Analysis of the status-quo of industrial 4.0 in the SMMEs: a critical review

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Abstract
The manufacturing sector has undergone number of challenges in the last 30 years. Currently is the industry 4.0. This sector is also facing a challenge to meet the continuously changing needs of consumer worldwide, taking into account that they must adapt to the changes to ensure sustainability. The manufacturing world is moving fast to the development of efficiency means of production and the adoption of new technology. This paper presents the benefits of the motives (sustainability, profits, market share, cost, productivity and competitiveness) of the adoption of industrial 4.0 stages of implementation in manufacturing and review the competitiveness of the Small Medium and Micro-Sized Enterprises (SMMEs). In order to deal with this challenge, manufacturing value creation must be geared in the direction of sustainability. Presently, the manufacturing value creation in the primary industrial states is designed by the expansion towards the industrial 4.0. Although a number of studies have been conducted the past 3 decades to address the gap, but there's still a need to address. Therefore, this paper aimed at theoretical assess the status-quo of industrial 4.0 in the SMMEs. The results of the critical analysis of the current literature, clearly demonstrate that there are flaws in the body of knowledge. The flaws identified was the lack of use of qualitative method and the practices or adoption of industrial 4.0 in the SMMEs.

Keywords
Industrial 4.0, South African Small Medium and Micro-Sized Enterprises (SMMEs)

1. Introduction

1.1 industrial 4.0

Around the globe, the traditional manufacturing has become tutus because of the technological or digital transformation that has continuously grow at a highest trajectory the world has ever seen. Smart technology has become a way of life, a way of doing things on a daily basis. Companies need to adopt to the rapid changes and exponential growth, others might be left behind by developed competitive countries. This applies to traditional industrial economics such as Germany and the United States of America, as well as emerging economies like Asia, Africa, and South America (Deloitte, 2016). The term industry 4.0 refers development stage in the organisation and management of the entire value chain process involved in manufacturing industries. Another term for this process is the "forth industrial revolution". Some commentators also use the term the "internet of things" or the "internet of everything or the "industry internet" (Deloitte, 2015). What all these terms and concept have in common is the characteristics of the traditional manufacturing and the production process are the throes of the digital or technological transformation. For some time now, most industrial process these days, have progressively embraced the modern information technology (IT).

The industry or sector has been evolving on an ongoing basis since the olden times. The biggest shift of industrial revolution took place in the 18th century and was related to the transition from the economy based on agriculture, manufacturing and handmade production to mechanical large scale factory production, this does not entirely exclude service industries or sectors. The 19th century was the age of steam and electricity, referred to as the industry 2.0. The other years of intense development was the period after the 2nd World War which continues until nowadays, this was in regard of the continuous improvement philosophy, with scientific and technical growth taking place. The most imperative elements of the Industry 3.0 include computerization/ technology, new energy sources, automation of work processes/ production, as well as enhancement of means of telecommunication. Industry 4.0 covers three possible archetypes See figure 2 below, which illustrate the evolution of industries since the 18th century.

