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DETERMINANTS OF GREEN PRACTICE BY MANUFACTURING SMEs IN URBAN AREAS OF SRI LANKA

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Abstract: This study examines factors that determine green practice adoption by small and medium scale manufacturing enterprises (SMEs) located in urban areas of Sri Lanka. The determinants include technological factors, organizational factors, business environments, and environmental attitudes and awareness. A questionnaire survey on the green practice adoption of manufacturing SMEs located in the Western Province of Sri Lanka was conducted and data from 342 sample firms was analyzed. The logit regression results reveal that external factors such as regulatory pressure, governmental support, relative advantage, compatibility of green practices and internal factors such as organizational support, quality of human resources, awareness, attitudes and costs and benefits have significant and positive influences on green practice adoption by urban manufacturing SMEs. Meanwhile, complexity has a negative influence on adoption of green practices. However, firm size and customer pressures do not have significant influence.

Key words: Green practices, SMEs, Sri Lanka, Manufacturing sector, SDGs, Logit model

Introduction

Green practices are a mainstream concept in manufacturing SMEs (Arun and Noble, 2017; Matt and Rauch, 2013). Several Sustainable Development Goals (SDGs) also address green concepts and development of a sustainable environment (SDGs 6, 7, 8, 9, 11, 12, 14, and 15). Small and medium scale enterprises (SMEs) comprise a considerable portion of the industrial establishments and value creation in any economy. Previous studies have particularly highlighted the reasons for adopting green practices in the manufacturing process of SMEs and have identified numerous pull factors as well as push factors (see, for example, Stopper et al., 2016). SMEs, when compared with large organizations, are more subjected to legislation requirements and pressures from numerous stakeholders (Esty and Winston, 2009), thus pulling them towards the adoption of green practices.

Some scholars take a positive view when justifying the SMEs' need for 'going green', arguing that "consumer demand for environmentally friendly goods and services as well as the escalating costs

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of waste disposal have triggered environment-related business opportunities for the SMEs" (Yacob et al., 2019: 6). Yacob et al. (2019) further elaborated that SMEs, which are successfully responding to market forces and are innovative enough to reduce waste generation and environmental cost, will gain a competitive advantage. Thus, the nature and character of SMEs (flexibility and innovation) have placed them in a better position to implement green practices (Esty and Winston, 2006).

The case of SMEs in Sri Lanka shows that they have dominated Sri Lankan industrialization during the past decades. The Economic Census conducted in 2013-14 by the Department of Census and Statistics of Sri Lanka (DCSSL) indicates that SMEs play a significant role in Sri Lankan industrialization accounting for 98.5 percent of industrial establishments. SME establishments doubled from 2004 to 2014[1], while the number of large establishments decreased from 1402 in 2004 to 720 in 2014. Employment in SMEs in 2014 was 633,933 which was 50 percent higher than the number of SMEs' employment in 2004. SMEs' value additions to the economy in 2004 and 2014 were 31.6 percent and 31.1 percent, respectively (DCSSL, 2015; 2017).

Of total SME employment (917,107), about 50 percent employment is generated in the industrial sector. The other two sectors, trade and service, generate 20.8 percent and 29.3 percent of employment opportunities, respectively. Meanwhile, 30.4 percent of non-agricultural SMEs are in the industrial sector. The highest number of SMEs are in the service sector, representing 44.2 percent of total SMEs. A large proportion of these establishments and employment is found to be concentrated in three groups of industries: (a) food, beverages and tobacco, (b) textile, apparel and leather products, and (c) non-metallic mineral products (DCSSL, 2015; 2017).

