

# Improving The South African Manufacturing Sector's Competitiveness through the Adequate Use of ICT

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**Abstract**—Information and communication technology expansion creates new opportunities and challenges for developing economies' manufacturing sectors. South Africa's inadequate application of information and communication technology (ICT) creates great concern about the manufacturing sector's inability to compete globally. This study explores how the South African manufacturing sector can improve its competitiveness through adequate use of ICT. For this purpose, an interpretive analysis of recent literature and document review were employed. This study found that the initial problem lies within the manufacturing sector's inability to successfully identify and integrate the right technologies into business processes. The reason for this is among other factors, the technical skills shortage. The findings of this study can be generalized to those manufacturing sectors that have not adopted ICT. However, the findings can be extended to and applied in developing countries, especially those in Africa, in terms of using ICT in innovative ways to enhance manufacturing performance.

**Keywords**—competitive manufacturing sector, improve, manufacturing sector, use of ICT.

## I. INTRODUCTION

THE manufacturing sector has become the main contributor/focus of developing countries in terms of economy growth and job creation. The manufacturing sector has a global competitive advantage amongst developing countries in the market. Accordingly, these countries constantly strive to improve the manufacturing sector through adopting and making adequate use of ICT in order to become and remain globally competitive. Reference [1, p.559] asserts that “developing a competitive advantage in the global marketplace depends less on the ability to develop new science or technologies than on the ability to apply and continually refine those innovations”.

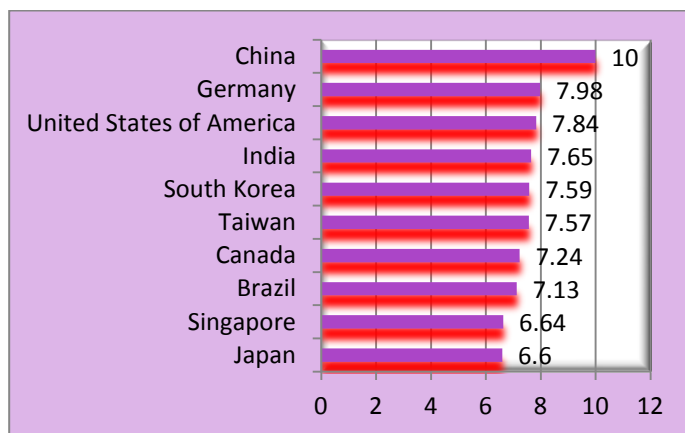
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Likewise, the improvement of manufacturing sector relies on the ability to apply and continually refine those innovations through the adequate use of ICT.

It is still perceived that the inadequate use of ICT is a great concern of the South Africa's manufacturing sector's ability to compete globally. Among other factors is the lack of expertise on ICT. This hinders the country to compete globally. Numerous reports confirm this status [7], [15], [16], [19]. Besides the numerous reports, literature shows that little has been done in an attempt to rescue the manufacturing sector. Clearly, the South Africans are seemingly not paying serious attention to this matter. On the other hand, peers like China and India are ranked as the most competitive manufacturing nations in the world with strong government investment in manufacturing and innovation [15]. (See Fig. 1). These economies are being transformed by the rapid development, adoption and use of ICT innovations [17]. These authors claim that manufacturers that use ICT cultivate faster, devote more, and are more creative and cost-effective than those that do not.



Source: 2013 Global Manufacturing Competitiveness Index

Fig. 1 2013 Country Manufacturing Competitiveness Index Ranking

Fig.1 represents the 2013 global manufacturing competitiveness top 10 ranked countries. South Africa has been ranked in the 24<sup>th</sup> position and it has been predicted that in five years the country will slide down to the 25<sup>th</sup> position. Clearly, this raises a great concern and it is questioned what would be required for South Africa to become competitive. Manufacturing competitiveness contributes to economic

growth and job creation, which the country is currently striving to achieve.

