PRODUCTION & MANUFACTURING | RESEARCH ARTICLE

Green servitization as a means of sustainable performance: Evidence of listed manufacturing firms

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Abstract: This study assessed green-servitization (GS) as a means of sustainable performance (SP) for publicly listed manufacturing firms in Malaysia. Manufacturing firms in recent times have faced serious challenges due to huge cost paid for environmental clean-up resulting from traditional operating system. Primary and secondary data were used for this study. Data were collected through the use of structured questionnaire. Ten (10) manufacturing companies were randomly selected, and three management staffs of the selected companies were purposely selected based on their designation to be the respondents. A simple linear regression was used to analyse the relationship between green-servitization (GS) and sustainable performance (SP). The regression result showed that the coefficient of green servitization GS is –0.040 and p = 0.247. The correlation coefficient, R = 0.218, indicates a very weak correlation between green servitization (GS) and sustainable performance (SP). The R² = 0.048 shows that the variation in SP is only accounted for by 4.8% of the GS. The F-test for the hypothesis testing showed that F = 1.400, p > 0.001, which implies that there is no positive significant relationship between green servitization (GS) and sustainable performance (SP). The implication of this research will be useful for policymakers to design suitable policies and industrial practitioners to improve their operations in terms of firms’ sustainable performance.

ABOUT THE AUTHOR

Idris Oyewale Oyelakin is a strategic management expert who specialized in area of manufacturing firms’ production activities that focus on green practices towards reduction of cost in the aspect of water conservation, energy and other material usage mainly to achieve sustainable performance. This study focuses on the challenges faced by manufacturing firms towards achieving sustainable performance due to recent environmental impact cost on their overall profitability. The study relates to a wider project in the area of providing an alternative to traditional production system to a new or modern production system in terms of important of using Green servitization and its urgent successful implementation for Manufacturing firms activities. This is believed to lead to a bigger project that is capable of providing major solutions to manufacturing firms’ industry at large.

PUBLIC INTEREST STATEMENT

The present paper is an attempt to provide new solutions to production activities of manufacturing firms through reducing usage of materials, water, energy and other aspects of the production process. This is regarded as Green Servitization (GS), capable of providing higher profitability and be able to continue business in the future, called sustainable performance. This is as a result of losses be incurred by this sector of the economy from government inform sections, which is largely attributed by waste and other environmental impact, thereafter, invariably coming back to affect profitability in the long run. Thus, if continuously using their present method of production, the survival of their business could be challenged and may lead to closure of business or affect overall production of manufacturing firms’ industry.
Subjects: Sustainable Development; Business, Management and Accounting; Industry & Industrial Studies

Keywords: Servitization; green-servitization; sustainable performance

1. Introduction
The effect of rising greenhouse gas emissions that results from the massive use of fossil-fuels has no doubt adversely affected the quality of natural environment around the globe (Fernando and Yahya, 2015) as well as manufacturing firms’ sustainability as it has led to cost sanctions by governments to firms. One of such scenarios is Indonesia economic losses estimated at $16 billion and China manufacturing economic loss of $62.5 billion both from environmental sanctions leading to growing concern in the manufacturing industries about challenges relating to sustainability, thus the clamour to adopt service-based or cleaner production process as a way to maintain competitiveness in compliance with environmental regulations (Opazo-Basáez et al., 2018). Baines and Lightfoot (2014)considered servitization as an innovative process in which a firm shifts from the production and selling of ordinary goods to the production and selling of service-based product. Similarly, Turunen and Neely (2012)also suggested servitization as Product-Service Systems of production process. However, the concept currently has not lived up to its full potential as most firms only use it more on the product aspect (practice) while neglecting the process in which the product is been made. This has posed a huge challenge to manufacturing firms with regard to waste management and environmental sustainability issue, showing that the practice of firm to focus only in adding value to product cannot be sustainable for manufacturing firms in the future, thus will also require infusing value to manufacturing production process in the form of an extension to green servitization.

