INFLUENCE OF ORGANIZATIONAL CULTURE IN THE RELATIONSHIP BETWEEN INFORMATION SYSTEM AND OPERATIONAL PERFORMANCE ON MANUFACTURING SECTOR IN UAE

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I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

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ABSTRACT

The manufacturing industry plays a very vital role in the economic growth and development of many countries including UAE. One of the important performance criteria in manufacturing is organizational performance (OP), which relates to the utilization of all resources (people/assets/time) to deliver lower cost and higher quality products, services to the customers in the shortest time possible. The operational performance depends on information system (IS) in many ways, such as through industrial technology applications or/and through its multiple administrative applications such as measuring the return on investment (ROI) and return on assets (ROA), relative profitability, economic input and outputs, total revenue and others. The literature review indicates that there is no much researches on the role of IS on operational performance and also its roles to lead to operational performance in the UAE manufacturing industry. Hence, this research aimed at investigating the role of Information System on the Operational Performance of Manufacturing Companies in the UAE. The study adopted a quantitative approach where the data was collected by administering questionnaires to 250 operation staff of Abu Dhabi manufacturing companies. However, 205 of the questionnaires were returned, and only 200 are valid which indicates a response rate of 80%. The collected data was analysed descriptively using SPSS and AMOS software to determine the critical factors of information system dimensions and also in operational performance. Ultimately the data was used to develop the relationship between information system dimensions and operational performance together with the organizational culture as mediators in the relationship. The findings from the descriptive analysis showed that the most critical factor for information system dimensions is the ease of use, and for operational performance is flexibility. While for multivariate analysis found that TPS has positive but not significant effect to OP; OIS has positive but not significant effect to OP; FMW has a positive and significant effect on OP; DSS has a negative and not significant effect to OP and OP has positive but not significant effect OC. For the path relationship between the four exogenous variables (TPS, OIS, DSS, and FMW) and the mediator variable (OC), the results are TPS has positive and significant effect to OC; OIS has positive but not significant effect to OC; FMW has positive and significant effect to OC and DSS has positive and not significant effect to OC. Collectively, the five exogenous constructs (TPS, OIS, DSS, FMW and OC) explained 89% variation in operational performance and 86% of the variation in organisational culture. However, for a mediator, it was found that OC has no significant mediating effect on the relationship between TPS and OP; OC has no significant mediating effect on the relationship between OIS and OP; OC has no significant mediating effect on the relationship between DSS and OP and OC has no significant mediating effect on the relationship between FMW and OP. It can be concluded that there is a positive relationship between information system dimensions and operational performance. However, organizational culture has no contributing any mediating effect to the relationship, which shows that manufacturing companies in the UAE need to pay more attention to improve IS, since it is more essential than OC to improve OP. These findings have contributed to the body of knowledge and could be shared among the UAE manufacturing practitioners.

ABSTRAK

Industri pembuatan memainkan peranan yang sangat penting dalam pertumbuhan ekonomi dan pembangunan banyak negara termasuk UAE. Salah satu kriteria prestasi penting dalam pembuatan adalah prestasi organisasi (OP), yang berkaitan dengan penggunaan semua sumber (orang / aset / waktu) untuk memberikan kos, produk dan perkhidmatan yang lebih rendah dan berkualiti tinggi kepada pelanggan dalam waktu sesingkat mungkin. Prestasi operasi bergantung pada sistem maklumat (IS) dalam banyak cara, seperti melalui aplikasi teknologi industri atau / dan melalui pelbagai aplikasi pentadbirannya seperti mengukur pulangan pelaburan (ROI) dan pulangan aset (ROA), keuntungan relatif, ekonomi input dan output, jumlah hasil dan lain-lain. Tinjauan literatur menunjukkan bahawa tidak ada banyak penelitian mengenai peranan IS terhadap prestasi operasi dan juga peranannya untuk membawa kepada prestasi operasi dalam industri pembuatan UAE. Oleh itu, penyelidikan ini bertujuan untuk menyiasat peranan Sistem Maklumat terhadap Prestasi Operasi Syarikat Pembuatan di UAE. Kajian ini menggunakan pendekatan kuantitatif di mana data dikumpulkan dengan mentadbir soal selidik kepada 250 kakitangan operasi syarikat pembuatan Abu Dhabi. Walau bagaimanapun, hanya 205 borang soal selidik dikembalikan, dan hanya 200 sah digunakan untuk kajian dan ini menunjukkan kadar tindak balas sebanyak 80%. Data yang dikumpulkan dianalisis secara deskriptif menggunakan perisian SPSS dan AMOS menentukan faktor penting dimensi sistem maklumat dan juga dalam prestasi operasi. Pada akhirnya data tersebut digunakan untuk mengembangkan hubungan antara dimensi sistem maklumat dan prestasi operasi bersama dengan budaya organisasi sebagai orang tengah dalam hubungan tersebut. Penemuan dari analisis deskriptif menunjukkan bahawa faktor yang paling penting untuk dimensi sistem maklumat adalah kemudahan penggunaan, dan untuk memperbaiki prestasi operasi. Daripada analisis multivariate mendapati bahawa TPS mempunyai kesan positif tetapi tidak signifikan terhadap OP; OIS mempunyai kesan positif tetapi tidak ketara kepada OP; FMW mempunyai kesan positif dan signifikan terhadap OP; DSS mempunyai kesan negatif dan tidak signifikan kepada OP dan OP mempunyai kesan positif tetapi tidak signifikan OC. Untuk hubungan jalan antara empat pemboleh ubah eksogen (TPS, OIS, DSS, dan FMW) dan pemboleh ubah mediator (OC), hasilnya adalah TPS mempunyai kesan positif dan signifikan terhadap OC; OIS mempunyai kesan positif tetapi tidak ketara kepada OC; FMW mempunyai kesan positif dan signifikan kepada OC dan DSS mempunyai kesan positif dan tidak signifikan kepada OC. Secara kolektif, lima konstruk eksogen (TPS, OIS, DSS, FMW dan OC) menjelaskan 89% variasi prestasi operasi dan 86% variasi budaya organisasi. Walau bagaimanapun untuk mediator didapati bahawa OC tidak mempunyai kesan perantaraan yang signifikan terhadap hubungan antara TPS dan OP; OC tidak mempunyai kesan perantaraan yang signifikan terhadap hubungan antara OIS dan OP; OC tidak mempunyai kesan mediasi yang signifikan terhadap hubungan antara DSS dan OP dan OC tidak mempunyai kesan mediasi yang signifikan terhadap hubungan antara FMW dan OP. Dapat disimpulkan bahawa terdapat hubungan positif antara dimensi sistem maklumat dan prestasi operasi. Walau bagaimanapun, budaya organisasi tidak memberikan kesan pengantara pada hubungan, menunjukkan bahawa syarikat pembuatan di UAE perlu memberi perhatian lebih untuk meningkatkan IS, kerana ianya lebih penting daripada OC untuk meningkatkan OP. Penemuan ini telah menyumbang kepada pengetahuan dan dapat dikongsi di kalangan pengamal pembuatan UAE.