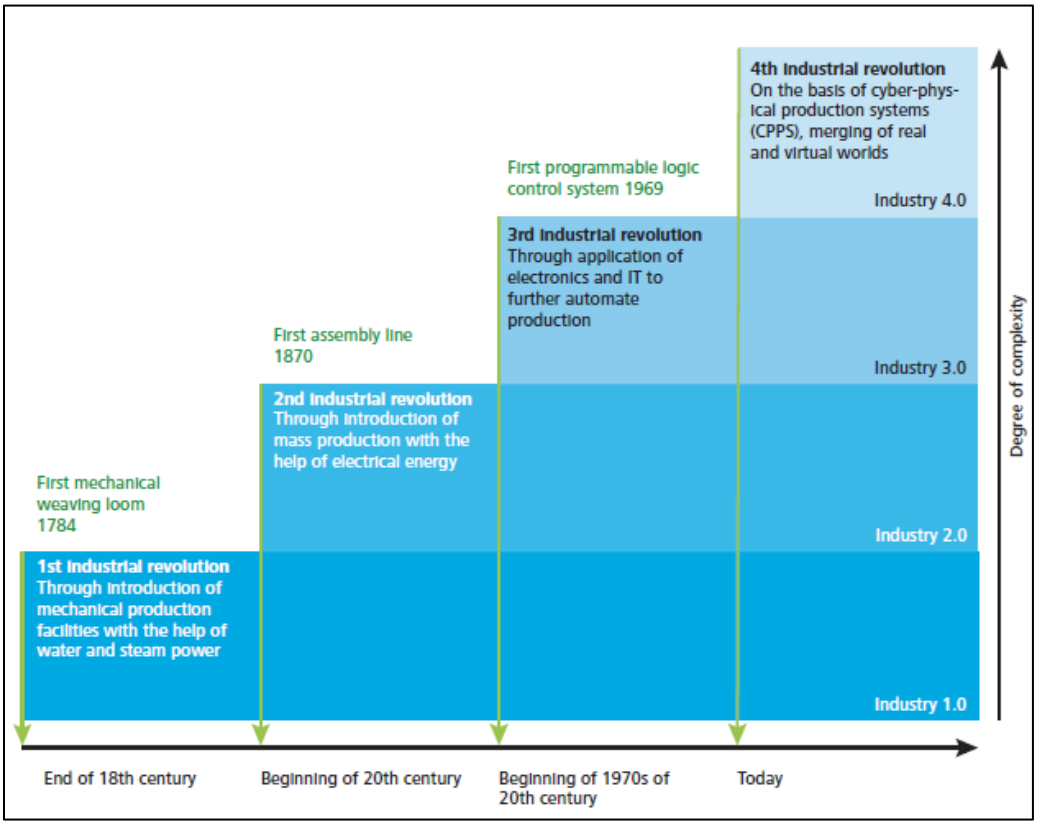

Figure 1: Industrial revolution (Deloitte, 2015).

Industry 4.0 stanches from the concept of internet of things, smart factory, involving the electronic flow of production/ processes (Hermann *et al*, 2015). This means that centrally monitoring and controlling devices connect using the operating principle of social media (Radziwon *et al*, 2014) Equipment and raw materials organize production on their own, beyond the borders of a company, or even countries, in order to ensure efficient and effectiveness of the operation. (Pfohl *et al*, 2015). The operations of such companies is centred on meeting customers order at high regard of quality, production is carried out in small batches. There is a very high variety of products, to help diversify the company's product offerings. The third archetype are these-called e-factories, focused both on individualization and remote operations. These companies operate on a small scale, producing limited amounts of products. The company's functional structures are integrated as per the mission

of the company. They are oriented towards low investment expenditure in order to remain cost competitiveness. However Industry 4.0 does not only refer to changes in industrial unit but also in distribution and procurement as per the supply chain. General Electric emphasizes the role of the integration of complex physical equipment and digital devices with networked sensors and software, used to predict, control and plan for better business and societal outcomes (Drath, Horch 2014). According to Pfohl *et al* (2015), Industry 4.0 can be considered on the process, technology or management level in the whole supply chain and is defined as the sum of all disorderly innovations derived and implemented in a value chain to address the trends of digitalization, empowerment, transparency, mobility, modularization, network collaboration and socializing of products and processes. Industry 4.0 is a collective term for technologies/ digital and concepts of value chain organization (Herman *et al*, 2015). Based on the literature research, conducted by Herman *et al*, (2015), the most imperative are: Cyber-Physical Systems (CPS), Cloud Technology, Industry Internet, Internet of Things, Smart Factory and Internet Service. However, Industry 4.0 is something more, Pfohl *et al* (2015) distinguish more than 60 technologies related to this concept. All of them can be divided into the following four groups (Lee *et al*, 2014):(i) data and connection, (ii) analytics and artificial intelligence, (iii) human-machine interactions (Chen *et al*, 2012), (iv) automated machine park. The description of these groups is presented in Table 1.