## II. PROBLEM STATEMENT

Evidence shows that the South African manufacturing sector has been deteriorating since 2001 [3], [8], [25]. In response, the South Africa Government considered developing a strategy to salvage the manufacturing sector, namely, the National Advanced Manufacturing Technology Strategy for South Africa (AMTS) [3]. The AMTS asserts that the South African Government believes that South Africa's future competitiveness heavily relies on the ability of the manufacturing sector to master advanced manufacturing technology. Therefore it is perceived that if South Africa desires to attain high growth rates in its economy, serious attention must be given to its manufacturing sector [3]. Recently the South African government proposed the National Development Plan 2030, emphasised the use of ICT, and acknowledged that a country that seeks to be globally competitive needs ICT. Clearly, the ideas of South African government about the use of ICT have been carried for the past decade. Yet the South African manufacturing sector still faces challenges replicated from the inadequate use of ICT, which manifests in the inability to create jobs; the lack of contributing to a higher percentage on GDP; and the inability to compete globally. Literature shows that little has been done to rescue the manufacturing sector. Evidently, academia, manufacturers, and ICT policy makers are seemingly not been paying serious attention to this matter. Therefore, it raises this question: What is still needed to salvage the South African manufacturing sector, if several plans have already been developed in this attempt?

## III. LITERATURE REVIEW

Competitiveness is a catchphrase within manufacturing sectors – both nationally and globally. [24] Defines competitiveness as a way in which country productivity utilises its human, capital and natural resources. On the other hand, [6, p.1] asserts that “competitiveness is the ability of nation's firm to achieve sustained success against foreign competitors, again without protection or subsidies”. Likewise, countries are measured with the productivity of their social development and economic growth. It is therefore no wonder that countries like South Africa are concerned about the manufacturing sector's inability to compete globally. The infusion of ICT constantly drives global competitiveness. This forces economies to revise their ICT policies and emphasise the adoption and adequate use of ICT within their manufacturing sector. The term Information and Communication Technology (ICT) is most often quoted and defined in different views depending on the sector's understanding. For example, in business terms, ICT is defined as “an umbrella term that encompasses a wide array of systems, devices and services used of data processing (the information side of ICT) as well as telecommunications equipment and services for data transmission and

communication (the communication side)”[13]. Correspondingly, [18], p.9 explains that Information Technology (IT) in its broadest sense covers all aspects of computing technology. The researchers believes that these systems and devices have become vital tools in the manufacturing sector, particularly to re-engineer business processes to deliver products or services that precisely meet the needs and expectations of customers. In 2011, [28] indicated that the sector was in a process of changing from low-tech, labour-intensive industries toward a manufacturing sector that is technology-intensive and highly productive due to the important discovery in technology. This is evident in the increasing availability of advanced manufacturing technology and its competitive superior position. Advanced manufacturing technology creates an advantageous opportunity for the manufacturing sector to increase its competitiveness [1], [4], [10], [11], [31]. Therefore, based on the literature, it can be said that if the manufacturing sector wants to stand in the marketplace and remain competitive; the implementation of advanced manufacturing technology is crucial.

### A. *Advanced Manufacturing Technology*

According to Reference [1, p.560] advanced manufacturing technology (AMT) is used as an umbrella term to describe a variety of technologies that primarily utilise computers to control, track or monitor manufacturing activities, either directly or indirectly. On the other hand, [11, p.1] are of the opinion that AMT involves new manufacturing techniques and machines combined with information technology, microelectronics, and new organisational practices in the manufacturing process. Table 1 represents some types of AMT and their respective abbreviations. AMT is widely considered as competitive weapon and believed to be a source of sustainable competitive advantage [10]. In addition, AMT increases flexibility, improves product quality, quick response to customer demand [11]. As a result, manufacturers are continuously strengthening their competitiveness through updating their technologies used in the manufacturing process [4]. However, AMT implementation needs cautious attention at all levels of the organisations to ensure its success. AMT applications have not produced their potential benefits frequently because its selection and implementation have not been carried out in relation to strategic objectives of an organization [4]. This obviously means that there must be a clear strategic selection process in line with the organization's overall strategic plan.

### B. *Strategy Selection of AMT*

Studies reveal that the main challenge associated with the implementation of AMT is the selection of the right technology. [4, p.341] claims that in selection of the best technology, objective factors such as cost, profit, revenue, time-saving, and completion time are considered while subjective factors such as flexibility, learning, capacity increment, etc. are overlooked. However, this study focuses on the selection of the exact ATM, in order to address the needs

of the implementing manufacturer. Manufacturers believe that “throwing money” or ATM at the challenge is enough [1].

TABLE I  
ADVANCED MANUFACTURING TECHNOLOGIES

<i>Type of Technology</i>	<i>Abbreviation</i>
Just-in-time manufacturing	JIT
Manufacturing resources planning	MRPII
Computer integrated manufacturing	CIM
Computer aided manufacturing	CAM
Automated process monitoring	APM
Automated process inspection	API

Source: Abdullah and Hassan (2012).