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CHAPTER 1

INTRODUCTION

This chapter begins by presenting the research background. Next, the research problem is articulated and the research questions asked with the research aim outlined with its accompanying research objectives. Furthermore, the research scope is contextualised, and the significance of research postulated. Subsequently, the thesis structure is also presented which has been designed around the research questions and objectives which are in dimensions for the evaluation of the influence of Organizational Culture (OC) in the relationship between Information System (IS) and Operational Performance (OP) in the manufacturing sector in UAE.

1.1 Background of the Study

The manufacturing industry plays a vital role in the economic development of many countries (Kagermann, 2015). The industry also contributes to the global economy in terms of goods and services supplies (Abdul Rashid, *et al*., 2017). In the UAE, the manufacturing sector contributed 11.6% of employment of the total workforce and 15% implemented investment flow compared with the other economic sectors in 2017. This is important in the diversification that is needed to implement the UAE economic agenda (Shaikh *et al*., 2017). Besides that, the UAE has also generated a plethora of sustainable development in terms of small and medium enterprises in manufacturing and services (Schilir`o, 2013).

The manufacturing sectors had experienced rapid growth and expansion in UAE due to its conducive business environment. A high amount of focus in a few vital sub-sectors highlights the potential for the growth of, and diversification within the

manufacturing sector (Schilir`o, 2013). The value of manufacturing projects served as a sign of the improved investment in the manufacturing industry which boosts the capacity for future growth. Two Billion USD or 25% of total manufacturing developments came into UAE and the lending to the manufacturing sector expanded by 21.3% year-in-year-out in 2014, which is higher than the 11.3% growth recorded in 2013 (Emirates NBD Research, 2015).

The performance of the manufacturing sector is one of the global trends in many countries where the operational performance of the manufacturing industry is about harmonisation of financial, environmental and social objectives in the delivery of the core business activities to maximize value for the industry. Industrial performance metrics are moving from economy-centric performance measures to those of sustainability (Despeisse *et al*., 2012). Sustainable manufacturing practices are among the crucial environmental efforts to manufacture with less harm to the surrounding location (Abdul Rashid *et al*., 2017). It is generally observed that executing sustainable manufacturing improves business performance. Thus, Muñoz-Villamizar *et al.,* (2018) suggested that by implementing information system that strengthens the competitive position of the manufacturing sector in its operational performance.

1.2 Problem Statement

In manufacturing, operational performance relates to the utilization of all resources (people/assets/time) to deliver lower cost and higher quality products, services to the customers in the shortest time possible (Araújo, 2017). The performance should harmonise financial, environmental and social objectives in the delivery of the core business activities to maximise value for the manufacturing industry. Information System (IS) is the main driver of organisational change and also the backbone of today's manufacturing business processes. Despite information system roles to lead Operational Performance (OP) in the production sector in the UAE, many difficulties pose issues linked to the efficient use of IS for the OP (Abdelfattah & Kumar, 2015).

These issues arise because of a higher degree of competition that requires strategic management of IS and OP, lack of readiness towards the digital world as well as the fourth industrial revolution (IR 4.0). Such challenges obstacles have a negative

impact on the role of IS to enhance OP in organizations, including the manufacturing sector. Moreover, the issues faced by IS in UAE manufacturing industries are also related to maintenance, the usage and poor back up of information, which is a main obstacle for the industrial sector, affecting the operational performance of organizations (Alnajjar, 2017).

Similarly, many studies in information systems attempted to investigate the relationship between IS and OP of manufacturing businesses (Li *et al*., 2015), and there is no clear evidence for similar studies in the manufacturing section in the context of the UAE, except for the study of Obeidat & Aldulaimi (2016) in the construction sector, which assured the importance of IS investments to improve the productivity of the OP, since the overall quality of the project management information systems software solution was the best available IT tool among 85% of the study sample. Also, the study of Alnajjar (2017), which showed that IS impact on OP was less than 0.01 which is significant. Such absence for such studies in UAE supports the need for the current study to provide insight for the manufacturing sector in UAE in terms of the role of IS in promoting OP of organizations.

Besides, for some researchers, information system is important for the enhancement of business value and competitive advantage (Melville *et al*., 2014); whereas, for some others like Shin (2006) IS contributes to financial performance significantly when it is measured by a gross margin. Liang *et al*., (2010) showed that both financial performance and organisational efficiency benefit from IS through the improvement of organisational capabilities. However, the description of the dependent variable (IS impact) as well as the variables measuring it, are still in need for further research due to the advancement of the technology, which requires constant investigation.