Table 1: Technologies used in Industry 4.0 (Szozda, 2017)

Technologies in Industry 4.0.	**Components and benefits**
Data and connection	Large databases (big data) - data storage, processing and calculations Internet of Things (IoT) and communication between machines (Machine to Machine) - connection and transfer of information / data Cloud technologies (cloud technology) - centralization of data storage and virtualization of storage
Analytics and artificial intelligence	Digitization and automation of work based on knowledge - use of artificial intelligence and machine learning Advanced analytics - improved algorithms and data availability, implementation of advanced data mining systems used mainly for predictions
Human Machine Interaction	Touch interfaces and new GUI interfaces - possibility of quick communication using portable devices Virtual reality - use of optics, including augmented reality glasses, in industry, e.g. in a warehouse
Automated machine park	New production opportunities, e.g. using 3D printers - extended range of materials, increased precision / quality, possibility to obtain spare parts or raw materials immediately Advanced robotics - use of artificial intelligence, full automation of production, use of M2M technology Energy storage - production and storage of energy by performing daily activities in companies

One of the fastest emerging technologies used in Industry 4.0 is Internet of Things (IoL).It is the indirect or direct ability of things and objects to store, process, and share or exchange data using network connections (Shimizu *et al*, 2016). In contrast with Industry 4.0., Internet of Things is not focused on factory, and its application is visible particularly in the distribution area or supply chain, logistic, mainly in customer service and use of objects. Business structure or models are created using IoT technology are completely different from the traditional ones. They demonstrate departure from conventional linear oriented value streams to creating values within a network of components. This means that when defining business structure/ models, the focus is on the entire bionetwork, including a supply chain/ logistics, rather than one single company, so that all parties involved improve their processes in order to maximize benefits for the end customers. (Atzori *et al*, 2010).

1.2 Background of Small, Medium and Micro- sized enterprise (SMMEs)

Small, Medium and Micro- sized enterprise (SMMEs) play a vast contribution to the global market and are vitally sourced of the economic growth, dynamism and flexibility. SMME's as economic agents are not only build on their intrinsic abilities and qualities, but also rely on business environment and availability. SMME's play an important role in the economy by providing an innovative environment, job creation, and the development of industrialised countries during the 20th century (Audretsch, 2002). SMMEs can also be grouped into three categories according to sizes: Micro, Small or Medium. These groupings are decided either based on the number of people employed or the business total sales as well as revenue generated in a year (SME, 2008). It is becoming an inevitable precedence for businesses to act in an accountable manner and give back to their community and the environment through several initiatives. While the community and society at large is demanding a social responsibility such as job creation, wealth sharing etc. from all businesses, including SMMEs, responsible businesses strive to have a progressive effect on the societies and environments they operate in. The term 'responsible business practices' (RBP), previous studies indicates that RBP are the practices that SMMEs follows, in order to act reliably headed for their stakeholders and their functional environments. The Institute for Business Ethics (2010) points out that RBP is imperative for the realisation of SMMEs. Most SMMEs use their social programmes to strengthen their brand image and to become more competitive (Dincer & Dincer, 2013; Jenkins, 2006).

2. Gap identification in previous studies

The purpose for this section is to analyses the past study and criticize the gaps or evaluate the work done by the author. The analysis will be looking at the core study of the research, the year published, location of the study, the sample size, methodology, and the findings of the study in order to increase the reader's understanding of the research. To begin with the critical assessment, the ISI web of science data base was used on the industrial 4.0 as key words. A critical analysis is subjective to a number of categorized objectives, are as follows:

- Publication year (1997 to 2017),
- Language selection (English),
- Pear reviewed article source title,
- Country/ region,

The search resulted had 257 document, that were critical assessed by means of tittle and abstract with the purpose, of developing boundaries (screening phase). Through the groups of inclusion, segregation of standards established and against which every journal was assessed. Article are those are precise, which focused in the adoption of industry 4.0 in the SMMEs. It pointed out that the studies which did not meet the requirements were taken out. At this stage generated 87 focusing in industry 4.0 in manufacturing and information and communication technology. These studies were labeled on the basis of the set of standards, i.e. the studies were assessed were selected based on the citation.