Meanwhile, a thorough investigation must be done first to determine the challenge that the ATM implementation intends to address. “Reference [11], p.2 asserts that the first step in planning for AMT generally occurs when an organisation recognises that current processes and procedures are inadequate to meet their current or future strategic needs”. This necessitates the firm to establish current available technologies and functions, and to identify the one that relates precisely to the perceived goals. Meanwhile, sustainability skills are considered and incorporated with the technology, hence if it is overlooked it might attribute to failure. Manufacturing sustainability skills can be referred to as skills needed to sustain the current and near future manufacturing sector. The manufacturing sector’s skills shortage issue is a serious concern in several countries, for example, Australia, United States of America and in African countries [3],[5],[7],[8],[9],[16],[21],[22],[32],[33]. However, these countries have created intensive action plans to close the skill gap within the manufacturing sector through partnership with all stakeholders [21], [22], [31]. Similarly, South Africa needs to learn from these countries. The country must start seeking the same or a more advanced approach to address the shortfalls of skilled labour.

#### IV. THEORETICAL PERSPECTIVE

The ontological and epistemological aspect concerns what it commonly referred to as a person’s worldview. This has a significant influence on the perceived importance of the aspects of reality. There are two views, namely the objectivistic and constructivist view [26], [27], [29]. The objectivistic view believes that scientific knowledge consists of facts and that reality is independent of social construction. Meanwhile, according to the constructivist belief, reality is socially constructed. According to [29], studies are based on some underlying philosophical assumptions about what constitutes “valid” study and which study method(s) are appropriate for developing knowledge in a given study. An interpretive analysis was considered for the framework of this study.

#### V. METHODS

In line with this study’s interpretive analysis, it employed recent literature and document review. Interpretive research assumes “that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools, and other artefacts” [2, p.2]. On the other hand, it is believed [2, p.2] that an interpretive approach provides a deep insight into “complex world of lived experience from the point of view of those who live it”. Equally, the researchers employed an interpretive approach to gain a deep insight into the current challenges facing the South African manufacturing sector in terms of ICT application. The interpretive approach depends on the researcher’s experience and understanding of the real world, based on the interpretation created through interacting with the world [26], [27]. “Reference [2] believes that the interpretive approach allows a study to address issues of influence, impact and to ask questions such as “why” and “how” particular phenomena occurred”. Admittedly, the interpretive approach was justified for this study method because the study sought to understand why the South African manufacturing sector lacks the ability to use ICT adequately to compete globally. Consequently, the study explored how the South African manufacturing sector can improve its competitiveness through adequate use of ICT. In terms of literature use, the interpretive approach is rooted within the Straussian theory [12].

#### VI. RESULTS AND DISCUSSION

The finding illustrates that in order for the South African manufacturing sector to improve the adequate use of ICT, the key entities must be identified and their role established. The key entities are the **South African Government**; the **manufacturing sector**, and **higher education institutions**. [29] state that emerging trends show that manufacturing sector competitiveness needs the attention and collaboration of policy-makers, civil society and business leaders. Equally, in 2011, South Africa proposed the Industrial Policy Action Plan 2011/2012-2013/2014 as an intervention to support industrial, employment creation, skills, innovation, technology and to build a partnership for economic growth. It is therefore imperative to understand how entities can improve the South African manufacturing sector’s competitiveness through the adequate use of ICT. **The South African government** needs to revise its ICT policy, which has been creating bottlenecks in the market [23]. As a result, there has been regulatory failure and limited competition [23]. In addition, the country has not created sufficient infrastructure to support the manufacturing sector’s competitiveness. This is notwithstanding the expectation that the manufacturing sector should compete globally and create jobs [32]. However, it should be noted that South African government has been trying to facilitate the improvement of the manufacturing sector [1], [7], [16], [23], [25], [27]. It is worth mentioning that with all the numerous reports, there are no clear feedback reports in terms of the current status of all the proposed initiatives, namely, the AMTS, and the Industrial Policy Action and Nation

Development Plan 2030. In terms of the **manufacturing sector's** findings, the following was discovered: There is inability to successfully identify and integrate the right technologies into business processes [1]. Manufacturers claim that there is indeed a shortfall of technical skills and skilled qualified artisans, which is critical for the manufacturing sector [19], [32]. In addition, the manufacturing sector is concerned with true abilities associated with qualifications. Clearly, this indicates that there is no partnership between the manufacturing sector and higher education institutions. Hence, this concern should not be stated. In order to close the technical skill or skilled labour shortfalls within manufacturing sector, serious partnership needs to be established [21], [22], [32]. Based on literature, **higher education institutions'** qualifications are not assisting the manufacturing sector to sustain business and compete globally [19]. It is imperative that an urgent partnership between manufacturing sector and higher education institutions must be developed. This will ensure that higher education institutions identify the skill needed by the manufacturing sector and design the program that meets the needs and expectations of the sector [21]. Recent study indicate that the main driver of global competitiveness is talent driven innovation (the quality and availability of researchers, scientists, engineers and skilled labour), that needs to be taken to consideration [15].