There are numerous studies, conducted all over the world, reflecting important aspects of green practices and/or green manufacturing in SMEs. Links between lean and green manufacturing have been examined through empirical as well as theoretical studies (Hartinia and Ciptomulyonob, 2015; Miller et al., 2010; Sawhney et al., 2007; Wadhwa, 2014). The implementation phase of green manufacturing has gained research attention in developing and developed contexts (Ajin, et al., 2015; Arun and Noble, 2017; Matt and Rauch, 2013). Green initiatives and environmental sustainability have also been researched extensively (Sajan et al., 2017; Stopper et al., 2016; Tiwari and Tiwari, 2016; Yacob et al., 2019). Moreover, green supply chain management activities and performance can also be noted as a well-attended research agenda of contemporary times (Dubey et al., 2014; Dües et al., 2013; Mafini and Loury-Okoumba, 2018). One observation made in the literature review is that the implementation phase of green practices or green manufacturing in SMEs has received more attention in the existing literature, rather than looking into the issue of sustaining of adopted green practices of such enterprises. Although several studies analyzed green supply chain management (GSCM) adoption in developed countries, these studies may not be relevant for emerging countries like Sri Lanka due to socio-economic differences. This justifies the rationality and significance of conducting empirical research on the factors that determine GSCM adoption in a Sri Lankan SMEs context. Therefore, to fill the gap in GSCM research, the purpose of the present research is to identify the factors that determine the adoption of GSCM among SMEs in Sri Lanka.

Furthermore, SMEs operating in Sri Lanka also experience pressures from numerous stakeholder groups for adopting green practices in their manufacturing systems and processes. However, the greening efforts of the SMEs in Sri Lanka, their failures or success stories, and the problems and issues associated with green manufacturing are yet to be examined in depth at individual firm and national level. SMEs usually try to apply cost savings methods. Therefore, it is very interesting to know that

[1] However, this trend can be observed everywhere in the world since industrial organizations were changed from 'hierarchy' to 'market' and then from 'market' to further 'network'.

SMEs, particularly in urban areas, tend to adopt green practices. What are the determinant factors?

On these grounds, the research questions raised to answer in the present study are as follows: (a) to what extent have the green practices been adopted by the manufacturing SMEs located in the urban settings of Sri Lanka, (b) what factors determine the adoption of green practices in urban SMEs and (c) what managerial and policy recommendations can be proposed to improve green practices and to obtain sustainable and better business performance. Thus, the objectives of this study are three-fold: (a) to explore the green practices adopted by urban manufacturing SMEs in Sri Lanka, (b) to identify determinants that influence adoption of green practices in urban SMEs, and (c) to draw lessons for adopting better green practices in manufacturing SMEs located in urban areas of Sri Lanka.

The paper is structured as follows: introduction, a review of literature which covers the existing knowledge on green manufacturing practices, followed by an elaboration of the methods adopted for facilitating the replication of the study. The next section will present the detailed findings with a discussion in line with determinants of green practices in urban manufacturing SMEs. Conclusion and recommended policy guidelines and directions for further studies will follow.

Literature Review

SMEs are identified as an important sector which acts as the backbone of economic growth, regional development, poverty alleviation and employment generation in many countries. Industrial globalization and the competitive marketing environment have gifted SMEs vast opportunities for the growth and development of its sectors (Thanaki et al., 2016). To enhance the operational performance, organizations use green techniques to identify and eliminate waste while optimizing resource utilization through continuous performance improvement (Siegel et al., 2019).

The concern for the environment has risen over the past decade and this has pressured SMEs to adopt green practices and operational practices in manufacturing. Green practices minimize the negative impact on the environment caused by production practices. It helps to enhance the ecological efficiency of the process while improving the financial performance.

Although SMEs account for more than 75 percent of the total number of enterprises, provide 45 percent of the employment, and contribute 52 percent of the Gross Domestic Product of Sri Lanka, the impact of this sector on the environment has drawn public attention over past two decades. This has persuaded SMEs to seek environmental efficiency over operational efficiency (Farias et al., 2017). Green practices play a key role in enhancing environmental efficiency. Increasing energy prices, natural resource pollution, global warming, and implementation of government policies and regulations related to environmental standards have resulted in Sri Lankan SMEs to adopt green practices.

Peng and Lin (2008) defined green management as the process of producing environmentally friendly products; such a process causes minimum harm to the environment. Costello (2008) stated that environmental management and corporate sustainability are close substitutes for green management. Baines et al. (2012) emphasized the usage of key words such as "green", "environmentally clean" or "cleaner", "ecological" or "eco-efficient" in production sector and defined "green production" as the application of environmentally and socially sensitive practices to reduce the negative impact of various aspects of manufacturing activities while, at the same time, harmonizing the pursuit of economic benefits. Hence, sustainable manufacturing refers to a manufacturing system or process that meets these three critical factors, i.e. impacts on the environment, economy, and society. Haden et al. (2009) stated that the green practice is a process of