According to Stoughton et al. (2009), green servitization can contribute enormously to a more sustainable economy by providing more eco-efficient alternatives to the delivery of environmentally problematic and economically critical functions and products. More attention is being paid to sustainability by companies willing to combine environmental, social and economic performance in the implementation of their business strategy (Gimenez, Sierra & Rodon, 2012). Moreover, its implementation has caused more businesses to get deeply involved in strategies that are more complex with global social-ecological challenges, like climate change, biodiversity loss and depletion of natural resources (Schäpke et al., 2017).

In effect, sustainability adoption has become a strategic imperative and a fundamental market requirement capable of influencing long-term organizational and economic viability, including success (Orlitzky, Schmidt & Rynes, 2003). Hence, over the years, companies have gradually been transitioning towards responsible environmental behaviour and sustainable management of their operations (Lindström et al., 2015), conceiving sustainability as an opportunity for compliance with stakeholders and government legislation, building difficult-to-replicate core competences, as well as optimizing firms’ operations and performance (Le & Wang, 2017).

1.1. Problem statement
Malaysian manufacturing firm from various reports, such as the one on the Malaysia Investment Development Authority, show that the country is facing high air and water pollution attributed to waste generated by manufacturing firms. As of 2005, the country waste was 19,000 tons per day at a recycling rate of 5%. Sadly, the numbers have increased sporadically in recent time to 38,000 tons per day thirteen years later as of 2018, despite the increased recycling rate of 17.5%. This shows the severity in manufacturing firm’s performance, whereby the nation’s environmental performance would decrease more if the manufacturing firms do not provide a new production process that can reduce their excesses in production and serve as an additional revenue generation in the form of service solutions. This is because a sustainable economy requires economically successful business activities and models that achieve fundamental reductions in energy, material and water, all of which are involved in the manufacturing production process towards the delivery of necessary goods and services.
(Stoughton et al., 2009). Hence, to achieve meaningful sustainable future economy, a service- and information-led economy must be transformed into a green economy. In other words, we must design a means through which services can change for the better to accommodate design, produce, utilise and recycle at the end of life in order to ensure environmentally friendly process in the manufacturing industry, which has been the aim of Malaysian government to employ green technology optimisation to assist the manufacturing industry in innovating products that have less environmental impact and improving sustainable performance as well as the socio-economy of the society (Fernando & Yahya, 2015).

1.2. Objective of the study
The objective of this study is to analyse the significant positive relationship between green servitization and sustainable performance among public listed consumer products’ manufacturing firms in Malaysia.

2. Literature review

2.1. Concept of servitization
The concept of servitization can be referred to as Product Service System (PSS), which is a market proposition that transforms the traditional functionality of a product by incorporating additional services (Baines et al., 2007). In this case, emphasis is laid on the “sale of use” rather than “sale of product”. The customer pays for using an asset, rather than its purchase, and so benefits from a restructuring of the risks, responsibilities, and costs traditionally associated with ownership. Similarly, the supplier/manufacturer can improve their competitiveness as these “solutions” may be clearly differentiated from product-based offerings while simultaneously retaining asset ownership that can enhance utilization, reliability, design, and protection.

The idea of servitization may also be considered to mean sustainability. The main expectation here is that an effective servitization will result in a lower environmental impact than the normal traditional transaction in which a manufacturer produces products and then transfers responsibilities of ownership and use to the customer. Neely (2007) studied the sustainability of manufacturing companies in parts of Europe. The sample as a whole consisted of 31.30% combined manufacturing firms and 68.70% were pure manufacturing. The study found that considerably more of the combined manufacturing and service firms went bankrupt than might be expected, suggesting that the transition from a manufacturing firm to a combined manufacturing and service firm might be problematic for some organisations. In some ways, this is not surprising as increased diversification (moving to product and service offerings) might hold some significant challenges for firms, at least because of the increased investment required and changed risk profile. Furthermore, it is argued that when dealing with such complex and unpredictable processes of change, it is impractical to suggest that firms can have clear objectives and that they make significant leaps from one stage to the next in a deliberate move to transform their business model through servitization (Robinson, 2019, 2019).

Goedkoop (1999) defined the key elements of servitization as follows:

(i) Product: a tangible commodity manufactured to be sold. It is capable of “falling on your toes” and of fulfilling a user’s needs.

(ii) Service: an activity (work) done for others with an economic value and often done on a commercial basis.

(iii) System: a collection of elements including their relations.