The below table is the list of all critical assessed studies, we have selected 15 most critical analyzed studies over the past 3 decades. Below after the table is the details of the critical assessed and the gaps identified.

2.1 Critical analysis of previous studies

		Sector			Enterprise size		
Authors	**Location**	Manufacturing	Information and communication Technology	Other	SMME	Large	**Methodology**
Lutz Sommer (2015)	Germany	X			X		Critical review
Kang et al. (2016)	Germany, U.S., and Korea	X				X	Survey and analysis
Djulbegovic et al.(2000)	USA		X			X	Critical review
Wang et al.(2016)	China		X			X	Qualitative
Monostori et al. (2016).	Not specified	X				X	Qualitative
Peidong et al. (2009)	China	X				X	Qualitative
Qiu et al. (2016)	Not specified		X		X		Quantitative and Qualitative
Han et al. (2016)	China		X			X	Qualitative
Luo et al. (2016)	China		X			X	Quantitative and Qualitative
Babiceanu et al. (2016)	Not specified	X				X	Qualitative
Xia et al. (2016)	Not specified	X				X	Qualitative
Hossain et al. (2016)	Not specified			X		X	Experimental evaluation and simulation
Liu et al. (2017)	Not specified	X				X	Virtualization method
Amin et al. (2016)	Not specified		X			X	Analytical
Huang et al. (2016)	Not specified		X			X	Qualitative

Lutz Sommer (2015) argued that there are critical hurdles for organisation and small businesses in regards, thus his paper aimed at examining businesses consciousness, willingness and competence to encounter this challenge compelling into justification the distinct character of SMEs. His methodology/ approach was based on the critical review of previous papers. Which means there was not enough data collected. The findings were based on the conscious regarding the significance of the study, though most of his conclusion was done by the capabilities of the existence of the readiness of industry 4.0 and the uncovering of the business size. The study was conducted in Germany. He failed to collect data using qualitative and quantitative methodology and also failed to disclose the size of the enterprise and doesn't argues the relevance of the industry 4.0. Therefore my research will be looking at competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Kang et al. (2016) argued that todays the "manufacturing industry" is targeting to increase effectiveness over the merging with leading powerful Information and Communication Technology (ICT) expertise in directive to strive an innovative development engine. He further indicates that smart factories, which is the 4th industrial revolution is intrusted with the manufacturing paradigm shift, is the assortment of leading-edge practices that sustenance operational and precise engineering administrative in factual period over the outlining of several ICT knowhow and the merging with the prevailing industrialised knowhow. His methodology was based on the "surveyed and analysed various articles" associated to smart factories. He further indicated some of these purposes, "1) the major key technologies related to Smart Manufacturing were identified through the analysis of the policies and technology roadmaps of Germany, the U.S., and Korea that have government-driven leading movements for Smart Manufacturing, 2) the related articles on the overall Smart Manufacturing concept, the key system structure, or each key technology were investigated, and, finally, 3) the Smart Manufacturing-related trends were identified and the future was predicted by conducting various analyses on the application areas and technology development levels that have been addressed in each article". He failed to collect data using qualitative and quantitative methodology and also failed to disclose the size of the organisation. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Djulbegovic et al. (2000) argued that the expose reportage of "pharmaceutical-industry" supported by past principled medical hearings repeatedly outcome in prejudiced results. He highlights moreover owing to discriminating recording of research is not equal supports or reports/ newsletter of lesser quality documents, in which poor fallouts are somewhat defined. The author further suggests that a sample experimental ought to be conducted only if there hesitation in regards to qualifying treatment versus another. His research shows that there is interpolation and regulator are believed to be not equal disruption to the indecision standard. His approaches was to examine the superiority of 136 available sample judgements that motivated on single syndrome grouping (numerous myeloma) and observance to the indecision standard. He also evaluated whether the indecision standard were upheld, with a comparison of the number of investigation preferring new handlings over normal ones. He examined data rendering to the basis of funding. The funding was only on the basis of 35 profit-making, which will make the business required a leaning just before greater "quality scores (mean 2•94 [SD 1•3]; median 3) than randomised trials supported by 95 governmental or other non-profit organisations (2•4 [0•8]; 2; p=0•06)". Inclusive, the indecision standard were endorsed, with 44% of sample trials preferring customary handlings and "56%