In addition, Melville *et al*., (2014) observed that Information System company value scholars that are driven by a willingness to know-how and to what extent IS implementation in manufacturing organizations leads to enhanced sustainable organizational efficiency. Sharing the same problems, other researchers like Tallon and Kraemer (2017) and Côrte-Real *et al*., (2019) argued that the lack of strong, firm-level IS impact measures is driven by the need for in-depth understanding and assessment of IS's firm-level impacts on operational performance. Therefore, this research attempted to assess the influence of information system on operational performance in UAE manufacturing sector, and also on how organisational culture will

be able to mediate the relationship between information system and operational performance for the sustainability of manufacturing.

Furthermore, organizational culture is considered a base of all the activities related to the organization, especially that it is attached to its fundamental goals such as vision, mission and developmental plans (Kwarteng & Aveh, 2018). Such link between the organization culture and its goals shows its significant impact on the organization performance (Kwarteng & Aveh, 2018). Accordingly, organization culture might have either a positive or a negative influence on the OP, and investigation the mediation role of organization culture assists the improvement of OP (Indeje & Zheng, 2010; HA, 2020). In other words, the smooth and efficient IS, that works in a well-established organizational culture, will improve the organization operations, which have a positive impact on the OP (Hope & Fraser, 2003; HA, 2020). Accordingly, the current research will investigate the mediation role of organizational culture between IS and OP of the manufacturing sector in the context of the UAE.

1.3 Research Questions

The research questions set to answer in this research are as follows.

- What are critical Information System and Operational Performance factors in Manufacturing Sectors?
- What is the relationship between Information System with Operational Performance?
- What is the influence of Organizational Culture on the developed relationship between Information System dimension and Operational Performance?

1.4 Research Objectives

The developed objectives to be achieved in this study are as follows:

1. To identify the most critical factor in the Information System and Operational Performance of the Manufacturing Sectors.
2. To evaluate the relationship of Information System dimension with Operational Performance.

3. To evaluate the influence of Organizational Culture toward the relationship between Information System dimension and Operational Performance.

1.5 Significance of the Study

This research is significant to policymakers, academicians as well as the general public. To policymakers, the research serves a yardstick to measure and gives an avenue in deciding the role of information system on the operational performance of manufacturing industries in UAE. The research helps the policymakers in figuring out how information system impacted the operational performance of manufacturing industries in the process of making a decision. Similarly, the research is of great significance for the academicians in which the research serves as a reference in conducting other researches. This research also suggests another new area of researches to the researchers. Moreover, the research is also of significance to the general public by highlighting and educating the general public on the role of information system on the operational performance of manufacturing industries in the UAE.

1.7 Scope of the Study

This study is on the role of information system on the operational performance of manufacturing companies in the UAE. As the current study is on the information system, the operation department staff of UAE manufacturing companies in Abu Dhabi which has a target audience because the role of operation staff plays in dealing with the information system is in the manufacturing companies in UAE. The coverage chosen offers easy access for data collection. A quantitative methodology in data collection then SPSS and AMOS software were employed in analysing the collected data.

1.8 Research Structure

The research will be divided into five chapters as follows.

Chapter 1: This chapter introduces the research; it starts with showing the background of the study and problem statement, followed by the research questions and the research objectives. The chapter explains the significance and scope of this research, definitions of key terms, structure of the thesis and ends with its summary.

Chapter 2: This chapter comprehensively reviews the related literature of this research study, such as different aspects and measures of the effectiveness of information system and sustainability performance, followed by a review of previous studies related to this research.

Chapter 3: This chapter illustrates the proposed methodology adopted for this study. It provides details of various analysing approaches used for data analysis together with the data collection strategy used. This is the base for the entire research efforts, as it acts as the fulcrum around which the essence of the whole research revolves.

Chapter 4: The chapter contains the descriptive analysis results including the pre-test and the pilot test as well as the demographic analysis. Also discussed in this chapter is the normality, exploratory factor analysis. The chapter presents the multivariate analysis using Structural Equation Modelling (SEM-AMOS). The chapter ends with a detailed critical discussion of results with previous literature as they agree or contrast.

Chapter 5: This is the concluding part, which strives to discuss in detail, the findings gathered during this research, as well as drawing some reflections on the policy implications emanated from the research, with a summary of the entire thesis. It focuses on summary and discussion of findings, policy implications of the findings, conclusion and recommendation.

1.8 Summary

It is worth to be noted that chapter one of this proposal is the pacesetter for the subsequent chapters that detail the expected efforts that shall be for achieving the main aim and all the five objectives of this proposed study. Therefore, as it was chronicled, it brought to the fore some of the background issues that acted as curiosity drivers around which the research shall be fully templated, as well as stating how the research will be completed through evoking solvable research questions, stating achievable aim and measurable objectives as well as testable hypotheses. The review of relevant literature that shall be presented in the next chapter is essentially meant to further deepen the essence and significance of this research through the exposition of various views, opinions and counter-opinions of past researchers, so as situate the gap created for the proposed research endeavour within the context of advancing the body of knowledge and contributing to the society.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the relevant literature about the information system and operational performance of the manufacturing industry. It starts with a detailed introduction of an information system followed by definitions of various information systems, parts of management information systems for assessing performance, information system and performance dimensions, key concepts of performance, performance measurement, obstacles to the implementation of performance measurement and information systems, tools of information system and finally the chapter closes with the conceptual framework and summary.

