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The Impact Of Sustainable Manufacturing Practices And Sustainable Maintenance On Economic Sustainability: A Conceptual Framework

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ABSTRACT

In today's changing global environment, companies' interest in achieving economic returns has become a critical factor in sustainability. Therefore, this study aims to achieve economic sustainability (EcS) by providing a proposed framework that integrates sustainable maintenance (SMA) into sustainable manufacturing practices (SMPs). Effective adoption of SMPs and SMA has a significant positive influence on EcS. Nonetheless, there are limited studies conducted on integrating SMA into SMPs and how it could impact EcS. The theoretical contribution of the present study depends mainly on expanding existing knowledge about highlighting the moderating role of SMA on the relationship between SMPs and EcS.

KEYWORDS: sustainable manufacturing practices; sustainable maintenance; economic sustainability

1.0 INTRODUCTION

In this time, economic sustainability (EcS) has become a significant issue for researchers and practitioners. On the other hand, EcS represents the optimal utilisation of resources efficiently while reducing the adverse effects of such exploitation to achieve long-term positive results (Abubakar, 2014; Yusuf et al., 2013), for future generations (Anis & Siddiqui, 2015). The vital question that arises is about how to address the issue of improving

the EcS. In this respect, sustainable manufacturing practices (SMPs) have not been widely studied and documented by researchers (Alayón, Säfsten, & Johansson, 2017; Annunziata et al., 2018). Moreover, several empirical evidence suggests that SMPs contribute to improve EcS (Amrina & Aridharma, 2016). Therefore, there is a necessary need to study SMPs as they will contribute to addressing the issue of EcS in the companies. Furthermore, Amrina and Aridharma (2016) pointed to the need to study sustainable maintenance (SMA). Zhang et al. (2017) stressed that literature in SMA is the most limited. Similarly, Ararsa (2012) noted that studies on SMA are still in infancy. Additionally, Franciosi et al. (2018) recommended through their systematic review that more research should be conducted on the impact of maintenance on EcS. Similarly, Seychelles (2017) suggested further investigation on the relationship between maintenance and EcS. However, many companies still do not have a full understanding of the importance of effective maintenance activities and their significant role in achieving EcS (Liyanage & Badurdeen, 2010). Therefore, there are two main reasons for investigating in SMA: first, to bridge the gap in the literature and the second reason, because it will contribute to addressing the issue of EcS in the companies.

Indeed, companies that have an interest in SMPs are more inclined to adopt SMA (Garetti & Taisch, 2012; Granados, 2014). This is because they have the same goal of improving EcS. Besides, many studies have examined the relationship between SMPs and EcS (Ighravwe & Oke, 2017; Jasiulewicz-Kaczmarek, 2013). However, SMA has not been given any consideration in their studies. Accordingly, to the best of the knowledge of the authors, surprisingly, the moderating effects of SMA are ambiguous and have not been closely studied in any previous study. This gap points to the need for a theoretical framework to investigate the moderating impacts of SMA on the relationship between SMPs and EcS. Therefore, this study aims to encourage the companies to achieve EcS by providing a proposed framework that integrates SMA into SMPs.

The results of the current study are expected to benefit many aspects in different areas. Academicians will obtain a better perception of the importance of integrating SMA into SMPs to achieve EcS. Additionally, policymakers and top management in the companies will gain a better understanding of how to improve the EcS, based the focus on SMPs and SMA.

The present study contains two sections viz.; following this introductory section is Section 2, Literature Review and Conceptual Framework which provides insights from empirical literature and conceptual framework about SMPs, SMA and EcS, followed by Section 3, which involve conclusions of this study.

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 *Economic Sustainability (EcS)*

Globally, economic sustainability (EcS) which also called “economic prosperity” (Stuchly & Jasiulewicz-Kaczmarek, 2014) means production and distribution of goods and services that improve the pattern of living in the globe (Bamgbade, Kamaruddeen, & Nawi, 2017). However, EcS refers to profit (Anis & Siddiqui, 2015), and creating added value (Callan & Thomas, 2009). Likewise, the idea of EcS is that the current generations are responsible for their decisions and actions that lead to adverse effects on the prosperity of later generations (Marshall et al., 2015). Nevertheless, EcS is not bounded to the profitable revenues only (Elkington & Rowlands, 1999), because it is not considered a measure of success (Bansal, 2005). But also should include preserving the environment and the people who live it (Yusuf

et al., 2013) and strengthening the quality of their life (Jamali, Mezher, & Bitar, 2006). Hence, companies can be considered EcS, when profits achieved while reducing or eliminating all environmental and social impacts that can cause harm to current and future generations.

