

# **The era of Digital Technology: Analysis of factors contributing to economic growth and sustainability.**

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## **Abstract**

The fourth industrial revolution (4IR) has become the main focus for economic development and competitive advantage for countries and sectors. The advancement of the 4IR technologies introduced the era of digital technology, whereby all sectors, government institutions, small and medium enterprises are seeking these technologies such as the internet of things (IoT), artificial intelligence, and machine learning to name but few. Yet, there is a perception that the South African manufacturing sector is lagging behind with the adoption of these advanced technologies. Moreover, some of these manufacturers are still depending on their traditional methods and conventional machine tools. Meanwhile, the era of digital technology has presented these tools with sectors that had successfully achieved a competitive advantage within the marketplace. As a result, this paper analyses the factors contributing to economic growth and sustainability in relation to the adoption and usage of new technologies. The paper provides some insights into the readiness and adaption of the South African manufacturing sector of the new technologies as well as the global conformity with 4IR. Sectors are being forced to rethink their business processes and the way they conduct business. In response to the challenges deriving from globalization, manufacturing companies today face the need for more flexible and agile manufacturing equipment. Also, the pressure has been posed by their competitors that have taken advantage of these technologies and noted significant improvement in cost reduction, cycle time, productivity, and safety issues. Clearly, the usage of the industry 4.0 tools such as automation, robotics, smart production, artificial intelligence, and big data presents opportunities. From the South African manufacturing perspective, 4IR is challenging a sector that has been in decline for the past decade due to a lack of adopting advanced manufacturing technologies. Whereas this sector is one of the sectors that is expected to strengthen economic growth and job creation. Findings suggest that there is a need to rethink the current production systems in order to develop a manufacturing digital transformation model that enables the conversion to smart factories, automation processes, real-time data of production process, and marketplace. The findings also revealed that there are few component elements that need serious attention, namely, ICT infrastructure, high tech skilled retention, development of the high-tech skilled workforce, particularly digitally skilled workers - which is the main problem in both developed and developing countries.

## **Keywords**

Digital technology, Manufacturing, Industry 4.0, Economic growth, Sustainability

## 1. Introduction

Before Industry 4.0, manufacturing sectors all over the globe relied on manpower, animals and hand tools to produce products such as food, automotive and clothes to sustain and keep the economy growing. Manufacturing productions nowadays are driven by global competitiveness and likewise, there is a need for faster adoption of agile equipment to the ever-changing market demand (Roko, 2017). These needs can be met by advancement in the current manufacturing digital technologies. Many studies showcased how Industry 4.0 is a promising approach for the integration of manufacturing processes and the integration of internal/external customers (Zhong, et al. 2017), (Muthu, et al. 2020) and (Kapur, 2018). Since the 18<sup>th</sup> century, manufacturing sectors have witnessed the digital transformation of technological aspects of these requirements such as automation, robotics, big data, smart factories and artificial intelligence, including physical cyber systems and the internet of things.

In the present existence, manufacturing sectors in South Africa and all over the world are under pressure to stay competitive, improve cost reduction, productivity and safety of their employees. With manufacturing sectors perceived to have a big impact on economic growth and sustainability globally, there is a challenge of emerging poor productivity within manufacturing sectors due to the denial of adopting the 4IR tools such as robotics, automation, ICT (information communication technology), IoT (Internet of things) and artificial intelligence (Nagy et al. 2018). Moreover, many sectors today are willing to deploy necessary technological innovations that have the potential to save cost, optimize production time and deliver incremental economic growth, like 4IR tools. Continuous improvement strategies like digital technologies are susceptible to the success of economic growth and sustainability. In the present existence, the use of digital technology is comprehensive and is being used by manufacturing sectors in all settings including South Africa (Kapur, 2018) to improve the productivity of employees (Kapur, 2018), to lower waste associated with costs and to improve trustworthiness (Muthu, et al. 2020). A survey was conducted in South Africa where more than 27% of the sectors who were of traditional method rated their sectors as digitalized and the value is expected to rise within the next five years (Pwc, 2016). Also, 2.9% reported an increase in total revenue cost and 3.9% reported reduced cost. Therefore it is of great importance for companies in the manufacturing sector to adapt and take advantage of this digital technology era to grow and expand businesses and even compete globally.