Many authors see the purpose of servitization as a competitive proposition, and so directly refers to the need for customer satisfaction and economic viability. While many others linked
servitization with achieving sustainability, Manzini, Vezzoli and Clark (2001) viewed this as the ultimate goal.

Meanwhile, Neely (2007) identified 12 different types of service offering: Consulting Services; Design and Development Services; Financial Services; Installation and Implementation Services; Leasing Services; Maintenance and Support Services; Outsourcing and Operating Services; Procurement Services; Property and Real Estate; Retail and Distribution Services; Systems and Solutions; and Transportation and Trucking Services, in which some of these drivers are considered in the present study.

2.2. Concept of green servitization

In manufacturing settings, green servitization represents a digital proposition to support operations in compliance with environmental regulations. It thus facilitates alignment of a company’s operations with environmental constraints to ensure sustainability of operations, which involves collection, reuse and recycling of components through the entire process (Schöggl, Fritz & Baumgartner, 2016). According to Oyewale and Johl (2021), green servitization is a related construct where strategy service infusion and integrated solutions could serve as alternative for manufacturer’s effort in improving services to their core offering of production process through successful implementation of ISO14001.

2.3. Drivers of green servitization

Lightfoot et al., (2013) highlighted the following drivers of green servitization:

Economic: Traditional manufacturing has shifted production away from western economies to emerging economies such as China and India. Lower labour rates in these nations mean that western firms cannot compete on cost alone, and therefore, have transitioned to services.

Environmental: Global populations are rising, and as a result, resources are being stretched. Western companies are looking to “do more with less”. Services are considered to promote dematerialisation, and therefore, servitization is seen as a viable strategy to meet these demands.

Social and Market: Evidence suggests that service contributions to an economy have a direct link to wealth. This implies that demand for services in Western economies is on the rise.

Technology: Information Communication Technology is one key enabler of servitization. Developments in ICT mean that certain services such as product monitoring and GPS position tracking are available to be offered now when they were not before.

The use of several tools or dimensions to measure servitization vis a vis green servitization has evolved over time by many researchers as shown in Table 1. Ambroise, Prim-Allaz and Teyssier (2018) drew on a configuration theory to analyse the conditions under which servitization strategies lead to increased financial performance to select its dimensions. Their selection was based on an extensive literature review to determine items that directly affect the service offerings and bring higher financial return to firms. Conversely, Ayala et al., (2019) used offerings, resources and activities to measure servitization. Their study stated that due to limited availability of measurement of construct for servitization in academic literature, they decided to follow the Churchill (1979) approach via creating new multi-item scales following certain procedures and techniques to ensure a reliable instrument as follows:

(a) The domain of each construct was first defined by an in-depth literature review.
(b) Information from 23 interviews was obtained from professionals of 7 companies and was contrasted with the outcome of the domain definition of systematic literature review.
Table 1. Literatures for dimensions development of green servitization, and sustainable performance

| No | Author/Year | Servitization Dimensions | Green Servitization Dimensions | Sustainable Performance | Methodology | ISO 14001 |
|----|-------------|---------------------------|--------------------------------|------------------------|-------------|-----------|
| 1  | Ambroise, Prim-Allaz & Teyssier, (2018); | 1. Added service, 2. Activities reconfiguration, 3. Business Model reconfiguration |  |  | Qualitative |  |
| 2  | Mastrogiacomo et al. (2018) | 1. Revenue strategy, 2. Design, 3. Organization, 4. Quality control and management, and 5. Customer relation |  |  | Mixed method |  |
| 3  | Ayala et al. (2019) | 1. Offerings (Competitive and differentiation advantage, Customer need, Value added, and Customer orientation), 2. Resources (knowledge, expertise, capabilities, and flexibility), 3. Activities (service area with NPD area, other functional areas, customer integration and further business unit’s integration.) |  |  | Quantitative |  |
| 4  | (Opazo-Basáez et al., 2018) | 1. Product, 2. Services | 1. ProductivityTotal sales, 2. Employees |  | Quantitative |  |
| 5  | (Marić & Opazo-Basáez, 2019) | 1. Supply chain systems, 2. Digital technology, 3. Reverse logistics, 4. Product return |  |  | Qualitative |  |
| 6  | Berhad (2015) |  |  |  | 1. Economic, 2. Environmental, 3. Social |  |
(c) A round of reviews with seven academicians (three postdoctoral research fellows and four associate professors) from three institutions were conducted.