2.1 Role of Manufacturing Industry in Growth of UAE

Economic literature argues that in countries with abundant natural resources (especially oil), exports of primary goods have negative effects on economic growth (see Sachs & Warner 1995, Gylfason 2001, Sala-i-Martin & Subramanian 2003, Stijns 2005; Harb 2009). Many explanations have been offered to explain this negative association where the natural resources are abundant, factors of production are directed from manufacturing to the non-tradable sectors (e.g., services). Second, as the demand for manufacturing goods grows faster than the demand for natural resources, terms of trade favour industrial countries. Therefore, countries exporting natural resources grow slower than in other countries. Third, the wealth of natural resources is known to dwindle public and private incentives to amass human capital, which in effect weakens economic development. Fourth, natural resources are thought to lead to high economic rents and inefficient distribution of resources that favour less efficient and corrupted

use. Finally, the volatility of the prices of natural resources increases risk and uncertainty which affects economic planning, projects, and reduces factor accumulation.

However, we may argue that in the case of the GCC countries, the abundance of oil may have played a positive effect on real non-oil economic growth. Dutch Disease which is the apparent causal relationship between the increase in the economic development of a specific sector (for example natural resources) and a decline in other sectors (like the manufacturing sector or agriculture) is an unlikely event in the GCC countries as they imported most of the labour force that is used to build the country and derive economic growth. Moreover, world demand for oil, which has been accelerating for several decades, prevented any expected deterioration of the terms of trade in these countries. The GCC countries, as they enjoy high levels of oil revenues, targeted aspiring development targets. Most significantly, GCC countries have been focusing attention on the diversification of their economies away from large dependence on oil, through larger support to manufacturing and some service industries.

Manufacturing has long been a key component of the UAE's economic diversification efforts as well as its thriving relationship with the United States. Over the past several decades, UAE has become an important producer of metals, such as aluminium, steel and building materials, as well as cement, ceramics, and glass. It has also turned out to be a significant manufacturer of petrochemicals, pharmaceuticals, food and beverages, and a wide variety of consumer goods. Also, it boasts a fast-growing aerospace and defence-manufacturing sector.

Looking ahead, the prospects for UAE in manufacturing are bright. UAE-based industry is poised to capitalise on the country's strategic location as well as its excellent transportation and industrial infrastructure. It is also set to benefit from relatively low taxes, business-friendly regulations, and the ready availability of energy, goods, and labour. These advantages should help UAE-based manufacturers to navigate any challenges from lower oil prices, increasing regional competition, persistent foreign dumping, or a rising global wave of protectionism.

The UAE's growing manufacturing sector presents a wide range of opportunities for U.S. companies and investors. First, U.S. companies could decide to establish manufacturing operations in the UAE and making the country a regional hub for producing and exporting goods. Secondly, U.S. businesses might explore

commercial relationships with UAE manufacturers, either as potential suppliers to these manufacturers or buyers of their goods. Thirdly, U.S. investors may decide to explore investments in a large number of UAE manufacturers that are quickly growing in the country and beyond.

To conclude, manufacturing sectors in the UAE contributes about 14% of the GDP, and the government aims to make this sector contributes over 20% of the UAE GDP by 2021. This percentage is aimed to increase to 25% by 2025. Generally speaking, most of the manufacturing companies in UAE are SMEs, which comprise about 94% of the manufacturing sector (Alefari, Almanei & Salonitis, 2020). Hence, improving the organizational performance of the manufacturing sector will increase its contribution to the GDP of the UAE.

2.2 Information Systems for Measuring Performance

Information systems are formal, sociotechnical, organizational systems designed to collect, process, store, and distribute information. From a sociotechnical perspective, information systems are composed of four components: task, people, structure, and technology. The simplest but most comprehensive definition in the history of the IS field was provided by Ismagilova *et al.*, (2019) who defined it as Information Systems (IS) are systems that provide information services. To do so, data must be received and stored, accessed, transformed, transferred and processed to create the required data service. Davis and Olson (1984) consider IS as an integrated, user-machine system providing information by utilising computer hardware, software, manual procedures, models for analysis, planning control and decision making, and a database. Chang and King (2005) argued that an IS system is an open system that has inputs and outputs.

According to Davis (2000), information systems comprise of the information technology infrastructures, application systems, and staff that use information technology to dispense information and communication services for transaction handling, operations, administration and management of firms. According to Gu & Jung (2013), the infrastructure of an information system contains system applications, data, servers and the network. Gu and Jung (2013) maintained that information system resources are a mixture of features consisting of a firm's knowledge and capability, internal and external relationships between the ICT elements with business divisions

and external stakeholders, technical skills and infrastructure. Davis (2000) upheld that information technology systems and applications for transactions and operations are what make an information system, which supports administrative and management functions, organisational communication and coordination, and is essential for adding value to products and services, which is supported by Kamble and Gunasekaran (2020). The following sub-section will discuss the aspect of information system for measuring performance.

2.3 Information Systems and Performance Measurement

The role of information systems, in organisational performance is vital in managing performance for manufacturing industries (Rocheleau, 2006; Aydiner *et al.,* 2017). Prior studies relied on financial measurements to evaluate IS impacts on a firm's performance. Measures such as return on investment (ROI) and return on assets (ROA), relative profitability, total revenue, economic input and outputs provides a good measurement for this type of study by analysing prior research that has used these financial factors to examine the IS impacts on the organizational performance (Aydiner *et al.,* 2017). However, these studies have focused on assessing the impacts of IS investments and relationships between IS and various ratios of financial performance (Aydiner *et al.,* 2017).

Overall, previous research has been ambiguous and failed to show clear link between IS to profitability performance and interpreting that relationship. Additionally, there is little evidence of clear positive effects of IS on financial performance from previous literatures (Bhuiyan *et al.,* 2015). Despite theoretical arguments and research belief about the relationship between IS and financial performance, empirical evidence on this relationship still lacking. Several empirical studies and ample anecdotal evidence indicated that organizations' expenditure on IS are usually not rewarded with improved financial performance (Prasad *et al.,* 2015).