Many scholars approaching Industry 4.0 today need to confront the lack of agreed definition that poses a serious limitation to theory building and research comparability (Culot, et al. 2020). According to (The Organization for Economic Co-operation and development, 2016) the Fourth Industrial Revolution is a confluence of technologies ranging from a variety of digital technologies to new processes. Meanwhile (Carvalo and Cazarini, 2020) defines Industry 4.0 as an advanced manufacturing model that includes within itself an extensive set of technologies not necessarily unpublished but integrated and with the whole industry which is characterized by its virtual, digital and technology performance.

Digitalized manufacturing sectors have the potential to increase economic growth and create sustainability through employment, increased manufacturing utilization and efficiency, meeting demand, reduced cost lastly but not least, increases competitiveness. Further, Industry 4.0 is considered as a sustainable manufacturing framework, as well as human work by offering a set of potential technologies that assist the work performed by humans in the industry. It eliminates aspects such as intense physical effort and market positioning, as Industry 4.0 has an extraordinary response time to internal and external stimuli (Carvalo and Cazarini, 2020). However, the digital technologies are again susceptible to failure, and, the evolution of global sectors in the Fourth Industrial Revolution is both exciting and scary (Xu, David & Kim, 2018) especially within the South African manufacturing sectors where lack of skills deficits have been perceived in terms of technical knowledge (Fick, 2019) and (Writer, 2019). The lack of skills in operating these technologies successfully is not only based in South Africa but also both developing and developed countries globally. Hence several studies have emphasized the need for an organization to establish their digital technology status before or prior adoption (Penprase, 2018), (Kamaruzaman, et al. 2019), and (Zervoudi, 2019). As a result, the speed and measure of the changes coming about by the Fourth Industrial Revolution cannot be ignored and therefore

being knowledgeable about these changes and the speed in which this is occurring can ensure that knowledge and technology can reach all and benefit all. Some of the serious challenges include:

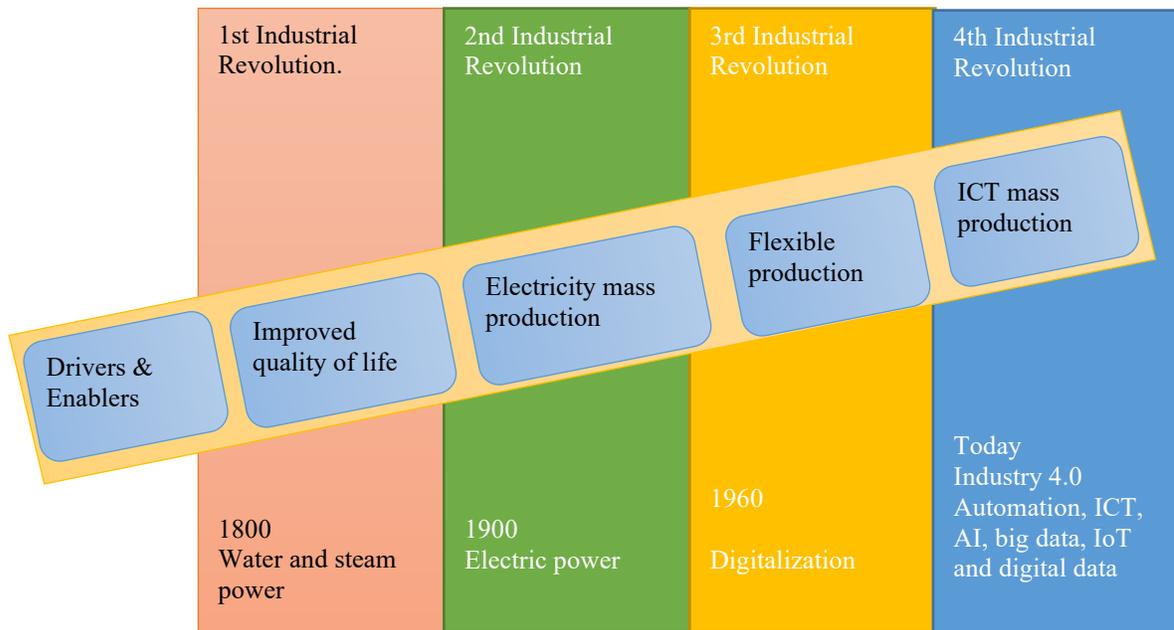
- (I) Talent or skills
- (II) IT infrastructure
- (III) Data security

This study explores the factors that are contributing to economic growth and sustainability, concerning technological advancement adoption, it will also focus on South African manufacturing sectors and their adoption of these technologies. The paper again seeks to address serious issues associated with these adoptions in South Africa such as skills. The skills challenge is not only occurring in South Africa, however, but also in the rest of the world. Adopting the use of these digital technologies is imperative as it will lead to the success of the manufacturing sectors.

