THE ROLE OF INDUSTRY 4.0 TECHNOLOGIES IN DETERMINING THE TRIPLE BOTTOM LINE SUSTAINABILITY-A FRAMEWORK FOR MALAYSIAN SMEs

Sreenivasan Jayashree

Associate Professor, Faculty of Management
Multimedia University, Persiaran Multimedia, 63100 Cyberjaya, Selangor
Malaysia
jayashree@mmu.edu.my

Chinasamy Agamudainambi Malarvizhi

Senior Lecturer, Faculty of Management
Multimedia University, Persiaran Multimedia, 63100 Cyberjaya, Selangor
Malaysia
malarvizhi@mmu.edu.my

Mohammad Nurul Hassan Reza *

Research Scholar, Faculty of Management
Multimedia University, Persiaran Multimedia, 63100 Cyberjaya, Selangor
Malaysia
hassanreza7171@gmail.com

**Corresponding author's Email: hassanreza7171@gmail.com*

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editor@readersinsight.net

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Abstract

This study contributes to the current literature by analyzing the role of Industry 4.0 technologies on its effective implementation towards achieving Triple Bottom Line (TBL) sustainability. Several hypotheses are presented to evaluate the relationship, considering the role of Industry 4.0 technologies that may be played to determine TBL sustainability and effective implementation of Industry 4.0 as a mediating variable. Because there has been little focus on financial, ecological and societal sustainability and the role of Industry 4.0 technology on these dimensions in the current literature, this study aims to analyze the connection among the variables in relation to Malaysian SMEs. The statistical analysis will be performed through the employment of the Structural Equation Modeling (SEM).

Research Highlights

The rapid-growing global population, the need for a better life, and the continuing misuse of natural resources have grown a massive consciousness about sustainability to live, organize, performance, and manage tasks (Köhler *et al.*, 2019). The term ‘sustainability’ has come to refer to ‘maintain the business running’- an idiomatic definition by Colbert & Kurucz (2007). Sustainability can be defined as a business strategy that involves long-term and long-lasting value creation and improves economic, ecological, and societal resources. This concept is close to Purvis *et al.* (2019), who define that sustainability involves concurrent attention on financial, ecological, and societal dealings. Similar to the expansion of Industry 4.0, sustainability has boomed through the combination of economic and environmental concerns into organizations’ decision-making procedures (Gunasekaran & Irani, 2014). SMEs are essential contributors to the world economies’ springboard (Nor-Aishah *et al.*, 2020). In Industry 4.0, organizations can achieve a platform for industry-based information systems that are flexible, transparent, smart, and up-to-date. By introducing Industry 4.0 organizations, can quickly access and evaluate the necessary technologies to address their demands. These technologies help organizations evolve with industrial manufacturing; they help fulfill the buyers’ expectations and requests, raise the volume of production, supply chain, recycling, and involve all relevant facilities.

Internet of Things (IoT) is a modern architecture of manufacturing integrating intelligent and independent computers, innovative project assessments, and machine-human associations to enhance efficiency, skill, and productivity (Wong & Kim, 2017). The IoT can be used in various fields to create sustainability (Bonilla *et al.*, 2018), including improving resource efficiency and strengthening sustainable energy (Beier *et al.*, 2018). IoT includes enormous possibilities for the end of life procedures (Song *et al.*, 2015) or smart maintenance services (Chukwuekwe *et al.*, 2016), and the overproduction can be reduced through the digital accessibility of buyer information (Beier *et al.*, 2018). IoT technology can help organizations build sustainable practices by reducing energy consumption, introducing energy-efficient production systems, and sharing renewable energy (Beier *et al.*, 2018).

In order to drive technological transformation, big data analytics are essential for organizations to analyze data or information. Consequently, they have a wide variety of expertise to build and understand the algorithms (Lee *et al.*, 2017). Big Data tools can help develop natural resources consumption and management, enhance energy and ecological productivity, and achieve sustainability (Song *et al.*, 2017). Scholars revealed that the big data can assist organizations in natural resources utilization and management, including energy consumption (Lin & Lin, 2017), resources efficiency (Li *et al.*, 2017), economic expansion, and resource protection (Xiao *et al.*, 2016), fossil energy consumption (Wang & Ye, 2017). On the other hand, researchers demonstrated, big data analytics can help organizations to achieve sustainability through the leveraging natural resources, such as water (Sun *et al.*, 2017) and land (Li *et al.*, 2017); construction (Zhang *et al.*, 2017), transport (Li *et al.*, 2017) and logistic sector (Wu *et al.*, 2017), products improvement (Hazen, 2017), and business management (Tseng, 2017). Additionally, big data analytics can contribute to pollution prevention and treatment (Chen *et al.*, 2017) and improving environmental efficiency (Chen & Jia, 2017).