Similarly, prior studies that related to measuring the market value of IS relied on privately gathered survey information. They had relied on public announcements of IT initiatives and stock market values to represent expectations of future earnings improvements associated with IS investments, which they also used some other factors

such as the volume of sales and demand, product quality, price, market share and customer satisfaction (Arabmazar *et al*., 2017).

Generally, these studies argued that the most important factors that should be taken into consideration when evaluating performance were the market factors, disregarding other factors such as effectiveness and quality of performance. Also, Kamble & Gunasekaran (2020) argued that bigger market share, sales volume and other marketing factors shows that IS has a major effect on performance. However, some of these studies, as mentioned earlier, were paradoxical in their findings. Furthermore, most of these studies investigated IS as a whole by looking at IS as investment associated with marketing performance from different perspectives.

2.3.1 Barriers in Implementing Performance Measurement of Information Systems

It is important to consider the obstacles and the success factors in the implementing performance measurement of information systems. Holloway, De Waal and Counet (2009) highlighted several barriers to the implementation of a performance measurement system. Among the enumerated barriers, only those relevant to this study are highlighted. First of all, lack of management commitment is one of the principal barriers to the implementation of a performance management system as it has implications for the allocation of resources and prioritisation of the implementation. Poor commitment from intermediate management and staff affects the execution and the adoption of the system. This connected to the absence of clear goals and understanding of the system. There is a lack of knowledge and skills to implement the system, in which a performance-management culture might be lacking within an organization. In an organisation where performance information is not used for day-to-day management to analyse and improve performance, there is no motivation to use the system. If the current ICT infrastructure in an organisation is unable to support the performance management system adequately, collecting, processing and reporting performance data becomes a challenge. Difficulty in obtaining performance data and calculating performance indicators makes it difficult to implement the system.

Certain departments gather a range of performance information, but the value of the gathered data is often poor. The main reason for the poor situation is that

overworked officials stressed with a load of data collection that needs to present the data to other officials but they seldom receive any feedback on what the data is used for (Mackay, 2007). Mackay (2007) recommends that an audit of data systems and a diagnosis of data capacities be required to address poor data quality. Honesty and objectivity are important concerns that are prevalent, for instance, where performance information is used for accountability purposes. This kind of situation requires independent data audits.

Barriers to the restructuring of the information flow and integration of the information within an establishment include position bias, sub-unit goal optimisation and emphasis on objectives that related to managers' positions instead of concentrating on the organisational goals (Fountain, 2007). The author suggests that a participatory strategic planning process which lessens the power of position bias and improves collaboration and integration activities. Ciuchi, Picu & Todoran (2011) posited that the focus on technological prominence in data storage in the information field is enormous. This includes the processing of data into useful information for decision-making. Consequently, decision-makers expend a lot of time looking through many organisations' data sources to find and collect relevant information for data analysis (Ciuchi *et al*., 2011).

Some of the challenges experienced by decision-makers in retrieving information include delays in finding data, the information presented in unsuitable formats and information that is hardly consistent and is subject to constant change (Ciuchi *et al*., 2011). Other challenges include trouble in selecting and interpreting proper performance metrics in hard-to-measure activities. Some of the data limitations including the inability of the current IS to provide required data in a valid, reliable, timely, and cost-effective method, are additional obstacles to the use of performance information for accountability and performance appraisal (Cavalluzzo & Ittner, 2004).

Bourne *et al*., (2005) postulated that there are certain barriers to the application of information systems to measure organisational performance namely the effort requisite for accessing information, the ease of data accessibility through IT systems, and the costs of measurement. According to Mimba *et al*., (2007), an inadequate institutional capability is categorised by weak supervisory practice, low levels of public accountability, administrative ineffectiveness, inadequate human resources, lack of facilities, and insufficient funding. Due to limited institutional competency, an organisation may have lengthy bureaucratic processes, lack of transparency on

delivery of services, and little information at the disposal of the stakeholders (Mimba *et al*., 2007).

According to Fountain (2007), the main challenges that the government faced on productive information flow, is not only related to technology but also to changing management. Complex political, social and cultural relationships within an organisation are considered as the main barriers for reforming and integrating information flow within an organisation (Fountain, 2007). Culbertson (2004) classifies certain cultural and structural barriers to e-government implementation, which include a silo-based vertical structure that narrows the horizontal inter-departmental work essential for ICT effectiveness within the department, the lack of a budget needed for developing and implementing ICT solutions across the units in the firm, a fear of ICT from the frontline and middle management and suspicion of ICT from top management, the risk-averse nature of government and the fear that government will not be able to handle a risen demand for information and expectations of a quick response because of the availability of ICT.

Dada (2006) maintained that a number of studies indicated that it is failed in its entirety and not e-government applications alone in the developing nations. It is imperative to establish the service and information requirements for a particular community that an organisation is serving, to reduce hard-soft gaps, which contribute to the failure of e-government (Dada, 2006). Hard-soft gaps are referred to as the differences between technology and the authenticity of the social setting within an organisation which comprises of people, culture and politics (Dada, 2006). Cloete (2003) contends that the expansion of information technology tools are rising rapidly for the governments to sustain and consequently aids the integration into public management practices.

Finally, Kamble, Gunasekaran, Ghadge & Raut (2020) argued that the use of IS in manufacturing sectors offer several advantages compared to the traditional manufacturing systems; however, good information systems are expensive and sometimes are complicated, which requires training. That is, IS requires integrating various technologies such as automation, data exchanges, cyber-physical systems (CPS), artificial intelligence, internet of things (IoT), and semi-autonomous industrial systems. Such requirements might be one of the barriers of adopting IS for performance measurement in the manufacturing sector, especially that most of the companies in this sector are SMEs.