ground-breaking conducts (p=0•17); mean and median favourite appraisal totals were 3•7 (1•0) and 4. Though, when the examination was done affording to the foundation of funding, reports funded by non-profit associations upheld equipoise choosing new treatments over normal ones (47% vs 53%; p=0•608) to a countless level than sample trials maintained exclusively by profit-making associations (74% vs 26%; p=0•004)". Though he failed to collect data using qualitative and quantitative methodology and also failed to disclose the size of the enterprise and doesn't argues the relevance of the industry 4.0 technology. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Wang et al. (2016) argued that the creation of "Cyber-Physical Systems (CPS)" announces the 4thstage of industrial development, normally recognised as Industry 4.0. He indicates the integration of numerous mechanisms inside an industrial plant to instrument a "flexible and reconfigurable manufacturing system, i.e., smart factory, big data, is one of the key features of Industry 4.0". He further presents the operations of a "smart factory structure that integrates industrial network, cloud, and supervisory control terminals with smart shop-floor objects such as machines, conveyers, and products". All the classifications of smart objects are coordinated in cloud. The smart factory system is operational and assisted by the incorporation of multi agent system and the feedback of big data coordination. Where the independent resolution and disseminated collaboration among agents tip to extraordinary rigidity. In addition, "the study illustrates that complementary strategies can be designed to prevent deadlocks by improving the agents' decision making and the coordinator's behaviour". The replication outcomes evaluate the usefulness of the projected cooperation instrument and stalemate stoppage tactics. Though he failed to collect data using quantitative methodology and also failed to disclose the size of the. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Monostori et al. (2016).argued that the greatest important enhancements in the improvement of "computer science, information and communication technologies is represented by the cyber-physical systems (CPS)". He indicates the structures of cooperating computational bodies which are in demanding association with the nearby physical world and with the provision of providing and consuming "data-accessing and data processing services available on the Internet". "Cyber-physical production systems (CPPS)", trusting on the newest, and the predictable advance improvements of "computer science, information and communication technologies on one hand, and of manufacturing science and technology, on the other, may lead to the 4th industrial revolution, commonly known as Industry 4.0". The authors' paper emphasises that there are substantial origins in overall and in specific to the CIRP communal – which indicates CPPS. Prospects near investigation in and application of "CPS and CPPS" are defined and in other areas are presented. Associated new research and developments defies are emphasised. He failed to collect data using quantitative methodology and also failed to disclose the size of the enterprise, as well as the location of the study. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Peidong et al. (2009) argued that "having 2.8x108–3.0x108t/a of wood energy, 4.0x106t/a of oil seeds, 7.7x108 t/a of crops straw, 3.97x109 t/a of poultry and livestock manure, 1.48x108 t/a of municipal waste, and 4.37x1010 t/a of organic wastewater", "China is in control of decent supply form for the growth of bioenergy manufacturing". He indicates that pending the conclusion of