## 2. Background

Manufacturing sectors within the South African context have been recognized to be the bedrock of economic growth and sustainability such as employment, quality of life, and increased profits. However, with diminishing production processes, it is hardly possible for the manufacturing sector to fulfil the expected needs. (Bhorat, 2017) argued that despite this recognition of manufacturing sectors in South Africa, it has continued to decline, both in terms of its contribution to economic growth and employment. Likewise, (William, et al, 2014) asserted that the manufacturing contribution towards growth in South Africa has been in decline for decades. He further argued that the only thing keeping the South African manufacturing sectors in operation is primarily traditional factors of production such as cheap electricity, low-cost labour and plentiful raw materials. Industry 4.0 accompanied by digital technologies, artificial intelligence, information communication technology, robotics, automation, big data and internet of things have been recognized as the best way for South African manufacturing sectors to cope with ever-increasing demand challenges: competitiveness, inflated costs, employment, quality of life and increased productivity. Although there is a challenge for competing, most South African sectors still perform under traditional methods (hand tools), which have also proven to be a success but not to a standard that is required in the current century. This study reports the finding of a thorough study to establish the factors that are leading to economic growth and sustainable development in other countries such as Germany, Singapore and France (Schwab, 2018), that can be applied in developing countries like South Africa, such as Industry 4.0 and its digital technologies.

The era of digitalization developed as follows: first, a revolution which used water and steam power to mechanize production; second, a revolution that used electric power to create mass customization e.g. the Ford T Model; the third revolution used electronics and information technology to automate production and lastly, the fourth industrial revolution will be characterized by smart factories. (Rojko, 2017), (Schwab, 2016) and (Effoduh, 2016). Figure 1 represents the three stages until the Fourth Industrial Revolution:



**Figure 1: evolution of industry 4.0**

Currently, we are in the Fourth Industrial Revolution which was simulated by the development of information commutation technology (ICT), its technological bases are known to be the cyber-physical system, automation robotics, artificial intelligence, which are presumed to be the solution of the decline of South African manufacturing sectors that are in the hunger of completion to produce the quality of work, efficiency and effective production systems that will contribute to economic growth and sustainability.

### 3. Literature review

In this section of the study, discussion of factors that leads to economic growth and sustainability such as Industry 4.0 tools will be highlighted. Further, the study will discuss the potential opportunities and the critical issues in the implementation of these factors within the South African manufacturing sectors, the economic growth and sustainability concerning these factors, improved performance and productivity that render the decline of manufacturing sectors, lack of infrastructure, and lack of knowledge which requires the level of leadership understanding of the changes underway across all sectors.

Industry 4.0 is a strategic tool that can drive manufacturing sectors, originating from water and steam. Industry 4.0 requires a radical change in manufacturing operations, a shift from traditional methods and mass production peculiar to manufacturing (Jayaram, & Nicolae, 2010). Also, faster adoption of agile equipment to the ever-changing market demand is needed (Roko, 2017). The evolution of Industry 4.0 digital technologies was briefly discussed in the background of the study (Schwab, 2018), (Effoduh, 2016) and (Rojko, 2017).

For manufacturing sector performances to improve, the practices of factors like Industry 4.0 technologies are required, for better manufacturing performance, improved competitiveness, manufacturing sector declines avoidance and cost reduction (Clark, et al. 1996), (Nagy, 2018) and (ATCC, 2015). The common causes of manufacturing declines are weak growth in exports, fear of globalization, yawning trade deficit (Houseman. 2018), resistance to manufacturing advancements like technologies, downtime, unnecessary movements and unnecessary repetition of the production process.

When implemented within the manufacturing sectors, the Industry 4.0 digital technologies like ICT, AI, robotics, automation and 3D printing are factors that drive economic growth and sustainability of many countries through increased productivity, increased customer value through continuous improvement, knowledge sharing and data sharing, and high manufacturing competitiveness.