2.3.2 Setting Performance Objectives, Indicators and Targets

According to Marr (2009), performance management encompasses the identification of things that truly matter to the organisation, to create values and to collect the right information to determine the level of organisational performance as planned. Performance measurement requires clearly defined performance indicators that allow a firm to collect relevant data (Marr, 2009) and to measure inputs, outputs, outcomes and the impact of organisational activities (Mackay, 2007).

Marr (2009) upheld that strategy formulation is an important precondition for performance measurement. It involves an assessment of key stakeholders and the clarification of objectives. Clarification of the objectives encompasses specific definitions of outputs and outcomes to measure and identifying the means of achieving organisational objectives (Marr, 2009). Zall, Kusek & Rist (2004) argued that it is important to first define outcomes before setting indicators because outcomes determine benefits. Information on indicators, targets and reference points, for the performance measurement framework, are instigated from the outcomes (Zall, Kusek & Rist, 2004). Baseline information indicates the position before the intervention, whereas targets are what the intervention aims to accomplish (United Nations Development Programme, 2002).

The chosen performance indicators should observe appropriately to ascertain quality performance. Performance indicators provide information about the quality of performance (Simonova, 2012). According to Zall, Kusek & Rist (2004), performance indicators can offer continuous feedback and useful performance-related information. Mackay (2007) held that performance indicators can be used to pinpoint problems, thus allowing remedial actions to taken. They can use to flag the need for a follow-up, review or evaluation of a certain issue (Mackay, 2007). The subsequent section discusses the collection of performance information used to measure performance against the performance targets.

To summarize this section, information systems are formal formal, sociotechnical, organizational systems, which are used to collect, process, store, and distribute information. The role of IS is vital to manage organisational performance for manufacturing industries, and it used to measure different performance aspects, including financial measurements, return on investment (ROI), return on assets

(ROA), relative profitability, total revenue, and economic input and outputs. However, there are different IS barriers such as lack of management commitment, and lack of knowledge and skills to implement the system, in which a performance-management culture might be lacking or ignored within an organization. Also, there are barriers to the restructuring of the information flow and integration of the information within an establishment include position bias, and emphasis on objectives that related to managers' positions instead of concentrating on the organisational goals.

2.4 Operational Performance

Operational performance refers to the measurable aspects of the outcomes of an organization's processes, such as reliability, production cycle time, and inventory turns. While operational performance management is the alignment of all business units within an organization to ensure that the units are working together to achieve core business goals. Operational performance in turn affects business performance measures such as market share and customer satisfaction (Voss, Blackmon, Hanson, & Oak, 1995). However, in the context of manufacturing, operational performance relates to the utilization of all resources (people/assets/time) to deliver lower cost and higher quality products, services to the customers in the shortest time possible (Manufacturing Institute, 2017).

However, for sustainability performance, it can be defined as the performance of a company in all dimensions and for all drivers of corporate sustainability (Schaltegger & Wagner, 2006). It extends beyond the boundaries of a single company and typically addresses the performance of both upstream suppliers and downstream customers in the value chain (Fiksel *et al*., 1999). The widely applied sustainability measures only have an environmental parameter, such as quantities of substances emitted and resources used, which are not sustainability measures; because they only have a cover to one side of the equation (DeSimone & Popoff, 2003).

Information system (IS) and operational performance from the IT/IS perspective focused on several areas including sales, production lead-time, inventory turnover and cost, utilisation of the available capacity, employee turnover. (Poltronieri *et al*., 2019; Yang *et al*., 2019; Hong *et al*., 2018). Operational Performance measures

are usually divided into two main groups. These are: financial measures and non-financial (or operational) measures (Tseng *et al*., 2018).

Financial measures, based on the economic state of a company, incorporate traditional measures (like profits, revenues, costs, financial margins, cash flow) and other more recent measures such as Economic Value Added (EVA), Cash Flow Return on Investment (CFROI), etc. Non-financial measures, on the other hand, aim at quantifying the organisational operational performance concerning customers (e.g. customer satisfaction-retention-acquisition), employees (e.g. employee satisfaction), innovation, quality, culture and others (Abdul-Rashid *et al*., 2017). The above measures have been further broken down into hard measures that are easily quantifiable (such as customer acquisition, number of complaints, etc.) and soft measures that are difficult to quantify, (e.g. satisfaction).

Nevertheless, having in mind that the two most desired characteristics of operational performance measures are (i) completeness, (i.e. the measure captures the 'whole truth' about operational performance) and (ii) controllability (the measure is only influenced by elements under the unit's control) (Soto-Acosta *et al*., 2016), it can be deduced that non-financial operational performance measures present many difficulties. The difficulty and the subjectivity inherent in measuring non-financial operational performance, along with the necessity to focus all efforts on the ultimate goal, which is to satisfy shareholders, have made some researchers suggest that operational performance measures should be purely financial.

2.4.1 Definitions of performance measurement

Organisational performance is an important element that must be measured. Several definitions of performance measurement are explored. Hatry (1999), as cited by Padovani, Yetano and Orelli (2010) opined that performance measurement is the regular evaluation of outcomes and efficiency of provided services. According to Barnes and Radnor (2008), performance measurement is the assessment of quantity or quality of inputs, outputs, outcomes or levels of activity. Marr (2009) viewed performance measurement as the assignment of values representing properties in an objective, even and rigorous manner.

The things that are measured are categorised in different dimensions that easily measured usually. Performance measurement could only show the level of performance because it does not cover all dimensions of performance and consequently, performance indicators do not measure performance in detail (Marr, 2009). Marr (2009) recommends considering performance assessment in place of performance measurement because of the broader meaning of the former compared to expressing performance in numeric values. Marr (2009) describes performance assessment as the systematic gathering of information for evaluation and learning of organisational performance.