2.2 *Sustainable Manufacturing Practices (SMPs)*

Sustainable manufacturing practices (SMPs) have gained vital importance over the past few years. Adebanjo, Teh, and Ahmed (2016) noted that there is a growing interest worldwide in the implementation of sustainable management practices. Also, interest in sustainable practices has increased as a result of grown interest in sustainable manufacturing (SM) over the years (Alayón et al., 2017). In other words, SM plays a significant role in manufacturing companies, and SMPs contribute to creating the right environment for companies (Tsai, Chou, & Hsu, 2009). It is because of linking the operations and decisions of industrial companies to environmental and social factors related to their activities (Abdul-Rashid, Sakundarini, Ghazilla, et al., 2017).

Depending on the perspective of the product life cycle, SMPs can be classified into four dimensions concerning the phase at which the practices are implemented. These dimensions include the sustainable product design, sustainable manufacturing process, sustainable supply chain management and sustainable end of life management (Adebanjo et al., 2016). Which it is considered the dimensions of SMPs in the present study. Hence, the product life cycle perspective is more appropriate for the companies when implementing SMPs.

2.3 *Sustainable Manufacturing Practices and Economic Sustainability*

The relationship between SMPs and EcS has been studied for more than a decade. For instance, Hami, Muhamad, and Ebrahim (2015) investigated in the context of manufacturing industries and found a significant influence of SMPs on EcS. Meanwhile, Annunziata et al. (2018) conducted a study of proactive socio-environmental practices in Italia. They reported a positive relationship between proactive socio-environmental practices and economic performance. RAO (2005) demonstrated over a sample of leading-edge ISO14001 certified companies in five of South East Asia countries that the adoption of greening at different stages of the supply chain leads to integrated of the green supply chain and eventually leads to competitiveness and economic performance. Literature as above shows mostly a significant positive relationship between SMPs and EcS. Thus, based on the arguments above and assumptions of Stakeholder Theory (Abdul-Rashid, Sakundarini, Ariffin, et al., 2017), which propose that some advantages, benefits, firms decision-making power should be taken away from shareholders and given to stakeholders (Hami et al., 2015), the following proposition is offered:

P1: Sustainable manufacturing practices have a significant positive relationship with economic sustainability.

2.4 *Sustainable Maintenance (SMA)*

These days, it is essential for academicians and practitioners to focus not only on the technical aspect of maintenance activities but as an integrated set of technical, economic, environmental and social and safety dimensions (RAO, 2005). This is because the maintenance activities and breakdowns in industrial companies result in harmful emissions, waste, dangerous accidents and consumption of energy and resources (Garetti & Taisch, 2012). While the adoption of sustainable maintenance (SMA) by companies will make a significant difference in the economic, environmental, social and safety and technical (Friedman & Miles, 2002). Likewise, additionally the economic and environmental dimensions, SMA included

social and safety dimension and worked to achieve a balance among these three dimensions (Stieb, 2009). Moreover, companies that interesting on sustainable manufacturing face a new challenge in their implementation of SMA (Zhang et al., 2017). This is because of the complexity of manufacturing practices and processes (Bengtsson & Lundström, 2018), the need to make changes in policies and procedures of maintenance, attention to environmental and social and safety aspects as well as financial aspects (Jones & Cooper, 2007), competition pressure in manufacturing (Jin et al., 2016) and the government regulations towards sustainable development in manufacturing (Jasiulewicz-Kaczmarek & Stachowiak, 2016). However, in recent years, changes in manufacturing paradigms have forced companies and managers to recognize the changing role of maintenance regards sustainability (Emmanouilidis & Pistofidis, 2010).