### 3.1. The importance of digital technologies

It has always been known that the danger each manufacturing sector face, is the decline of its workforce (Bildstein & Seidelmann, 2016). Today, we are at the cusp of the Fourth Industrial Revolution in which the worlds of production and network connectivity are integrated through IoT and CPS to make Industry 4.0 a reality (GTAI 2014). In this new ICT-driven technological evolution, embedded systems, IoT, CPS, Industrial Integration and Industrial Information Integration are playing important roles in organizations and businesses (Xu, Xu and Li, 2018). The development of digital technologies such as the internet of things (IoT) allows manufacturing sectors to continuously share a network of people, machines and through value creation processes. Nagy (2018) argued that the manufacturing processes through digital technology have allowed sectors to produce products that can compete globally.

**Effective communication** is one of the important stances within the manufacturing sectors. The use of digital technology and agile equipment like machines have led to increased effective communication on a large scale. Manufacturing sectors are now able to collaborate with their employees even from a large distance due to these smart factories. Communication is now easier than before and has assisted manufacturing in yielding productivity, thus avoiding delays. Many scholars also argued that effective communication achieved by digital technology is based on real-time (Kapur, 2017) (Sjodin, et al. 2018). Through digital technology, you can get response time that supports your activities (Sadowsky, et al. 2013). Further, the increase in effective communication enables manufacturing sectors to continuously benchmark their processes internationally from the comfort of their country, thus allowing them to also compete globally.

**Increased agility and flexibility** - Within the last years, the need for agility and flexibility initiatives towards smart manufacturing have been introduced all over the world to re-establish and regain a significant industrial share in the economy (Tvaronavičienė 2014),(Travkina & Tvaronavičienė 2015) and (Prause 2015). The use of digital technology enables manufacturing sectors to perform at an excellent mode, thus capable of meeting the change in market demands. Through the reorganized structure of the business and expanding the portfolio of competence (Gotz, 2019) manufacturing sectors can remain flexible to demand downtime, low production processes and unnecessary movements that lead to waste of time and fatigue of the workforce.

Therefore it is of great importance for companies in the manufacturing sector to adapt and take advantage of this digital technology era to grow and expand businesses and even compete globally to grow its economy and develop sustainability of its country.

### 3.2. Critical issues pertaining to digital technology

The critical issues accompanied by the rise of Industry 4.0 and digital technologies (ICT, AI, RO, automation, 3D printing, etc.) cannot be ignored; therefore, being knowledgeable about these changes and the speed in which it is occurring can ensure that knowledge and technology can reach all and benefit all.

#### 3.2.1. Manufacturing processes

The disruptive technologies such as robots, AI, internet of things and 3D manufacturing are changing how manufacturing sectors operate (Segmentation group, 2018). According to (Sjodin, et al. 2018) manufacturing sectors find it difficult changing their traditional routines and work processes to accommodate the digital transformation. Earlier on, in the introduction, it was noted that manufacturing sectors are resistance to change to the modern agile

and flexible equipment. This is because the traditional methods in place aren't just simple methods to them, however, they have become traditional cultural practices, and as a result, the radical culture can be difficult to change. The adoption of these technologies is risky and expensive although they promise a great increase in the total revenue cost and competitiveness (Tupa, et al. 2016). Manufacturing sectors lack the strategic approach to adopt recent technologies that lead to improvement within the economy of the country, hence it is necessary to find ways that will attract manufacturing sectors to adopt the technology such as fund schemes for Industry 4.0.

### **3.2.2. Government**

The Fourth Industrial Revolution technology has been known to be the bedrock for economic growth; however, with growing technology, the Fourth Industrial Revolution will increasingly give the citizens the ability to use technology to seek greater autonomy which may challenge the power of government in disruptive ways (Lye, 2017). Failure of government to adopt these technologies earlier than citizens may lead to rising unemployment and the greatest inequality. The government must also set policies and structures in place that support the development of digital technologies such as funding schemes.