(d) Reconsideration and adaptation of some items was carried out, while others were removed to better represent the objective of each construct.

(e) Finally, the survey instrument was individually submitted for a test with three professionals to obtain their feedback regarding clarity of the questions.

Similarly, Mastrogiacomo et al. (2018) measured servitization in terms of revenue strategy, design, organization, quality control and management and customer relation. Their measurement was empirically chosen based on a number of procedures as follows.

(a) A preliminary qualitative literature review performed by a focus group (three academicians and seven practitioners) to select the dimensions.

(b) Discretization of the dimensions (each dimension was discretized based on its level or degree to the general domain without losing its value).

(c) Clustering and ordering of extracted data from ORBIS aimed at identifying a set of typical profiles able to describe the most common servitization statuses. As a result, their study developed the above 5 mentioned servitization dimensions based past literature, input from academicians and practitioners via an empirical procedure.

However, the event of achieving resource sustainability (Tsai & Liao, 2017) and having good health with regard to environment (Doni et al., 2019) have led other researchers to explore as well as extend the study to green servitization and used different dimensions to measure it. Recently, Opazo-Basáez et al. (2018) and Oyewale and Johl (2021) investigated green servitization and digital effect on firm productivity by using product, digital technology and CO2 emission to measure green servitization in European automotive industry. Findings showed that the dual concept of green servitization provides higher firm performance if they coexist or jointly operated but the studies used secondary data. Furthermore, Marić and Opazo-Basáez (2019) studied the implementation of using reverse logistic for electronic and computer practitioners via green servitization to achieve product recovery at its end of life. The study of green servitization dimensions includes energy or water conservation, waste management, maintenance and repair, raw material recycling, as well as emissions reduction. These they believe will solve sustainability issue with regard to resources, but their inclusion criteria were based on a qualitative systematic review to arrive at a theoretical development.

Based on this, the procedure recommended by Churchill (1979) which stated that selecting a dimension involves specifying a domain thereafter delineate what is included and excluded in the operational definition of the variable is employed in the present study. In line with this, in order to have a conceptual specification of the construct as well as what is and what is not included in the domain (green servitization), the present study adapts the following parameters as the dimensions of green servitization:

(a) Some of the dimensions of Ayala et al. (2019) are employed as the independent variables because they directly involve the operational definition of the present study as proposed by Churchill (1979) when developing a dimension for a domain.

(i) Ayala et al. (2019) employed offering but it is adapted as product in the present study because it represents a strategic element necessary for green servitization that can produce a higher financial and environmental performance. This is measured in terms of its efficiency, cost saving and safety. The use of its measurement is motivated based on the guidelines set by Malaysian Standard with regard to product usage by firms (Malaysian Standard, 2015).

(ii) Similarly, resources are adapted as one of the dimensions of green servitization but modified as internal competencies because it is required as the internal intellectual assets or capability of
the product centric firm to change towards green servitization that is measured with knowledge, expertise and capabilities as used by previous studies (Ayala et al., 2019).

(iii) Also, activities are adapted and used as maintenance in the present study. These are measured with technical, service and sales requirement, respectively, because most of the contents of the indices used are in line with maintenance activities of manufacturing firms that can generate more revenue for organization as well as contribute to environmental performance while also serve as the operational element required in form of internal processes that can allow green servitization to bring about higher sustainable and environmental performance.

(iv) Lastly, digital technology is adapted from the study of Opazo-Bosáez et al. (2018) because it represents all technological advancement that fosters and facilitates communication flow in operations of the firm to reduce cost and improve environmental performance. Digital technology in the present study involves the convergence of economic objectives and sustainable development goals (economic sustainability), improves enabling cost-efficient allocation as well as distribution of resources to bring about optimization of green servitization. This is necessary because most of the time when there is no technological procedure in production activities that involve green initiative, achieving or successful implantation of new strategy might be difficult in the internal working system of the firm, hence its inclusion for the present variable (green servitization). But due to its lack of available indices in past literature, the indices development follows the process employed by Ayala et al. (2019) in order to derive at an empirical conclusion by employing digital interaction with product and digital value creation with product in line with the standard set by Malaysian Standard ( Malaysian Standard, 2015).