2007, "China has popularized 2.65x107 rural household biogas, established 8318 large and middle-scale biogas projects, and produced 1.08x1010 m3/a of biogas; the production of bioethanol, biodiesel, biomass briquettes fuel and biomass power generation reached to 1.5x106t/a, 3.0x105t/a, 6.0x104t/a and 6.42x109 kWh, respectively. In recent years, bioenergy industries developed increasingly fast in China". Nevertheless, the industrialised foundation was fragile with some predicament surviving in "raw material supply, technological capability, industry standards, policy and regulation, and follow-up services". Commencing the standpoint of continuing operational expansion structure for bioenergy productions in China, a progressions of strategy propositions have been presented, such as establishment policy investigation, enlightening bioenergy productions expansion strategies and proposal, improving systematic investigation contribution, continuing in technology novelty, creating product quality standard, enlightening industrialised standard organisation, introductory marketplace and fast-tracking commercialization, etc. It is anticipated that the guidance stated above might be supportive for the upgrading of bioenergy productions growth. Though he failed to collect data using quantitative methodology and also failed to disclose the size of the enterprise and doesn't argues the relevance of the industry 4.0 technology. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Qiu et al. (2016) argued that toughness is an imperative and stimulating matter in the "Internet of Things (IoT)", which comprises numerous sorts of various grids. He indicates that refining the sturdiness of topological organisation, for example, surviving an assured quantity of nodule failures, is of countless importance particularly for the energy restricted frivolous systems. He indicates that the "small world model" has indicated the viability to enhance the system topology. The author proposed a "Greedy Model with Small World properties (GMSW)" for assorted sensor systems in IoT. The author used both quantitative and qualitative methodology to attend the two acquisitive measures used in GMSW to differentiate the significance of diverse system nodes. He also presented an algorithm that transforms a systems and so evaluated the performance to validate that, by individually calculating a lesser figure of shortcuts, GMSW can rapidly permit a system to show the "small world properties". He also compared GMSW with the Directed Angulation toward the Sink Node Model (DASM), displaying that GMSW outdoes DASM in relations of "small world" features and system expectancy. Though he failed to disclose the location of the study and doesn't argues the relevance of the industry 4.0 technology. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Han et al. (2016) argued that "wireless charging technique" deliver an additional flexible and encouraging way to answer the energy restraint difficult in "industrial wireless rechargeable sensor networks (IWRSNs)". Nevertheless the significant investigation has remained prepared on "wireless charging algorithms", furthermost it's simply emphases on inactively reloading nodes taking inadequate energy. The author proposed a "grid-based joint routing and charging algorithm for IWRSNs" to resolve the arraigning difficult in an active manner. Subsequently an innovative steering procedure is considered affording to arraigning individualities of the charger to realize limited energy balance. He mentions that on the other side diverse charging slots are distributed at diverse charging points on the foundation of energy consumption produced by the steering progression to realise world-wide energy balance. He then concluded that the simulated results authenticate advantage of his projected algorithm in answering the harmonising energy challenges

and cultivating existence rates of nodes. Though he failed to collect data using quantitative methodology and also failed to disclose the size of the enterprise and doesn't argues the relevance of the industry 4.0 technology. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Luo et al. (2016) argued that cloud computing plays a vital role in permitting applied presentations established on the "Industrial Internet of Things (IIoT)". He unpacked that the quality offerings of these has a direct influence to the usability of IIoT presentations. He also selected and endorse the greatest web and cloud established services, the one technique chosen was the massive data that are relevant to the "quality of service (QoS)". He continue to point out that a set of a distinct QoS standards to define and differentiate operation comparable web services. He indicates that in overall the "QoS is a non-functional performance index of web services", and it varies by end user dependency. His views are "that the QoS values for services that the end user has not appealed would be missing". He viewed his opinion by implying that to naturally resolve by hiring around predication algorithms to approximation the misplaced QoS values. The authors study, shows that the "data- driven scheme of forecasting the missing QoS values for the IIoT established on a kernel least mean square algorithm (KLMS) is suggested". Throughout his data extrapolation progression, the "Pearson correlation coefficient (PCC) is used to find the significant QoS values from comparable service users and web service items for each known QoS entry". The author used both qualitative and quantitative methodology to interpolate the rational of the data. Though he failed to disclose the size of the enterprise and doesn't argues the relevance of the industry 4.0 technology. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Babiceanu et al. (2016) argued that the modern developments in "sensor" and integrated systems can offer the basics for connecting the "physical manufacturing facility and machine world to the cyber world of Internet applications". He indicated that the combined "manufacturing cyber-physical system" is projected to carry the tangible processes in the corporal domain while concurrently observing them in the cyber domain with the assistance of progressive data dispensation and recreation models at mutually the industrialised progression and scheme functioning stages. Furthermore, he identified that the sensor-packed manufacturing system it advances more with Big Data analytics, these has highlighted to be more relevant for the event response variety and process virtualization. He indicated that such spaces are vulnerable to the "inevitable cyber- attacks, unfortunately, so common for the software and Internet-based systems". He also underlined that the authenticity creates cybersecurity diffusion within the industrialised domain an essential that goes recognised across investigators and specialists. He provided a "review of the current status of virtualization and cloud-based services for manufacturing systems and of the use of Big Data analytics for planning and control of manufacturing operations". Though he failed to collect data using quantitative methodology and also failed to disclose the size of the enterprise and the location where the study was conducted. Though he argues the relevance of the industry 4.0 technology by incorporating the "cyber physical system (CPS), big data and the internet of things (IoT)". Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Xia et al. (2016) argued that tractability of a "manufacturing system" is relatively significant and beneficial in contemporary manufacturing, which purpose in an economical location where market