applying innovation to achieve sustainability, waste reduction, social responsibility, and a competitive advantage via continuous learning and development and by embracing environmental goals and strategies that are integrated with institutional goals and objectives. Lo (2013) divided the green supply chain practices into green design, green purchase, green manufacturing, and green logistics corresponding to the plan, source, make, and deliver/return processes. Lo further found that some firms had modified their organizational structure to accommodate green practices. In this perspective, "greening" of business is part of a long-term strategy of becoming sustainable, i.e. being able to achieve business tasks in the way that does not develop any threat — economic, social or environmental — for both current and future generations (Čekanavičius et al., 2014). These green practices may be internal or external practices (Čekanavičius et al., 2014). Internal green practices are, for example, removing extra devices from computers when they are not used, switching off computers when leaving the workplace, switching off lights when leaving the workplace, recycling, introducing an "office without paper" system — printing only when necessary, and no smoking in the office (Čekanavičius et al., 2014). Some examples for external green practices include manufacturing ecological products, (financially) supporting environmental projects conducted by others, supporting students' environmentally friendly projects, organizing and participating seminars about environmental issues.

During the production process, the 3R concept — reduce, reuse and recycle techniques — can be used to reduce the impact to the environment (Thanaki and Thakkar, 2017). Adoption of green practices will provide SMEs with environmental, financial and operational benefits, and improve health conditions of employees and reduce safety risk. Adoption of green practices by SMEs will also be an answer for the larger existing environmental and ecological degradation problems which have caused over exploitation of natural resources by humans. At micro level, implementing green practices will bring higher profits and help to increase the performance of SMEs as well.

In addition, green practices directly contribute to achieve several Sustainable Development Goals (SDGs) by 2030. Green practices by manufacturing SMEs will ensure healthy lives and promote well-being for all at all ages (SDG 3); ensure availability of water and sustainable management of water and sanitation for all (SDG 6); ensure access to affordable, reliable, sustainable and modern energy for all (SDG 7); promote inclusive and sustainable economic growth, full and productive employment and decent work for all (SDG 8); promote inclusive and sustainable industrialization and foster innovation (SDG 9); make cities and human settlements inclusive, safe, resilient and sustainable (SDG 11); ensure sustainable consumption and production patterns (SGD 12); take urgent action to combat climate change and its impacts (SDG 13); conserve and sustainably use the oceans, seas and marine resources for sustainable development (SDG 14); and protect, restore and promote sustainable use of ecosystems, sustainably manage forests, combat desertification (SDG 15).

Sri Lanka has taken various momentous initiatives to achieve SDGs by 2030 (Ministry of Sustainable Development, 2018). The most significant one is the Sustainable Development Act in 2017.[2] Under the Act, the Sustainable Development Council was established. The Council has the power to formulate related national policies and guides new development projects. Further, the government established the Ministry of Sustainable Development in 2018 and conducted a baseline survey to investigate the baseline situation. All the national strategy plans and other development projects are aligned with SDGs.[3] The National Industrial Development Policy report (currently

[2] The Act establishes the legal framework to implement the SDGs.

[3] where about 98.5 percent of industrial establishments are SMEs.

developing) addresses how the industrial sector contributes to achieve SDGs. Since 2018, Sri Lanka mainstreamed SDGs into the Government's National and Provincial budgets.

However, there are numerous challenges when implementing green practices. Lack of measurements to identify the sustainability of green concept, lack of awareness on green initiatives of the top management, and lack of employee engagement in organizations are some common challenges in implementing green initiatives. As there are many structural differences between SMEs and large organizations, SMEs face more challenges in implementing these green initiatives. In SMEs the lack of human resources to implement green practices is a factor of failure. Financial constraints in adapting to new technologies, reluctance of top management for investments of such projects, and poor engagement in new product development are the major challenges in implementing green practices (Premaratna et al., 2021). These challenges can be overcome by developing and implementing a broad framework and developing a set of tools for green initiatives. At the same time, some empirical studies (Esty and Winston, 2009; Yacob et al., 2019) highlighted that SMEs are in a better position to implement green practices because they are more flexible and open to niche markets in response to emerging demands from new stakeholders. This indicates that empirical studies have shown mixed or even conflicting findings although most past studies (Dixon-Fowler et al., 2013; Tilley, 1999) argued that good environmental performance including green practices could lead to better financial performance. Addressing the research gaps in green management is a necessity.