To sum up, this study adopted the comprehensive definition of performance measurement posited by Marr (2009). The United Nations Development Programme (UNDP) (2002) and Marr (2009) defines performance measurement as the systematic analysis of performance against goals, taking into consideration details behind performance and the persuading factors.

2.4.2 Operational performance measurement

Performance measurement systems were developed as a means of monitoring and maintaining organizational control, which is the process of ensuring that an organization aims at strategies that could lead to the achievement of its overall goals and objectives. Performance measures, the key tools for performance measurement systems play a vital role in every organization as they are often viewed as forward-looking indicators that assist management to predict a company's economic performance and many times reveal the need for possible changes in operations (Nanni, Dixon & Vollmann, 1990; Otley, 1999; Peñaloza, Saurin & Formoso, 2020)

However, for sustainability, it is beyond just measurement because it is about ecological integrity, quality of life and transformation. Bell & Morse (2010) argue that trying to tie down and measure sustainability was a futile exercise of measuring the immeasurable. The approach and efforts to quantify sustainability do not appear to work or poorer still: end up measuring things that can measure and not things that should measure because a component of obliqueness appears unavoidable. The research outcomes suggest that the approach to measurement is always based on an individual's vision of sustainability which in turn can be changed, subject to

measurement conviction, order to be integrated effectively into company strategic planning and day-to-day operations. It deals with the social, environmental and economic aspects of the companies in general, and corporate sustainability performance in particular (Epstein, 2008; Schaltegger & Wagner, 2006; Epstein & Roy, 2003; Schaltegger *et al*., 2003).

Sustainability performance reflects one target end of the move of companies in the corporate responsibilities' continuum (Bhimani & Soonawalla, 2005; Schaltegger & Wagner, 2006) from corporate conformance, certifying, compliance and reporting with given standards to corporate performance in relation to stakeholder expectations (Epstein, 2008). Although performance measurement has a long history (Neely, 1999) early empirical research into environmental and social (performance) management and reporting were partly founded in the 1970s business ethics debate (Schaltegger & Wagner, 2006). Business strategists, in the last three decades, have developed wide internal management systems and measurements.

A range of methods and initiatives were developed in the last two decades to measure the different performances of organizations; including principles of sustainability measurement, sustainability accounting, sustainability reporting initiative and other economic measurements. Nevertheless, according to Schaltegger & Wagner, (2006) a research during the 1980s, which centred around two features, had also made the main contribution to the body of knowledge. The first dealt with the societal and environmental performance of corporations. The second focused on a theoretical discussion of the definition and measurement for environmental and social performance, CSR or corporate citizenship. In general, measuring organizational performance is difficult, especially when what has to be measured keeps changing (Hubbard, 2009).

2.4.3 Manufacturing Production

Manufacturing is the mass production of products intended for use or sale using labour and machines, tools, chemical or biological processing or formulation which is considered as the secondary industry (International Trade Administration, 2017). One way to improve the performance of manufacturing companies is to take advantage of new technologies. As stated by Chakravarthy and Doz (1992), new technology is

critical in the survival of companies across industries. This is due to that manufacturing industry implements new technology to gain a competitive advantage in the market (Milgrom & Roberts, 1990).

One of the technologies that are used to improve operational performance in product technology, which is defined as the science and art of developing and producing performance products, by either improving existing products or designing new products to meet the demands and requirements of society (Voncken *et al*., 2004). Product technology is becoming increasingly important in a manufacturing environment due to customers' high demand for products with high levels of performance and functionality. Rosen and Kashawy (2012) maintained that product technologies contributes to a firm's success concerning both introduction and mature lifecycle stages of products.

Another manufacturing technology that helps to improve operational performance in the manufacturing sector is process technology, which facilitates the production and delivery of a product to consumers (Slack *et al*., 2013). In other words, process technology is the machinery, equipment and devices that assist manufacturers to transform materials into products that add values to customers. Cramer and Zegveld (1991) argued that operational performance of manufacturing organizations can be improved with process technology.

The introduction of both product and process technologies in the late 1970s have eased firms to gain economies of scale and desired profitability, since the operational performance of the organizations is improved. The concern on product technology shifted towards process technology, where manufacturing firms are emphasising on an even lower cost of production as innovation rate in product technology has become slower (Slack *et al*., 2013). For instance, Samsung Foundry formed Semiconductor R&D Centre to offer process technology to meet its customers' process specifications and requirements.

Another example is the Semiconductor R&D Centre, which emphasises on process technology development to produce mobile and information technology computing applications that consume energy more efficiently. Therefore, technology is important to the current market for it helps to improve the operational performance of organizations, especially that the manufacturing and production speed becomes high and more efficient (Institute of Sustainable Process Technology, ISPT, 2011).

Technology can assist manufacturing industries to expand productivity through improved process control and better resource management. Diverse manufacturing processes and resources have different or overlapping capabilities with varying efficiencies. It is well understood that presently available life cycle assessment LCA tools such as GaBi (2008) or SimaPro (2006) uses lifecycle inventory (LCI) databases, which are classically limited to primary material production (e.g. sheets, foils) and recycling processes (Kellens *et al*., 2012). Generally, rough estimation made today ignores the manufacturing process related to LCI and hence introduces uncertainty in planning, cross-comparisons and decision-making.

Feng and Joung (2009) proposed that manufacturing measurement process is an arrangement of operations, with the essential instruments and tools to have the objective of determining the value of an indicator. Moreover, technology has been identified as a main measurement indicator that helps to improve operational performance, especially that technology can assist in improving manufacturing sustainability (Sarkar *et al*., 2011).