### **3.2.3. Cybersecurity**

Cybersecurity or data security likewise has been mentioned by many scholars as an issue in the modern adoption of technology (Pradhan & Agwa-Ejon, 2016), (Nagy, 2018) and (Sontos et al., 2015). There is some security violation in the use of technology that limits the trust and confidentiality of information (Sodowsky, et al. 2013). With digital technology, it is possible to forge information including signatures or access confidential information that might put the reputation of manufacturing sectors on line. Industry 4.0 security and data privacy issues have arguably become one of the most significant concerns in the Fourth Industrial Revolution where technology has become a driver (Manda and Dhaou, 2019). With increased data sharing, there is a high risk of someone getting the data and use it for own benefit. The leakage of customer detail and employees may lead to a company's bad reputation. Javier, et al (2017) assert that special attention needs to be paid to the information source and if privacy is breached. Further, IT security sectors must develop new systems to protect the confidential data better than before from spying, fraud, hackers, viruses and terrorism (Waibel, et al 2017). Therefore, protective and preventative systems need to be developed against such actions or threats i.e. block manufacturing systems from being accessed by outside sources.

### **3.2.4. ICT infrastructure**

The lack of technological infrastructures like ICT, automation and robotics has always been a major problem for most countries. However, the South African country is supported by a strong and well-developed structure (Pradhan, et al. 2017); further, even though with strong supporting manufacturing sectors they seem to lack knowledge of how they can take advantage of such factors for their benefit and redesign their manufacturing into smart production. It should again be noted that some of the South African manufacturing sectors are practicing the use of digital technologies (AI, ICT, automation and big data) and benefiting from it. Nevertheless, the use of ICT requires a big layout that can handle the capacity of the required equipment. Building these infrastructures requires a large amount of investment and cost, which not all manufacturing sectors can afford. This has been one hindrance of effective utilization of ICT in South Africa.

Another major problem we face in terms of ICT infrastructure in South Africa is that we lack good renewable resources. Every year the South African country faces load shedding, in which this can cause downtime, loss of data and high-security risks. South Africa's decline and falling of economic growth are most times associated with decreasing electricity sustainability or uncertainties (Ateba, et al. 2019). Hence it is a necessity to research and design ways in which such hindering factors can be avoided in every manufacturing sector before starting with the digital transformation process.

### **3.2.5 Skills**

There appears to be an existing gap of knowledge in the adoption of 4IR tools. Further, skills deficits undermine digital technology promises (Fick, 2019). The Fourth Industrial Revolution presents wealth and opportunities; however, the lack of high-end skills in South Africa could hamper the progress of the fourth industrial revolution (Writer, 2019). Skills have been identified to provide more needed intellectual guidance in the development and implementation. Manufacturing staff often lack skills and knowledge of smart factories implementation. This has been one of the issues obstructing the adoption of digital technology within the South African sectors.

### **3.2.6 Lack of funding**

Barwa (2016) declares that access to money is among the key stumbling blocks stopping individuals from adopting Industry 4.0 digital technologies in their manufacturing sectors in bigger sums. The (BWA, 2016) approves that and is of the view that money facets of a business start-up are with no doubt one of the major difficulties of most sectors today. Whyte as reviewed by (Ogbomo, 2011) suggested the following sources of investment for digital technology programs:

- Grants
- Public subsidies
- Private donations, fundraising events
- In-kind support (e.g. equipment, volunteers)
- Community support
- Membership fees
- Revenues earned from core business
- Connectivity
- Educational services (training)

From the assessed critical issues, many factors may limit the infusion of digital technology within the South African manufacturing sectors. These critical issues include ICT infrastructure, inadequate funding or lack of investment and skills. Hence such factors must be addressed before any manufacturing sector can start with the adoption to avoid fear and failure of the method.

## **3.3 Opportunities presented by digital technology that aid to economic growth and sustainability**

Over the past few years, most manufacturing sectors have heard about the Fourth Industrial Revolution and how it lessens costs and increase customer satisfaction. The truth is that only a few sectors know and have experienced real opportunities for 4IR. The Fourth Industrial Revolution brings many opportunities for manufacturing sectors around South Africa. (Min, et al. 2018) argued that manufacturing productivities will be fifty times greater than it was before. Job losses will be there, however, many more roles and exciting/ satisfying roles will be created (Schwab, 2016).

**Table 1: Opportunities created by digital technology**

Increased efficiency, productivity and global competitiveness
Lower barriers between investors and markets (Min, et al. 2018)
Improved quality of life around those within the manufacturing sectors and the world
Cost savings in hardware, processing cost reduction and the ability to test the value of the systems
Improvement in manufacturing strategies and operations
Performance monitoring
Create a new employer to employee relationship, one that works for both parties.
Create flexibility for both the employer and employee.