Theories and Conceptual Framework

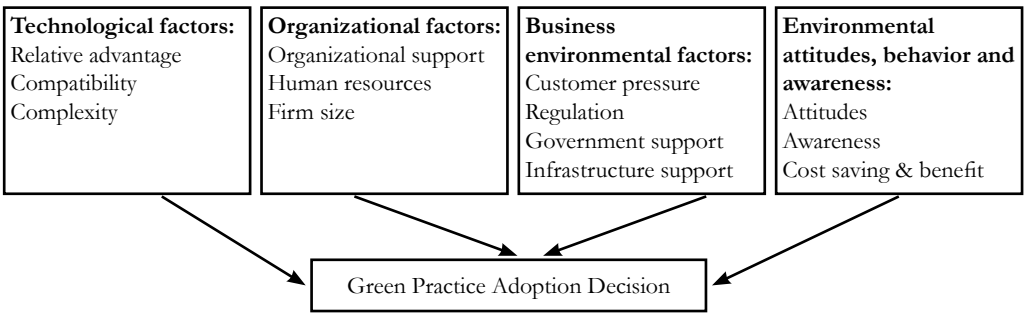
Identification of green determinants is important for the people who are engaged in SMEs in order to improve the processes they use and to develop new green processes. Financial performance is a key determinant which has to be considered when adopting green practices. Studies have found that implementing green practices into production processes has improved cost parameters (Wen Chiet et al., 2018). Providing financial incentives to companies who are willing to implement green practices is another key determinant which will bring positive results. Government policies play a key role as SMEs should adhere to the environmental policies formed by the government and develop their processes according to those legislations. Increasing awareness in green practices, conducting training programs and providing education on green practices are prerequisites for the employees in SMEs for adopting green practices (Zhu and Kramer, 2005).

Customers, suppliers, environmental groups, financial institutions and other external stakeholders who are aligned with the SMEs influence green practices as they request for certified products while the suppliers are unable to conform with environmental certifications and lean management techniques yet (Yacob and Moorthy, 2012). As well as the external stakeholders, internal stakeholders influence in adopting green management practices of SMEs. Their knowledge, attitudes, management and commitment are crucial for fruitful application of green management practices. Raising public awareness is crucial as when customers request for certified products, the suppliers will match with the customer specifications. As SMEs account for more industrial pollution in developing countries than large organizations, this matter should be wisely addressed and necessary actions should be taken (Koirala, 2018).

Theoretically, the paper employs an integrated model which is developed by Ibrahim and Jaafar (2016), combining Technology-Organization-Environment (TOE) theory and Theory of Planned Behavior (TPB). TOE theory was developed by Tomatzky and Fleischer in 1990 to predict the likelihood of innovations adoption. According to TOE, innovations adoption is determined by

technological factors, organizational factors, and environmental factors (Kauffman and Walden, 2001; Kowtha and Choon, 2001). All of them are a combination of internal and external factors in business firms. Technological factors depend on benefits or relative advantages, compatibility, complexity, trialability and observability. In the present research, only relative advantage, compatibility and complexity will be focused on as done by Tornatzky and Fleischer (1990). Organizational factors include top management support, organizational culture, firm size, management structure, and quality of human resources (Tomatzky and Fleischer, 1990). Business environment factors are related to competitive pressure, trading readiness, socio-cultural environment, government support and regulation, and other aspects of infrastructure (Scupola, 2003; Zhu and Kramer, 2005). However, TOE is silent about the influence of behavioral, attitudes, awareness and benefits on green and technology adoption decisions (Awa et al., 2012; Bohdanowicz, 2005; Ibrahim and Jaafar, 2016). Theory of Planned Behavior (TPB), which is rooted in theories of social psychology, addresses these behavioral and attitude related factors (Ajzen, 1985; Lin et al., 2009) such as environmental awareness (Roberts and Tribe, 2008), owner-manager attitude (Bohdanowicz, 2005; Yoon, 2011), and cost savings and perceived benefits (Gerrans and Hutchinson, 2000; Nicholls and Kang, 2012; Tzschentke et al., 2004). Therefore, the present paper establishes a theoretical triangulation of TOE and TPB and employs the following conceptual model.