One of the challenges of the manufacturing sector is energy, and it is important to improve operational performance of manufacturing organization through reducing energy consumption. Conserving and using energy optimally is important in manufacturing (O'Driscoll *et al*., 2013). Depending on the production process, energy computations will have to be made. We must note here that operational performance might be improved, but energy consumption is still important for better operational performance in manufacturing organizations.

Further, manufacturing organizations need to be energy efficiency, which refers to the way in which the immediate production processes (moulding, assembly and finishing) arranged to meet the production schedule, which can have a dramatic influence on energy consumption in manufacturing processes (Solding & Petku, 2005; Solding & Thollander, 2006). This is also considered a challenge that might affect the operational performance of manufacturing organizations.

To conclude, production is a vital element in manufacturing organizations, and it is important to consider different elements to improve the operational performance of the organizations. Besides, technology has a main influence on this regard, especially product and process technology, since it makes the work process easier and clear for employees, and it mainly helps to solve other manufacturing issues such as energy consumption and speeding the manufacturing process.

2.5 Information System

Organisations use a Management Information System (MIS) to make managerial decisions in all domains and phases of the business. Using an MIS, the organisation can procure, analyse and document data on all of its strategic business functions. Once an analysis performed, the company top management then bases its decisions on the reports generated by an MIS. On every occasion, there are tweaks in the functioning, for which the management is capable to take remedial action instantly. There are several MIS tools. An organisation could use one of them in isolation or a number of them simultaneously at a given point in time and these are the examples that could be found (Abernethy & Guthrie, 1994; Sharma, Mithas & Kankanhalli, 2014).

2.5.1 Transaction Processing Systems (TPS)

The Transaction Processing System (TPS) is the most basic and elementary type of MIS. Using this, an organisation could record and document all of its recurrent and routine business dealings. These are transactions for example orders of raw materials, inventories, customer transactions and sales (Wang & Kogan, 2018). Companies record all of their transactions using the TPS mechanism. The trends of transactions needed to be observed and controlled by recording them with the aid of TPS. For instance, if an organisation discovers that some monthly customer orders above others, it can understand that the demand during those months is favourable. The company is then capable of taking steps to handle that demand by employing and deploying more resources during those months.

2.5.2 Operations Information System (OIS)

Operations Information Systems (OIS) are tools used to devise strategies, schedule production and assemble functions. Applying these tools, a manager can decide the level of inventory and raw materials stock, and how to structure production functions. What component is to be produced after which and how the final product will be assembled is the essence of OIS. The operations manager also supervises the deployment of workers for production purposes. With effective processes in place, the

company never encounters or experiences downtime situations or stock-out (Oleson, Schwan, Eisenhauer *et al*., 2000).

2.5.3 Decision Support Systems (DSS)

Senior management for executive decision-making uses DSS (decision support systems). This tool comprehensively employs the use of computers, computing tools, mathematical and scientific models for its analysis. With the DSS, the company can analyse, scrutinise and evaluate all the approaches it could deploy for use in departments such as production, sales, marketing and finance. The establishment is then able to choose the option that saves the most on costs, time, and both human and material efforts while gaining maximally (Kohli & Devaraj, 2004).

2.5.4 Financial Manager's Workbench (FMW)

Financial Manager's Workbench (FMW) is the application used to manage the campus' permanent budget and staffing obligations. In addition to its role as a transaction system, FMW is a highly flexible software tool well appropriated to budgeting and planning applications. The system offers access to multi-year permanent budget information at both the transaction level and summary/roll-up level aiding both analysis and research. Integration of detailed monthly distribution of payroll expense (DOPE) data with summary FIS operating ledger data to facilitate monitoring and forecasting of the current year operating budget (Lee, Akkiraju & Tian, 2008).

2.5.5 Evolution of Performance Measurement Systems

Performance Measurement Systems have undergone different changing conditions. According to Neely (1999), PMS revolution came as a reaction to different working conditions, including the changing nature of work, quality awards, improvement initiatives, increasing working competition, and the external demands. Such requirements called for the need of information technology, and PMS became popular. Also, Adams, Kennerley & Neely (2002) argued that there were a few organizations

that follow a systematic process to manage the evolution of their measurement systems, and this could help to improve PMS according to the organization requirement.

The evolution of PMS called for dynamic rather than static PMS, and this was important, since the focus was changed from performance management instead of performance measurement only. This is supported by Srimai, Radford & Wright (2011), who concluded that PMS have changed from static systems to dynamic systems and the focus became on performance management to support the improvement of organizational performance. One of the improvements in PMS was by Taticchi & Balachandran (2008), who reviewed existing frameworks and developed a framework, which integrates five systems: performance system, cost system, capability evaluation system, benchmarking system, and planning system. Besides, Micheli and Mura (2017) suggested a more comprehensive PMS design in order to facilitate transitioning from the paradigm of cost towards the support of innovation.

Another improvement in PMS can be noticed in the study of De Lima, Da Costa & Angelis (2008), who presented a developed theoretical framework in order to improve the capabilities of the performance measurement systems in a strategic management system context. They presented different elements for the improvement of PMS, including continuous improvement capability, strategic management, organizational learning, and change management with the recommendation that measurement systems should be designed, implemented, and managed as dynamic systems.

Digitalization has a major influence on PMS, since all the processes have become automated, which requires technological advances in information technology including software, computing power, and surrounding devices, and new and developed algorithms. Such advancement has brough new opportunities for the advancement of PMS (Schildt, 2017). Hence, PMS became more dynamic to the changes in the internal and external environment of the organization. Also, the current scenario has employed IT-based systems, artificial intelligence, and neural networks for the sake of facilitating closed-loop systems. However, there is no clear base or common ground for the radical elements of PMS in the current highly digitalized organizational environment (Sahlin & Angelis, 2019).

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