Cloud computing enables the networking of production materials, services, information, and humans over the internet in the manufacturing platform, building a smart and connected world. It helps organizations to enjoy the real potential of intelligent productivity in the manufacturing industries (Yue *et al.*, 2015). Cloud computing can be the solutions to improve energy performance, to handle data center infrastructure efficiently (hardware and software), to minimize the cost of operations (Radu, 2017), to mitigate greenhouse pollution (Cappiello *et al.*, 2015), and to leverage renewable energy (Bateman & Wood, 2009).

The product is manufactured by improving additive manufacturing's consecutive coverings, where combining product parts and elements is not required. This technology enables organizations to manufacture small groups of classified items (Stock & Seilger, 2016). The benefits of additive manufacturing include reduced waste generation because of an additive procedure, the potential for lightweight goods to minimize material and energy use, the resulting decrease in shipping in the supply chain, and the capacity to produce spare parts on-demand and eliminate excess inventory (Ford & Despeisse, 2016).

Modern robots are autonomous, agile, and cooperative and will interact with humans very closely soon (Pei *et al.*, 2017). The robots can help organizations create sustainability by accessing new resources from under the seas or lakes, reusing resources with the deployment of spectroscopic methods, which are difficult for the human being. The organization can employ robots in reducing waste during industrial production, manufacturing processes to generate fewer polluting by-products, aiding the repair of products, assisting in food production, and so on (Bugmann *et al.*, 2011).

The organization's attention only on revenue-earning without addressing the stakeholder concerns has become significantly undesirable from a sustainability perspective (McWilliams *et al.*, 2016). Accordingly, scholars have demonstrated sustainability design from the 'Triple

Bottom Line,' which includes profit, planet, and people, and this concept works from a financial, environmental, and social perspective (Norman *et al.*, 2004).

Research Objectives

The primary intentions of this study are as follows,

- Examine the consequence of Industry 4.0 technology on its successful implementation.
- Assess the consequence of Industry 4.0 technology on TBL sustainability.
- Inspect the influence of Industry 4.0 on TBL sustainability.
- Scrutinize the mediating effect of Industry 4.0 between its technology and TBL sustainability.

Research Framework

Fig. 1: Research Framework

Methodology

This study proposes a new model that includes Industry 4.0 technologies and the effect on Industry 4.0 accomplishment and sustainability in Malaysian SMEs. A cross-sectional survey will be carried out, and the samples will be collected from SME Corporation. The statistical analysis will be performed through the employment of the Structural Equation Modeling (SEM).

Findings

This study focuses on the advancement of sustainable development through Industry 4.0 technologies in organizations. The study provided several hypotheses reflecting the linkages between the variables and. These hypotheses should be tested, and it would be essential to learn how Industry 4.0 technologies can help promote sustainability in the manufacturing sector.

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Author's Biography

Dr Sreenivasan Jayashree, Associate Professor, Multimedia University, Cyberjaya, Malaysia has widely published in many international journals and has secured many grants. She has supervised many students. Her areas of interest are Environmental Management, Strategic Management, Industry 4.0, Waste Management, Consumer Studies.

Dr Chinasamy Agamudainambi Malarvizhi, Senior Lecturer, Multimedia University, Cyberjaya, Malaysia has more than 18 years of teaching and research experience in Economics, Environment and Health issues, Knowledge Management and Tourism Development. She regularly publishes in journals and presents at international conferences. She has guided many PhD research scholars, Master students, and undergraduate students.

Mohammad Nurul Hassan Reza, Research Scholar, Faculty of Management, Multimedia University, Cyberjaya, Malaysia. Graduate Research Assistant of the project titled 'Testing a Framework for Industry 4.0 Digital Disruption-A Crunch Point for Environmental Sustainability in Malaysian SMEs', Ministry of Higher Education (MOHE), Malaysia. His areas of Interest are Fourth Industrial Revolution, Industrial Management, environmental management.