Figure 1: Conceptual Framework



Data and Method

To investigate determinants of green practices among urban SMEs, a sample survey of 342 SMEs in the Western Province in Sri Lanka was conducted under the World Bank project, namely 'Green Adoption of SMEs in Sri Lanka'. During May-September 2019, face-to-face interviews were carried out with SME owners and managers. The sample was selected randomly from the manufacturing SME list which was prepared by the research team collecting information from the Chamber of Commerce, Ministry of SME Development, and Department of Census and Statistics in Sri Lanka since there was no single list readily available about SMEs in Sri Lanka.

In this research, the general population comprises manufacturing SMEs in Sri Lanka. As mentioned above, there is no nationally accepted definition for the small industries in Sri Lanka, while different definitions have been adopted by different institutions and studies for different purposes. Some organizations adopt the criteria of employment while others adopt a criteria based on the value of fixed assets. Using the size of capital and the number of employees as criteria, the Industrial Development Board (IDB) in 1994 defined a small industry as an establishment whose

capital investment in plant and machinery does not exceed LKR 4 million and the total number of regular employees does not exceed 50 persons. Many studies on the small industries sector have formulated their own definitions. The present study employs the definition used by IDB for SME development.

According to the latest available Industrial Census conducted by the Department of Census and Statistics (DSC) in 2014, there are 5114 formal manufacturing SME establishments in Sri Lanka of which 3044 are located in the Western Province. Since 60 per cent of the total manufacturing SMEs are located in the Western Province, the samples have been selected from the Western Province. Using the Krejcie and Morgan formula with 5 percent degree of accuracy and 95 percent confidence interval, 342 of manufacturing SMEs are selected for the survey:

$$S = X^2NP(1\text{-}P) \div d^2 (N - 1) + X^2 P(1 - P)$$

The survey was administered by face-to-face interviews by trained research assistants and closely supervised by the research team. At least one member of the research team visited SMEs during the data collection period. Descriptive statistics, correlation and logit regression models were used for analyzing data.

Model Specification

The current study seeks to analyze green practice adoption decisions by urban manufacturing SMEs in Sri Lanka. We first treat urban manufacturing SMEs' choice — i.e. whether to adopt green practices or not — as the dependent variable. Therefore, the dependent variable is a binary one: that is, whether SMEs adopt green practices and not. The logistic regression has been recognized as the best approach to obtain precise estimates on the level of adoption in social sciences and management (Adeogum et al., 2008). In other words, the logistic regression is the best fitting model to describe the relationship between the dichotomous dependent variable and a set of independent variables. The logistic regression is characterized by representing one or more independent variables, which can be continuous and/or categorical, that determine a dependent variable or outcome, which is a binary variable.

The Logit method is a non-linear probability model. The model has a probability function which is the standard normal cumulative distribution function and gives the probability of occurrence of a certain event. In the model that is employed in this study, the dependent variable is a dummy corresponding to green practice adaptation, which takes the value equal to one when the SME has decided to adopt green practices and zero in the other case.

Thus,
$$P(y = 1 \mid x) = G(x \mid \beta) = p(x) \tag{1}$$

where x = matrix of the complete group of independent variables and β = matrix of the group of coefficients of independent variables.

In equation (1), G(x) is a cumulative distribution function (CDF) which assumes restricted values between zero and one. In the Logit model used in this study, G is a function of the standard normal CDF as follows:

$$G(z) = \Phi(z) = \int_{-\infty}^{z} \phi(v)dv \tag{2}$$

in which $\phi(z)$ is the standard normal density:

$$\phi(z) = (2\pi)^{-1/2} e^{(-z^2/2)} \tag{3}$$

The Logit model is derived from an underlying non-observed variable model, represented by y^*:

$$y^* = x\beta + e,$$
$$y = 1[y^* > 0] \quad (4)$$

In equation (4), $1[y^* > 0]$ defines a binary outcome, since it assumes the value 1 if the event in brackets is true, and 0 in case it is not. Therefore:

$$y = 1, \text{ if } y^* > 0 \quad (5)$$

$$y = 0, \text{ if } y^* \leq 0 \quad (6)$$

It also assumes that the error term is independent of x in this model, and consequently, the error is symmetrically distributed around mean zero, and 1-G(-z) = G(z) to every real z. Following these assumptions, the response probability for y is:

$$P(y = 1 \mid x) = P(y^* > 0 \mid x) = P[e > -(x\beta) \mid x] = 1 - G[-(x\beta)] = G(x\beta) \quad (7)$$

$$Logit\ (P) = Ln\left(\frac{P_i}{1 - P_i}\right) = P[e > -(x\beta) \mid x] = 1 - G[-(x\beta)] = G(x\beta) \quad (8)$$