(b) With regard to sustainable performance, which is the dependent variable of the present study, economic, environment and social parameters are used as indicators for its measurement. The economic performance focuses on the profitability gain of the firm when green servitization is employed while the social and environmental aspects involve the environmental performance contribution after usage or successful implementation of green servitization. The selections of these indicators are based on the measurement standard by Bursa Malaysia to all public listed firms (Bursa Malaysia Berhad, 2015). As such, the availability of secondary data is guaranteed due to the mandate given by Bursa Malaysia to all public listed firms to be published in their annual bulletin sustainability reporting. As such, the next section shows the proposed conceptual framework of the study.

2.4. Conceptual framework
The conceptual framework of the present study is depicted in Figure 1 to show the independent variables (IV) and dependent variables (DV) as well as to explain the relationship that exists between them (McGaghie et al., 2001). The IV (green-servitization) entails green-product, internal competencies, maintenance, digital technology, respectively, while the DV is sustainable performance that involves economic, environment and social as measured by Malaysian Standard (Malaysian Standard, 2015).
2.5. Hypothesis of the study
The study by Opazo-Basáez et al. (2018) mentioned that the successful implementation of service solution in the production process of manufacturing firms in place of tangible product (equipment or material) will improve operational production process as well as brings about positive effect to the environment. These intangible solutions that involve the usage of important green product (machine or equipment) as identified by Soroshian and Yee, (2019) must be energy efficient and electromagnetic compactible to achieve better environmental effect. However, previous studies have only focused on servitization and did not discover any association of service solutions to provide higher sustainable performance (Annorelli et al., 2019; Wang et al., 2018). Most of these studies were qualitative in nature and did not provide any empirical findings about the relationship of green servitization and sustainable performance. Similarly, few studies also believed that a sustainable economy will also depend on the successful survival of manufacturing business activities capable of achieving higher reduction in water, material as well as energy usage in the course of their production activities (Bustinza et al., 2019; Humbeck et al., 2019). The studies mentioned that these activities provide manufacturing firms sustainable performance in the future. As such, the present study attempts to provide empirical findings on the relationship that exists between green servitization and sustainable performance (Marić & Opazo-Basáez, 2019). Hence, hypothesis H1 is developed as follows:

H1: There is a significant positive relationship between green servitization and sustainable performance.

2.6. Research model

Figure 2 above shows the proposed research model that is the positive association between green servitization (independent variable) and sustainable performance (dependent variable). The dependent variable is further measured by Economic (Risk Reduction Practice and Procurement Practice), Environment (Waste and Effluent and Emission), and Social (Anti-competitive Behaviour and Anti-Corruption) as recommended by Malaysian Standard (Malaysian Standard, 2015). Furthermore, it shows that the use of control variable (firm size and age) has been employed by previous studies (Ahmad & Zabr, 2016; Crozet & Mile, 2017; Dang & Li, 2018; Opazo-Basáez et al., 2018). Finally, it shows the use of Resource-Based View theory (RBV) as previously employed in
prior studies (Afriyie et al., 2019; Azmawani; Abd Rahman et al., 2014; Singh et al., 2020). The rational for using RBV is stated in the following section.

2.7. Resource based view theory
The Resource Based View (RBV), founded by Barney et al. (2001) and Barney (2001)is a model that sees resources as key to superior performance of the firm. Arend and Lévesque (2010) mentioned that the RBV as resources represents the characteristics and weapon necessary for a firm in a turbulent or competitive environment and can be used to provide sustainable performance for the firm. Meaning that there is a functional relationship between the RBV and the sustainable performance (Barney, 2001). However, there is still scant literature on the usage of green-servitization as a resource of the firm. Hence, the present study employs green-servitization constructs (Product, Internal Competencies, Maintenance, and Digital Technology) as the firm resources and believes that it can be used to achieve sustainable performance for manufacturing firms.