## VII. DETERMINING THE WAY FORWARD

The improvement of South African manufacturing sector through the adequate use of ICT depends upon the following entity levels:

### A. South African government level

The South Africa Government has been concerned with the manufacturing sector's inability to increase its contribution towards the gross domestic product (GDP) [3], [7], [16], [25]. During the past decade, the country has suggested interventions to salvage the sector. Literature identifies as attributing factors policy and lack of infrastructure to support the adoption and adequately use of ICT [22], [23]. Policy-makers in countries like China and Brazil are gearing to improve their manufacturing competitiveness. [32], p.4 is of the opinion that, "infrastructure will enable manufacturing sector to flourish and contribute to job growth. Consequently, competition amongst countries to attract foreign investment will increase dramatically". However, the lack of support to the manufacturing sector's global competitiveness will have a negative impact in future and it might be difficult to reverse. Therefore, the South African government must consider the following broader interventions: ICT policy review (since it was last done in 1996); facilitating the partnership between the manufacturing sector and higher education institutions; and developing an action with these entities with exact estimated years to close the shortages of skills. For instance, countries like Australia have done this in 2010, when all stakeholders came on board to identify the skill needs and to

develop qualifications based on the manufacturing sector's specification, in order to address the skills gap.

### B. The South African Manufacturing sector level

The South African manufacturing sector has stated that among other factors, the skills shortage is hindering the sector's opportunity to create jobs and to compete globally. However, this leads concerned citizens to ask: "Do firms invest in talented human capital in the long-term?" If so there would be no skills shortage. It is therefore crucial that the manufacturing sector establishes partnerships with higher education institutions to identify talented human capital and to develop studying programs based on the sector's specification. Meanwhile, granting access to postgraduate students to conduct their study, meanwhile sharing knowledge in the process. It is sadly with mentioning that some South African manufacturing firms are not willing to assist postgraduate students. Therefore, this partnership will also address this serious matter with its potential of negative repercussions to both manufacturers and the country as a whole. Hence scholars might consider leaving the country, to seek opportunities in neighbouring countries. Partnerships with higher education institutions will furthermore ensure that graduates meet the exact requirements of manufacturing sector. On the other hand, this would mean that the higher education institutions would be responding to the urgent demand of skill shortages instead of designing qualifications that do not serve the needs of the manufacturing sector. Similarly, the manufacturing sector must also realise that in order to have a substantial competitive advantage, employees must be constantly trained to keep up with the technologies [21].

### C. South African Higher Education Institutions Level

South African higher education institutions need to establish a proactive approach in order to understand their customers (business industries/sectors). Preparing the scholars of South Africa to be skilled without looking on the skills demand is detrimental to South Africa, the manufacturing sector and the society as a whole. Hence graduates are stacked with qualifications that are not trusted by manufacturing sector. In terms of customer perspective, entities need to understand the needs and expectations of their customers in order to meet them. This can be achieved through partnerships that allow feedback and guarantee from both partners. In turn, this would allow the re-designing of programs to meet the precise needs of the manufacturing sector in terms of qualifications [14], [21].

## VIII. CONCLUSION

It is undisputed that ICT has become a global tool to drive global manufacturing competitiveness. The result of this study highlights key entities for improving the South African manufacturing sectors' competitiveness. In addition, the study results highlight key factors that hinder countries and the manufacturing sector's global competitiveness (for example, the lack of ICT expertise). In South Africa, little has been done to address the skill shortage compared to countries like

Australia and the United States of America. Therefore, this study suggests a more proactive approach to determine the way forward. This approach requires a collective effort from all stakeholders to change the South African manufacturing sector. "Reference [32, p.4] believes that companies and countries that are able to attract, develop and retain the highest skilled talent – from scientists, researchers and engineers to technicians and skilled production workers – will come out on top. In the race for future prosperity, nothing will matter more than talent". Equally, South Africa is required to strengthen the facilitation of skill talent, since it is the main driver of global manufacturing competitiveness and economic growth [32].

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