From the opportunities highlighted by different scholars in **Table 1**, it can then be concluded that the manufacturing sectors within South Africa can yield good results towards adopting digital technology. These good results can in turn gain good economic growth and sustainability. Manufacturing sectors can now compete globally and be recognized across the world.

#### **4. Limitation**

The study is limited to manufacturing sectors, however, the study should also be transferred to other sectors such as the service sectors.

#### **5. Methodology**

A desk research strategy was used to identify the factors that lead to economic growth and sustainability within countries, derived from the performance of manufacturing sectors through the adoption of digital technologies. Issues and opportunities related to these factors were also discussed. A case study was provided to review how some of our manufacturing sectors in South Africa are benefiting from the adoption and what critical issues and benefits they encounter daily. The digital technologies readiness presented in this study was developed through a review of global Industry 4.0 advanced manufacturing literature. Further South African manufacturing economic declines and failure of sustainability development was reviewed (Bhorat, 2017) (Williams, et al. 2014), (Christopher, 2018) and (Nagy, 2018). Data collected was extracted from online reviews of literature, the internet, the University of Johannesburg publications, public libraries and government policies. The online materials were collected from different sources like South African manufacturing sectors, the historical evidence of the Industrial Revolution, Industry 4.0, the evolution of robotics and automation, artificial intelligence, information communication systems, and opportunities and challenges in implementing Industry 4.0 within South African manufacturing processes.

#### **6. Analysis of data and discussion**

Gathering of the information collected from reviews of the literature to analyze the factors involved were mainly grouped as economic growth and sustainability.

## **6.1. Drivers or factors contributing to economic growth and sustainability**

### **6.1.2. Industry 4.0 and IoT (Internet of things)**

According to (Maple, 2017) the internet of things (IoT) is a technology that can revolutionize the way production takes place in businesses, in sectors ranging from transport to health, from entertainment to our integration with the government. Further, one of the biggest impacts globally of the IoT come through the advent of the Fourth Industrial Revolution, in which the IoT technologies are to be incorporated into each phase of the manufacturing process. This involves a shift from manual work to the intelligent manufacturing process (Thoben, et al. 2017) incorporating cyber-physical systems, automated robotics, and cloud computing and big data (Frodorov, 2015). The IoT can connect physical devices to the internet, which enables manufacturing to collect and analyze information and create action or make a decision based on the data collected. As a result, IoT is very vital for a business as it can optimize manufacturing processes and make documentation processes easier for workers, as well as connects manufacturing sectors across the world, thus leading to a competitive advantage.

### **6.1.3. Big data Cloud computing**

For manufacturing sectors to have the means to analyze, evaluate and organize their large amount of data, cloud computing and big data can never go wrong. Big data forms part of digital technologies together with AI and cloud computing (Pradhan, et al. 2015). Cloud computing works together with big data to address/manage the challenges brought by big data within the documentation of larger data in sectors (Li, et al. 2019). The challenges cloud computing overcomes are that small medium-sized manufacturing cannot implement big data, however they can if they combine it with cloud computing, cloud computing and big data work together to assist manufacturing sectors to overcome the processing of data. With these two, they can work effectively and with less time to minimize delivery delays to suppliers. Manufacturing sectors from all over the world and within South Africa can work together to perform repair work since individuals and machines can communicate through Cloud (Waibel, et al. 2017). In conclusion, the two stances help lower costs in terms of data processing within the manufacturing sectors.

### **6.1.4. Robotics and artificial intelligence**

Artificial intelligence and robotics are the most known technologies that will bring a disruptive force within the manufacturing sector. According to (Raj and Seamans, 2019) these two technologies can bring turmoil as well as great progress. For example, the use of these technologies can lead to great economic growth as well as lead to job displacement. However, the use of these technologies does not necessarily mean replacement of labour force --- they can work relatively with humans, lift the heavy burden of tasks to continuously improve performance within the production process. Robotics and artificial intelligence help maintain the structure of competitive advantage through minimization of costs within the production processes, strategy and mission goal achievements (Fareri et al. 2020)

### **6.1.5. Automation**

Automation in manufacturing can be defined as putting new products into high volume production while ensuring that parts are designed for the available manufacturing process (Taneja, 1989). Automation connotes visions of software performing human tasks; the term means automation of service tasks that were previously performed by humans for business processes (Madakam et al., 2019). Automation has created many opportunities for the globalization of the manufacturing sector and continues to change how our day to day operations are being conducted. Through automation, manufacturing sectors can produce large amounts of quality products and little defect or error. This has assisted manufacturing sectors to always meet demand when the markets change.