2.5 *Sustainable Maintenance and Economic Sustainability*

According to Ali et al. (2010), the efficiency in maintenance tasks and activities comes through the selection of proper maintenance. Although studies on SMA and EcS are limited (Ararsa, 2012), studies in most case studies have confirmed that EcS is achieved through the choice of sustainable maintenance (Baluch, 2013). Zhang et al. (2017), who studied in the context of port infrastructures in Japan, explained that the use of technology in equipment maintenance has positive effects on the all of sustainability performance dimensions namely, financial, social and environmental. In many circumstances firm sustainability is explained into three dimensions of firm performances, namely; an economic "financial", a social "people" and an environmental "planet" performance (Mohd Salleh, Yusoff, & Saad, 2015). Therefore, based on the arguments above and assumptions of Natural Resource-Based View (NRBV) Theory (Ali et al., 2010), which proposition that clean technology that encompasses a range of activities and processes undertaken by companies lead to achieving sustainable competitive advantage, creating value for shareholders and achieving sustainability (Hart, 1995), the following proposition is offered:

P2: Sustainable maintenance has a significant positive relationship with economic sustainability.

2.6 *Sustainable Maintenance as a Moderating Variable*

Indeed, the moving of the manufacturing paradigms towards sustainable development has led to a change in the maintenance paradigms towards of product lifecycle, which involves four phases (Stieb, 2009). This is due to the trend toward SMPs (Jasiulewicz-Kaczmarek & Stachowiak, 2016). From a practical perspective, each phase of the product life cycle must be supported by maintenance (Ighravwe & Oke, 2017), from product design to end-of-life (Hart & Dowell, 2011). These phases can be utilised to manufacturing equipment and manufacturing products (Starr & Bevis, 2010). In this regards, to illustrate and justify the new process of understanding maintenance, Takata introduced the term "maintenance value chain" (Takata et al., 2004). This emphasis on the life cycle view of sustainable manufacturing has produced the redefinition of the task of maintenance as being "a prime method for life cycle management whose objective is to provide society with required functions through products while minimizing material and energy consumption" (Takata et al., 2004). In the same vein, the role of maintenance in the phases of the product lifecycle leads to the availability and reliability of equipment, improve environmental efficiency, achieve safety (Baluch, 2013). Thus, maintenance plays a vital role in interacting with all phases of the product lifecycle within SMPs. Based on the discussion and the arguments in the above, it concludes that the impact of SMPs on EcS will be stronger if sustainable maintenance moderates between them. Accordingly, based on the arguments above and assumptions of NRBV Theory the following

proposition is offered:

P3: Sustainable maintenance positively moderates the relationship between sustainable manufacturing practices and economic sustainability.

In short, the proposed conceptual model of this study is formulated by combining the Stakeholder Theory and the NRBV Theory. Meanwhile, the current study integrating SMA into SMPs to examine their effects on EcS, as depicted in Figure 1.

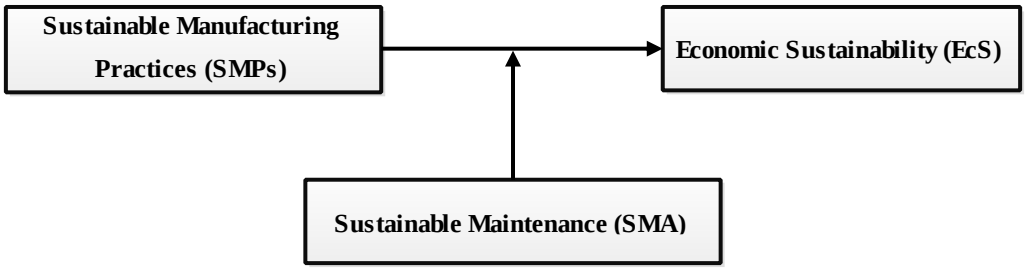

Figure 1: *A Conceptual Framework for Economic Sustainability*

3.0 CONCLUSION

The present paper offers a conceptual framework that investigates the moderating effect of SMA on the relationship between SMPs and EcS. This research gap has been addressed in the present study. Previous empirical studies pointed out that there is evidence that adopting SMPs and SMA in companies improves EcS. The proposed conceptual framework in the current study will have some potential theoretical and practical implications. Firstly, as a contribution to the body of knowledge, academicians will obtain a better perception of the importance of integrating SMA into SMPs to achieve the EcS. Secondly, the practitioners in the companies can put in place SMPs and SMA framework, to achieve EcS. More clearly, the proposed framework will be necessary to policymakers and top management in the companies in which will provide a better understanding on how to achieve EcS through SMPs and SMA.

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