3. Methodology
The present research employs the quantitative (deductive) approach method to validate the developed hypothesis of the study. This is carried out via sample questionnaire across publicly listed consumer and product manufacturing firms for the independent variable, while the dependent variable utilizes available secondary data of Bursa Malaysia for all public listed consumer product manufacturing firms in Malaysia. The analysis of the data is done through the use of Scientific Package for the Social Science (SPSS) software version 26 due to the small numbers of expected data. This is expected to give a scientific analysis of the present study as there exists little research in this respect.

3.1. Scope of the study
The present study scope involves majorly Malaysian consumer product public listed manufacturing firms. These are firms that are involved in the production of consumer goods and households’ products, agricultural products, automotive products, food and beverages as well as personal goods. These set of firms make and sell products that are intended for direct use by the buyers for their own use and enjoyment. They are selected in the present study because of the huge impact this sector of public listed manufacturing firms has on the overall economy of the country (Yap et al., 2019). Besides that, majority of the available literature focused more on larger firms without due consideration on small and medium firm enterprises even though the latter contributes more to environmental pollution as well as affecting sustainable performance.

3.2. Types of data used
There are majorly two types of data (primary and secondary) employed in the present study (Johnston, 2017; Megel et al., 1994). Both of these types of data are employed in the present study as follows:

(i) Primary data involve gathering of data from first-hand experience. These are data that are objective, reliable and authentic in nature as they have not been published before. Based on this, the validity of such data is greater than secondary data (Saunders et al., 2019). Hence, the present study’s primary data involve collecting data of green-servitization practice based on the constructs identified in this study (Product, Internal Competencies, Maintenance, Digital Technology) of all the consumer product public listed manufacturing firm in Malaysia.

(ii) Secondary data on the other hand involve gathering of data from another sources which have been published initially (Taherdoost, 2018) such as the review of literature, annual reports, census reports, and many more. For the present study, the secondary data involve the annual reports of all the consumer product public listed manufacturing firms in Malaysia.
3.3. Sampling Methods

(i) Sampling elements are usually the object matter in which a certain study information is about. Normally, it is characterised as respondent. The present study sampling element involves managers of public listed consumer product manufacturing firms in Malaysia to determine the relationship of green-servitization and sustainable performance.

(ii) Due to the nature of the present study, the sampling population involves a multistage sampling method in which three (3) managers in ten (10) public listed consumer product manufacturing firms across Malaysia, in total of 30 respondents (general managers, operation managers, R&D managers and environmental or safety managers) were selected as these respondents’ activities directly involve the day-to-day operations of the manufacturing firms.

4. Data collection

There are different types of data collection techniques as identified by past scholars. Morgan and Harmon (2001) explained different mostly used types of data collection procedure and the followings are applied for the present study:

(a) Questionnaire and interview: The term questionnaire is normally used to derive a pattern within a large number of population while interview on the other hand can be used to derive a broad in-depth information on respondents’ behavioural insight as well as actions (Harris & Brown, 2010). Interview technique is usually employed in qualitative research while questionnaire is normally used in a quantitative study. However, both can also be employed in a mixed study. In terms of questionnaire, the survey method is normally employed to gather data (Lutabingwa & Auriacombe, 2007; Megel et al., 1994; Saunders et al., 2019; Taherdoost, 2018).

(b) Reports: This involves data that are originally collected for different purpose and used in another study such as statistical record, annual report, sustainability report as well as administrative record. This type of data are sometimes called archived data as they are already been collected for a certain purpose and preserved to be used in another current research (Hox & Boeije, 2005). Its use is to extract useful information necessary for certain research as employed in the present study.

Based on this, the present study employs the use of questionnaire techniques for the primary data to derive a pattern of green-servitization for independent variable and uses annual reports from Bursa Malaysia as secondary data for the sustainable performance which is the dependent variable among public listed consumer product manufacturing firm in Malaysia. Therefore, the procedure of collecting data involves the use of both primary (questionnaire) and secondary (annual report). The primary data collection involved the use of questionnaire as explained in the following section.