### **6.1.6. Smart production**

The strategic approach to smart manufacturing is promising. Smart production of smart factory systems can assist manufacturing sectors in South Africa by far-reaching improvement on every industry level (Waibel et al. 2017). It has also been recognized as a factor that can improve the standard of living in the South African country. Smart

production can allow production to take place in a single assembly line, thus elimination of unnecessary movements and downtime is reduced. Again we cannot ignore the risks that come with smart production. Smart production eliminates routine tasks that were previously done by humans, thus causing massive loss of jobs to employees (Wang, et al. 2014). Most scholars termed the massive job loss to skill deficits in the changing of traditional culture methods to digital methods (Fick, 2019), (Maisiri, et al. 2019), and Fareri, et al. (2020). Therefore the government should support the higher institution with necessary tannings that will prepare employees for the upcoming and recent Industry 4.0 world.

### **6.1.7. ICT (Information communication technology)**

The role of information communication technologies (ICT) in the resurgence of economic growth has been experienced across all countries. ICT plays a vital role in the manufacturing processes of a production system. Aliu and Halili, (2013) defend this view as they believe that the role of ICT is quite crucial, in both growth and creating sustainability. Despite being a major contributor to growth, ICT also increase efficiency and productivity (Abri and Mahmoudzadeh, 2015). Scholars have reported a yield in several important opportunities presented by ICT: improved exports; create employment; reduce costs of production; allowing manufacturing sectors to compete in the markets; and reduce costs of trading (Banga, and te Velde, 2018). Further, ICT can help the declining manufacturing sectors in terms of productivity and competitiveness. However, ICT job destruction should not be ignored, as skills need to be enhanced in employees so they can work hand in hand with such technology.

## **7. Recommendations**

One major area of this study which has contributed to knowledge is that digital technology, AKA and industry 4.0 lead to an increased customer base, market share, profit level, goodwill, and dominance over competitors, thus leading to growth in economy and sustainability, as well as a threat to larger sectors. Furthermore, with the fact that many authors have researched on this topic, this work has contributed to the understanding of the impact of digital technologies like ICT, artificial intelligence, robotics, automation and 3D printing on manufacturing performance, which could help in efficient and successful implementation Industry 4.0 on sectors. This paper recommends digital technology as a major determinant of manufacturing sectors production processes and growth. However, for further conclusions, more studies should be carried out in this area, especially concerning the solutions that were highlighted as critical issues about Industry 4.0. Finally, the paper recommends the steps in figure 2 to be utilized by manufacturing sectors to avoid critical issues brought by Industry 4.0 digital technology, the steps assist in adopting the use of technology successfully. These steps have been presented by a flow chart process in figure 2, as it will depict how manufacturing sectors can apply the processes from the beginning to the end.

