the whole community, that is, Tele awareness for community, Telemedicine for patients and Tele education for doctors. Several digital projects is implementing in the health sector with the aim of ensuring the citizens' accessibility to the healthcare services, improving its scope, scale and quality, saving the patients' time and money and the financial sustainability for health coverage services. These projects including Universal Health Insurance program, National Network for Public Health Treatment, Clinical Laboratory Information Systems project and many Mobile Applications in Health that help in spreading health awareness by sending patients short messages, as well as, controlling and reducing the non-communicable diseases spread, such as, hepatitis, blood pressure, diabetes and so on ^[42, 55].

3.1.4. Energy:

Egypt has an abundance of renewable energy resources; (hydro, wind, solar and biomass) with high deployment potential ^[63]. The Ministry of Electricity and Renewable Energy has adopted a new plan in collaboration with some Chinese companies to develop a smart energy grid based on innovative solutions in the fields of communications and information technology that lead to build a flexible, strong and safe electricity grid. In addition to, several hydropower stations, which are under construction from 2015 across Egypt. As well as, the ministry adopted, upon the National Council for Payments recommendation, a unified digital system to collect electricity bills, and digitalize all public services. Consequently, it has automated about 415 payment collection centers, which are affiliated to the Egyptian Electricity Holding Company (EEHC). In addition, the electricity bills payment will be available in all banking outlets, whether ATMs, branches and Internet banking.

Furthermore, the Egyptian Electricity Transmission Company (EETC) made a contract with Siemens company to supply the Egyptian market with the first digital power transformer. As well as, new reform policies are implemented by the electricity sector to launch the digital transformation process of energy, increase energy efficiency, and achieve sustainability and security of electricity. These policies pave the way for the private sector to invest in the fields of smart networks and renewable energy, and enhance the governance and transparency of the sector. For example, KarmSolar is a solar integration and technology company that benefits from the Egypt's abundance of solar power. It delivers innovative solutions to various sectors including tourism, business, agricultural and industrial sectors ^[7, 64].

3.1.5. Industry, Innovation and Infrastructure:

Egypt has made significant progress in infrastructure in many fields, including roads, bridges, ports, and renewable energy, among many others. Drinking water and wastewater projects are also being increased, to cater to the population increase ^[7].

ICT infrastructure is a key factor that promote economic activity in each sector across the nation, therefore, MCIT seeks to foster a cutting-edge infrastructure that meet the growing needs of the individuals, business and government in the fast pace

global communications era. As well as, MCIT continues to promote the new and cutting-edge technologies that assist the overall socioeconomic development and endeavor to improve and upgrade its telecommunications infrastructure as traffic grows, technology evolves, and usage changes and increases ^[42].

Furthermore, digital transformation has a strong impact on the Egyptian industry sector, by implementing the suitable digital technologies to improve and transform business processes, thereby, enhancing the companies' overall performance and increasing their competitiveness by creating new business models, digital services, products and solutions; achieving additional revenue and accomplishing the real-time quality control. Also, the existence of technological systems and data enable companies to better know their production distribution, clients, consumption, solutions and determine its target clients and markets.

In this context, the Egyptian ministry of trade and industry started to digitalize the industry sector, three years ago. It has Launched the "Digital Transformation and Technology Support Program Action Plan 2019-2020" through the Industrial Modernization Centre (IMC), to develop fintech and digital transformation in companies. In addition to, "Egypt Exports through Product Innovation (EEPI)" project that is implemented by The Engineering Export Council of Egypt (EEC) and funded by the European Union ^[64, 65].

3.1.6. Peace, justice and strong institutions

Both E-government and big data highlight the five key dimension of Peace, justice and strong institutions (SDG 16); inclusion, effectiveness, openness, accountability and trustworthiness^[2].

Therefore, MCIT tends to launch several projects to automate the legislative entities services involved in the system, with the aim of developing an integrated system to facilitate procedures, improve and accelerate services for citizens, ensure justice and speed up the implementation of judgments. These projects including Citizen Security and Law Enforcement, Prompt Justice Initiative, Law Enforcement, Developing Notarization offices, Developing Supreme Constitutional Court, Africa Constitutional Court Digital Portal, Achieving Personal Status Documents, Administrative Prosecution Authority Lawsuits Electronic

Management, Automation of Legal Departments at Ministry of Justice, Automation of Family Courts [42].

3.1.7. Responsible consumption and production:

Many new technologies have the potential to mitigate trade-offs between the production and environment [1]. The Enhancing productivity initiative, which is implemented by using cloud-computing technologies, provides brilliant and cost-effective services and release financial burden for the maintenance and operation of data centers, as well as reducing the need for specialized human resources. Since the launch of the project a number of services were provided to more than 125 government entities including the provision of 18,250 e-mails and 1500 accounts of the internet portal. This is in addition to providing 600 accounts in the system of unified communication, which facilitate video conferencing services [42].

3.1.8. Clean water:

Egyptian Government has made significant achievements in transforming the traditional techniques of monitoring water pollution on the Nile to the most advanced technological solutions. Whereas, until now Twenty-one stations was installed to monitor both the quality of direct industrial wastewater that is released into the Nile River and the quality of the Nile River itself. The monitoring stations' number is expected to reach 95 by 2030 [7].

4. Discussion and Conclusion:

Digital transformation is undoubtedly affecting the overall society, rendering new technologies more accessible, knowledgeable, agile and competitive, and help in making the better decision, so it plays a role as a catalyst for development and achieving the sustainable development goals (SDGs). As it helps in using resources effectively, decreasing costs, saving time, and so on. Therefore, Egypt is utilizing ICT for achieving sustainable development. As well as, the public- private partnership (PPP), plays a main role in achieving SDGs as it considered the most important actor in implementing the digital projects and initiatives for development.

Therefore, Egypt's government has created partnerships with different entities; whether government or private sector for launching digital initiatives and projects to enhance the social, economic, and environment sectors. These initiatives

are to develop human resources by providing them with the required digital skillsets and creating jobs opportunities, as human resources are the main actor in all sectors and have the main responsibility of the business success. In addition, these initiatives cover all sectors such as; education, health, energy, business, legislative, infrastructures, among others. As well as, the advancing in each sector can cause advancement in other sectors.

However, all the Egypt's achievements in digital transformation field, Egypt is still in the early stages and has lower levels of investments of ICT that focused SDGs. As well as, the internet speed and using rate is still lower than the global rate.

5. Recommendations:

- Egypt's government have to give more attention to the ICT industry, innovation, research and development.
- Egypt's government must improve the digital infrastructure and infostructure to enhance the internet speed.
- The Internet illiteracy need more attention in an effort to increase the internet users rate and enhance the digital awareness
- Providing data bases for all sectors that helping them in the development strategy.
- Activating the use of information technology and artificial intelligence in all sectors, to utilize them in data analyses and decrease costs.
- Encouraging investments in information technology sector particularly in the SDGs related-areas

Limitations and Future Research Recommendation:

This research is limited on Egypt country in order to presents a comprehensive narrative of the Egypt's achievements towards SDG through digital transformation, so any other country can utilize from Egypt's experience in SDG. This paper collect data from various sources including researches, reports, and websites, and focused on determine the role of information technology in achieving SDG in various studies.

Future studies could examine the challenges and opportunities that encounter the implementation of information technology in such study. Also the future studies could examine the successful elements of information technology.

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