4.1. Data analytical technique

In order to test all the hypothesis of the conceptual framework in the present study, the use of simple linear regression analysis technique is employed using the Statistical Package for Social Sciences (SPSS) version 26. Simple linear regression analysis is used to achieve the objective of this study which is to determine the positive significant relationship between green servitization (GS) and sustainable performance (SP) as the present study involves direct relationship among variables IV (GS) vs DV (SP). The model for the linear regression is given as follows:

\[ Y_1 = \beta_0 + \beta_1 X_1 + \epsilon \]

Where;
- \( Y_1 \) = SP (dependent/response variable)
- \( X_1 \) = GS (independent/regressor variable)
- \( \beta_0 \) = Intercept
- \( \beta_1 \) = Coefficient
- \( \epsilon \) = error term or random disturbance term assumed to be normally distributed with mean zero.
4.2. Results and discussions

Table 1 below shows the summary of the correlation coefficient, R, its square ($R^2$), and the adjusted version of the coefficient (adjusted $R^2$). The correlation coefficient, $R = 0.218$ indicates that there is a very weak correlation between green servitization (GS) and sustainable performance (SP) as expressed by the regression model. The $R^2 = 0.048$ shows that the variation in sustainable performance is only accounted for by 4.8% of the predictor variable (GS). However, $R^2$ tends to increase when more terms are added to the model even if the terms do not add explanation to variability in the population. This requires a downward adjustment to make provision for chance increases in $R^2$, with bigger adjustments for larger sets of explanatory variables (Everitt, 2001). The adjusted $R^2$ results in a revised estimate that only 1.4% of the variability in sustainable performance is explained by green servitization (GS).

The error term measures the difference between sustainable performances of individual company and the mean sustainable performance subject to green servitization. In regression model, the mean deviation is zero (positive and negative deviations cancel each other out). However, the more variable the error, the larger the absolute differences between observed SP and the expected SP. In this case, the model summary Table 2 shows an estimate of the standard deviation of the error term under the column “Std. Error of the Estimate” to be 0.15653 which is very small compared with observed SP which ranges from 2.8 to 5.8.

Table 2 represents the ANOVA Table that provides an F-test for the hypothesis testing. The alternative hypothesis to be tested in this study states that there is positive significant relationship between GS and SP. Here, we clearly reject this alternative hypothesis ($F = 1.400$, $p > 0.001$), and so conclude that there is no positive significant relationship between GS and SP.

Table 3 shows the regression result of the relationship between green servitization (GS) and sustainable development (SP). The table indicates that the coefficient of GS is $-0.040$ which implies a negative relationship with SP. The result is in line with the find of Neely (2007) which discovered that more of the combined manufacturing and service companies went bankrupt than can ever be expected, which implies that transforming from a normal manufacturing firm to a combined manufacturing and service firm might be problematic for some organisations. In some ways, this is not surprising as increased diversification (moving to product and service offerings) might hold some significant challenges for firms, at least because of the increased investment required and changes in risk profile.

The T-ratio ($-1.180$) or P-value (0.247) of GS also indicates that there is no significant relationship between GS and SP as shown in Table 4. Hence, this study revealed that there is no positive significant relationship between GS and SP.

| Model | R | R Square | Adjusted R Square | Std Error of the Estimate |
|-------|---|----------|-------------------|---------------------------|
| 1     | 0.218 | 0.048 | 0.014 | 0.15653 |

| Model | Sum of square | Df | Mean square | F | Sig |
|-------|---------------|----|-------------|---|-----|
| Regression | 0.034 | 1 | 0.034 | 1.400 | 0.247 |
| Residual | 0.686 | 28 | 0.025 | | |
| Total | 0.720 | 29 | | | |
4.3. Validity result

There is need for judgment and feedback from experts who are in the field of servitization and operation management to review the items used in the questionnaire and recommended areas that might require inclusion, amendments or omission. Hence, the present study obtains feedback from two (2) academicians, two (2) policy makers and two (2) industry experts, respectively, from various universities, government institutions and industries to determine validity of items used. In which they all participated and validated the items with feedbacks where appropriate corrections were made (Drost, 2011).