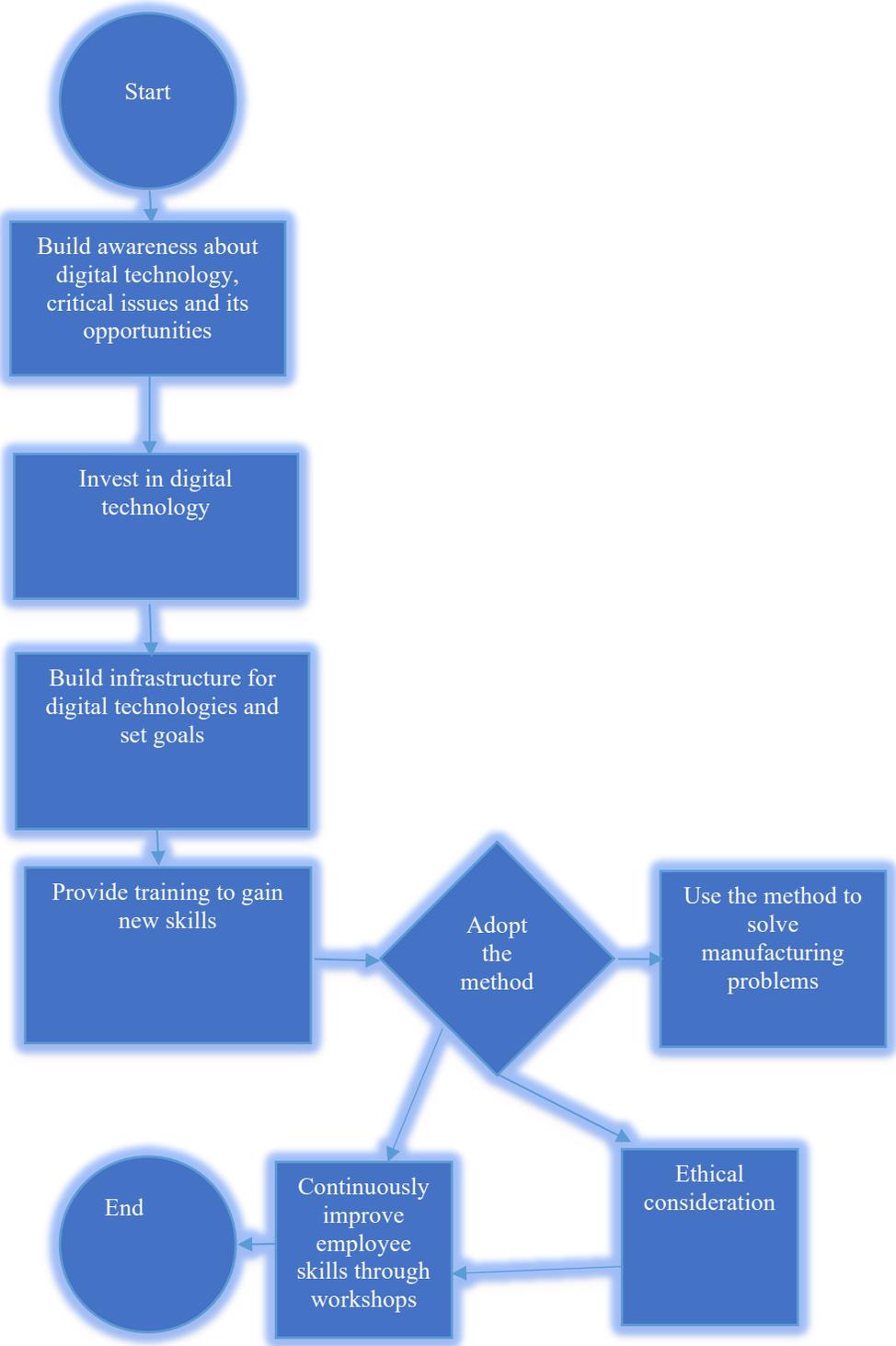


Figure 2: Steps for adopting digital technology successfully

## 8. Conclusion

To successfully grow the South African economy and enhance sustainability, manufacturing sectors need to believe in the solution of high productivity, increased performance, effective communication and reduction in cost that can be achieved through the adoption of digital technology. South African manufacturing sectors need to master the critical issues pertaining to the adoption and find a solution for these issues and accept that the change in market demands can only be overcome through these technologies; thus resistance to change is not a solution. This paper has looked at the factors affecting economic growth which were highlighted to be the digital tools of the Industry 4.0. The paper again highlighted critical issues pertaining to digital technologies. The value and contribution of digital technologies and understanding how innovations can contribute to the wider development of economic growth and sustainability have been highlighted. Therefore this paper is challenging manufacturing sectors in South Africa and across the world to use this digital technology to their advantage as it accumulates improved manufacturing processes and achieves best results leading to a decline in manufacturing stagnation.

On the sustainability and economic growth perspective, digital technology can bring fundamental improvement. Manufacturing sectors all over the world have the potential to share information faster with suppliers and customers. Therefore it is promising that through this digital world of Industry 4.0, manufacturing sectors can be flexible to change by responding faster to the changes in market demands, overproduction and high cost can be eliminated. Through artificial intelligence, manufacturing sectors can now use materials and energy consumables efficiently.

However, it should be noted that serious attention needs to be paid regarding factors obstructing the adoption of these technologies, e.g. IT securities, employment, and infrastructure. The era of digital technology enables a wide range of unforeseen opportunities, including return of investments and shares.

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