In order to estimate the effect of the explicative variables x_j on $G(x\beta)$, i.e. the probability of success, the calculation of the partial derivative of $P(y = 1 \mid x)$ will be done:

$$\frac{\partial p(y = 1/x)}{\partial x_j} = g(x\beta)\beta_j, \text{ in which } g(z) \equiv \frac{dG}{dz}(z) \quad (9)$$

where G = CDF of a continuous random variable, and

g = probability density function.

As both functions G[.] and g(z) are strictly increasing, the partial effect of the independent variable x_j on $p(x)$ depends on x due to $G(x\beta)$, and, consequently, the partial effect will have the same sign as β_j, as is clear from the partial derivative above. This process also shows that the effect of two continuous variables is independent of x; the ratio of partial effects of x_j and x_h and is given by β_j / β_h. In examining the marginal effects, the partial derivative can be measured and it shows whether the effect is positive or negative. But to find the magnitude of the effect, it is necessary to estimate how the whole cumulative distribution function changes when the explanatory variable changes. Simply, marginal effect (dP/dX) indicates the effect of one unit change in each exogenous variable on the probability of the SME green practice adaptation.

The equation estimated in this study is as follows:

$$GPA = \beta_0 + \sum_{i=1} \beta T + \sum_{i=1} \delta_i O_i + \sum_{i=1} \gamma_i BE_i + \sum_{i=1} \varphi_i EAA_i + e \quad (10)$$

where GPA is green practice adoption (GPA); T is for technological factors; O is for organizational factors; BE is for business environment related factors; and EAA is for environment related attitude and awareness factors.

Results and Discussions

It has been observed that 65.5 per cent of the urban manufacturing SMEs (224 SMEs out of the total sample) in the study area adopted green practices. This indicates that the majority of the

manufacturing SMEs in Sri Lanka adopted green practices. This result is supported by the findings of Jayarathna and Wickramasinghe (2019). About 66 per cent of the SMEs have started to adopt green practices in the last 6 years. However, only 2.3 per cent of the manufacturing SMEs have a written policy on green practices (Table 1). Table 1 presents some important information related to green practice adoption by the manufacturing SMEs.

Table 1: Some Important Information Related to Green Practice Adoption by SMEs

	Yes		No	
	Number	Percent	Number	Percent
Manufacturing SMEs adopting green practices	224	65.5	118	34.5
Manufacturing SMEs with written policy on green practices	8	2.3	334	97.7
Types of green practices adopted by manufacturing SMEs:				
1. Produce environment friendly products	149	43.6	193	56.4
2. 3Rs (Reduce, reuse, and recycle)	123	36.0	219	64.0
3. Making environment green	117	34.2	225	65.8
4. Supplier evaluation (green checking of raw materials)	69	20.2	273	79.8
5. Life cycle analysis	6	1.8	336	98.2
Reasons for adopting green practices:				
1. To comply with regulations	305	89.2	37	10.8
2. Owners' own ideas/awareness (voluntary)	66	19.3	276	80.7
3. Under pressure from competitors	46	13.5	296	86.5
4. Under pressure from customers	45	13.2	297	86.8
5. Under pressure from suppliers	4	1.2	338	98.8

Source: Field survey, 2019

The majority of the manufacturing SMEs (89.2 per cent) that have adopted green practices have done so due to regulatory requirements. 19.3 per cent of the manufacturing SMEs have voluntarily adopted green practices. Only 13.2 per cent of the sample firms adopted green practices due to pressures from customers (Table 1). The manufacturing SMEs under study adopted various types of green practices. However, most common green practices are (1) environment friendly products (43.6 per cent), (2) 3Rs (36 per cent), (3) making environment green (34.2 per cent), and (4) green checking when buying raw materials (20.2 per cent) (Table 1). This indicates that manufacturing SMEs apply green practices across the supply chain. Empirical studies (Meera and Chitramani, 2016; Rao, 2007) in other countries confirm the findings of the current study.