variety and the essential for modified produce are developing. He highlighted that crucial equipment in a "manufacturing system should be reliable, flexible, intelligent, less complex, and cost effective". He identified that to realise these objectives, the culture of continuous improvement should be included in the conceptual design and be effective in order to address potential hurdles and defects in the manufacturing system. A combined and synchronised method should be reflected in the design development, and comprehensive design phases. He also highlighted that in certain areas of the system, a "multi-criteria decision making, multi-domain modelling, evolutionary computing, and genetic programing". He indicated such multi vested approach brings about the challenges such as absence of methodical methods and the actuality of practical barricades in "substantial condition data acquisition, transmission, storage and mining. Recently, the internet of things (IoT) and cloud computing (CC)" are being industrialised speedily and they offer novel prospects for evolutionary strategy for such responsibilities as records attainment, storage and dispensation. He proposed a basis for the "closed-loop design evolution" of industrial schemes in directive to realise continuous design enhancement for an industrial scheme through the usage of a "machine condition monitoring system assisted by IoT and CC". Novel strategy necessities or the discovery of strategy flaws of a prevailing industrial system can be done through a planned background. From the study it shows that the author used a qualitative methodology to gather data. Though he failed to collect data using quantitative methodology and also failed to disclose the size of the enterprise and the location where the study was conducted. Though he argues the relevance of the industry 4.0 technology by incorporating the cloud computer (CC) and the internet of things (IoT). Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Hossain et al. (2016) the argued that the promising prospective of the evolving "Internet of Things (IoT) technologies for consistent medical devices and sensors has shared some positivity in the next generation healthcare sector for excellence patient care". He highlights that the numeral of ageing and incapacitated individuals, the gaps shows that there is a need of focus for an actual well-being monitoring structure for examining patients' healthcare records to evade avoidable deceases. He then identified the fundamentals of Healthcare Industrial IoT (HealthIIoT) that there importance of such a system it's a "combination of communication technologies, interconnected apps, Things (devices and sensors), and people that would function together as one smart system to monitor, track, and store patients' healthcare information for ongoing care". In the paper he proposed that a "HealthIIoT-enabled monitoring system and other healthcare records are composed by mobile devices and sensors, steadily sent to the cloud for continuous access by healthcare specialists". From the study it shows that the author used an experimental evaluation and simulation methodology to gather data. Though he failed to collect data using quantitative and qualitative methodology and also failed to disclose the size of the enterprise and the location where the study was conducted. Though he argues the relevance of the industry 4.0 technology by incorporating the Health Industrial IoT (HealthIIoT) and the internet of things (IoT). Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Liu et al. (2017) argued that "cyber-physical systems are integrations of computation, networking, and physical processes and they are progressively discovery submissions in manufacturing". He indicates that "cyber physical system for manufacturing is not a manufacturing cloud if it does not use virtualization technique in cloud computing and service oriented architecture in service