4.4. Reliability result

This provides the consistency of measurement of a study. Klotz (2007) mentioned that the measurement shows the confirmation of result with the equal value. This is done by removing outrightly bias in a study, hence it ensures consistencies and the reliability of the observed score across the instruments used. For the present study, the Cronbach’s Coefficient Alpha by Cronbach (1951) is used to test the reliability and internal consistency. This is because it is the most widely used instrument employed by most researchers in measuring reliability and is able to assess the quality of the research instrument employed for the type of the present study (Mcneish & Mcneish, 2018). As such, Table 5 shows the reliability (Cronbach’s Alpha of .901) which shows a higher reliability of the variables.

Similarly, the item reliability is shown in Table 6 which reveals an acceptable level of >.7 which is the threshold.

According to Klotz (2007), reliability coefficients value ranges between 0 and 1. He identified that higher coefficient indicates higher level of reliability (Heale & Twycross, 2015). Furthermore, a reliability of 0.5 indicates a strong result but the acceptable value of alpha is 0.7 or above which implies that the items

| Table 4. Relationship between Green Servitization (GS) and Sustainable Performance (SP) |
|----------------------------------------|--------|---------|------|-----|
| Variable                               | Coefficient | Standard error | T-ratio | P-value |
| Constant                                | 0.882   | 0.137    | 6.440 | 0.000 |
| Green Servitization (GS)                | -0.040  | 0.034    | -1.180| 0.247 |

| Table 5. Total reliability statistics of GS |
|---------------------------------------------|-----|
| Cronbach’s Alpha                           | N of Items |
| 901                                         | 17 |

| Table 6. Item-Total statistics |
|--------------------------------|
| Scale Mean if Item Deleted  | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach’s Alpha if Item Deleted |
| Product 1                  | 39.300                          | 74.631                          | .759                           | .951 |
| Product 2                  | 39.4667                         | 75.913                          | .594                           | .957 |
| Product 3                  | 39.1667                         | 74.695                          | .750                           | .951 |
| Internal Competencies 1    | 39.400                          | 75.628                          | .805                           | .949 |
| Internal Competencies 2    | 39.4333                         | 75.357                          | .768                           | .950 |
| Internal Competencies 3    | 39.5667                         | 73.702                          | .851                           | .947 |
| Maintenance 1              | 39.4333                         | 72.737                          | .871                           | .947 |
| Maintenance 2              | 39.600                          | 71.076                          | .827                           | .948 |
| Maintenance 3              | 39.600                          | 71.145                          | .823                           | .948 |
| Digital Technology         | 39.7000                         | 73.459                          | .860                           | .947 |
| Digital Technology         | 39.6667                         | 73.333                          | .812                           | .949 |
combined in the scale are measuring the same construct and shows an adequate level of internal consistency (Saunders et al., 2019). Meanwhile, 0.3 value represents the minimum correlation coefficient, thus anything less than that shows an indication that the item in question does not correlate well with the overall scale (Heale & Twycross, 2015; Mcneish & Mcneish, 2018). Based on this, all the reliability of the measurement variable and items is accepted for the present study as they seem to be above 0.7 which is the acceptable threshold.

5. Conclusion
In conclusion, the regression result shows that there is no significant positive relationship between green servitization (GS) and sustainable performance (SP). The negative coefficient of GS indicates an inverse relationship between green servitization (GS) and sustainable performance (SP). This study result is supported by Neely (2007) which discovered that more of the companies that are involved in combined manufacturing and servicing have gone bankrupt than can ever be expected, which implies that transforming from a normal manufacturing firm to a combined manufacturing and service firm might be problematic for some organisations. In some ways, this is not surprising as increased diversification (moving to product and service offerings) might hold some significant challenges for firms, at least because of the increased investment required and changed risk profile. Also, the lack of internal competencies required in manufacturing firms towards achieving green driven initiatives that can transform into sustainable performance which most respondents decline of its availability in the descriptive statistics could also be a contributing factor to the insignificance of green-servitization to sustainable performance. This could serve as a novel finding for this study, thus a recommendation of necessary internal competencies, such as knowledge by managers required to drive green initiative that can provide sustainable performance is eminent for public listed firms of consumer products manufacturing firms in Malaysia.

5.1. Limitation and future recommendation
The present study utilizes small set of data due to the current situation of COVID-19 pandemic, which does not allow for field sampling of large data among many public listed manufacturing firms in Malaysia as a lot of them declined participation. Hence, future research is encouraged to employ larger than this research.

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