computing". On the hind side, he discovers that a "manufacturing cloud is not cyber physical system if it does not have components for direct interactions with machine tools and other physical devices". The author proposed a novel paradigm of "Cyber-Physical Manufacturing Cloud (CPMC) is presented to close gaps amongst cloud computing, cyber physical systems, and manufacturing". Where he noticed that a CPMC permits direct processes and observing of machine apparatuses in a "manufacturing cloud over the Internet". He indicate that orientation of layered architectural scape of CPMC is established. Which he showed that a firm practices of industrialised net facilities and cross-platform applications exists with a clear announcement procedures such as "MTConnect, TCP/IP, and REST are discussed". The author failed to collect data using quantitative and qualitative methodology and also failed to disclose the size of the enterprise and the location where the study was conducted. Though he argues the relevance of the industry 4.0 technology by incorporating the Cyber-Physical Manufacturing Cloud. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Amin et al. (2016) argued that in recent times, Farash et al. pointed out roughly security softness of Turkanovi ´c et al.'s protocol, which they prolonged to improve its security. Nevertheless, he identified some challenges with Farash et al.'s protocol, such as a recognised gathering detailed temporary info attack, an offline key guesstimating attack using a embezzled smartcard, a fresh smartcard subject attack, and a user impression attack. Moreover, he identified that their protocol cannot reserve user privacy, and the secret key of the access node is uncertain. The author proposed that is best to design an effective and vigorous smartcard based operator verification and session key covenant protocol for wireless sensor systems that use the Internet of Things (IoT). From the study it shows that the author used an analytical methodology to gather data. Though he failed to collect data using quantitative and qualitative methodology and also failed to disclose the size of the enterprise and the location where the study was conducted. Though he argues the relevance of the industry 4.0 technology by incorporating the internet of things (IoT). Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

Huang et al. (2016) argued that the current growth of the "Vehicular Ad-hoc Networks (VANETs)" has interested a cumulative attention in vehicle ingesting, and hence, the "Popular Content Distribution (PCD)" has develop an intense concern. He identified that the comparative of PCD solutions were centred on the extensively used "cellular networks and Dedicated Short Range Communications (DSRC), solutions based on Collaborative Downloading (CD) are more economical and efficient". His analysis were owing to the restricted "bandwidth, the On-Board Units (OBUs) passing through a Road Side Unit (RSU) can only download a portion of the popular content". He addressed the "efficient collaborative downloading scheme (ECDS) for PCD in urban traffic scenarios". He identifies that in order to familiarise to the fast changing appearances of the "VANET topology", a novel cell built huddling system is projected, which significantly shortens the modelling. From the study it shows that the author used a qualitative methodology to gather data. Though he failed to collect data using quantitative methodology and also failed to disclose the size of the enterprise and the location where the study was conducted and doesn't argues the relevance of the industry 4.0 technology in his study. Therefore my research will be looking at the impact and competitiveness of the adoption of industry 4.0 in the South African SMMEs.

CONCLUSION

The manufacturing sector has undergone number of challenges in the last 30 years. Currently is the industry 4.0. This sector is also facing a challenge to meet the continuously changing needs of consumer worldwide, taking into account that they must adapt to the changes to ensure sustainability. The manufacturing world is moving fast to the development of efficiency means of production and the adoption of new technology. This paper presents the benefits of the motives (sustainability, profits, market share, cost, productivity and competitiveness) of the adoption of industrial 4.0 stages of implementation in manufacturing and review the competitiveness of the Small Medium and Micro-Sized Enterprises (SMMEs). In order to deal with this challenge, manufacturing value creation must be geared in the direction of sustainability. Presently, the manufacturing value creation in the primary industrial states is designed by the expansion towards the industrial 4.0. Although a number of studies have been conducted the past 3 decades to address the gap, but there's still a need to address. Therefore, this paper aimed at theoretical assess the status-quo of industrial 4.0 in the SMMEs. The results of the critical analysis of the current literature, clearly demonstrate that there are flaws in the body of knowledge. The flaws identified was the lack of use of qualitative method and the practices or adoption of industrial 4.0 in the SMMEs. Additionally, the theoretical analysis/ review has shown strong argumentative in the Information and Communication Technology (ICT) sector, though a couple of studies done in the manufacturing space, most in the large enterprises. Very little was done in the small medium and macro-sized enterprises (SMMEs), the analysis showed that the multi-nationals in the world have shown interest of the so called industry 4.0. Though the interest is there from a government point of view, but very little or close to non-existence implementation done in most SMME's. The industry 4.0 has taken great attention to most business owners and individuals, it's said that the impact of such a revolution will take industry by surprise especially in the optimisation of the business supply chain.

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