Factor analysis was used to check the validity of the determinant factors. The results are presented in Table 2. According to the reliability coefficients (Cronbach's α values for technological factors, organizational factors, business environmental factors, and environmental attitudes and awareness are 0. 7622, 0.8532, 0.7662 and 0.7652, respectively. It can be concluded that the results are reliable since all the Cronbach's α values for this study are above 0.7 (Nunnally, 1978).

Table 3 shows the correlation matrix of the determinant factors and the adoption of green practices. The determinant factors are not highly correlated, and this has confirmed that there is no multicollinearity issue. All the other key assumptions of linearity, normality, and heteroscedasticity were tested; and they were found satisfied.

Logit regression analysis is used in this study to test whether the proposed determinants (technological, organizational, and environmental factors and environmental awareness and attitudes) will affect the adoption of GSCM by manufacturing SMEs in urban Sri Lanka. Regression results are presented in Table 4.

Table 2: Description, Measurement and Validity of the Variables

Variable	Description of variable	Measurement of variable	Cronbach's α
Dependent variable			
Green practice adoption (GPA)	Whether or not SMEs adopt green practices	GPA = 1, if SMEs adopt green practices; GPA = 0, otherwise	0.8112
Independent variable			
Technological factors (T)			0 .7622
Relative Advantage (RA)	1. The green practices are able to provide better environmental performance (Likert scale 1 to 5)* 2. The green practices can enhance our firm's reputation (Likert scale 1 to 5)* 3. The green practices can provide higher economic returns (Likert scale 1 to 5)*	RA = 1, if RA (average value) > 3; RA = 0, if RA (average value) ≤ 3	0.8881
Compatibility (COP)	1. The green practices are line with our firm's values (Likert scale1 to 5)* 2. The green practices are compatible with our current production line (Likert scale 1 to 5)* 3. Integrating the green practices with our firm management system is easy (Likert scale 1 to 5)*	COP = 1, if COP (average value) > 3; COP = 0, if COP (average value) ≤ 3	0.6722
Complexity (COX)	1. Understanding the green practices is not easy (Likert scale 1 to 5)* 2. Learning the green practices is not easy (Likert scale 1 to 5)* 3. Sharing the knowledge of the green practices is difficult (Likert scale 1 to 5)*	COX = 1, if COX (average value) > 3; COX = 0, if COX (average value) ≤ 3	0.7253
Organizational factors (O)			0.8532
Organizational Support (OS)	1. Owner/management encourages employees to learn green knowledge (Likert scale 1 to 5)* 2. Our firm provides facilities for employees to learn green knowledge (Likert scale 1 to 5)* 3. Our firm has a system to provide rewards for employees' green behavior (Likert scale (1 to 5)*	OS = 1, if OS (average value) > 3; OS = 0, if OS (average value) ≤ 3	0.9263

Variable	Description of variable	Measurement of variable	Cronbach's α
Human Resource (HR)	1. Workers are capable of learning new technologies easily (Likert scale 1 to 5)* 2. Workers are providing new ideas for our firm (Likert scale (1 to 5)* 3. Employees are capable of solving problems easily (Likert scale 1 to 5)*	HR = 1, if HR (average value) > 3; HR = 0, if HR (average value) ≤ 3	0.8652
Firm Size (FS)	1. Our firm size is big enough for green practices (Likert scale 1 to 5)* 2. We have enough manpower to apply green practices (Likert scale 1 to 5)* 3. Firm size is not a problem for us to apply green practices (Likert scale 1 to 5)*	FS = 1, if FS (average value) > 3; FS = 0, if FS (average value) ≤ 3	0.6231
Business environment related factors (BE)			0.7652
Customer Pressure (CP)	1. Our customers ask us to improve environmental performance (Likert scale 1 to 5)* 2. Customers are mindful about green products (Likert scale 1 to 5)* 3. Green practices are an important consideration for our customers (Likert scale 1 to 5)*	CP = 1, if CP (average value) > 3; CP = 0, if CP (average value) ≤ 3	0.5326
Regulation (R)	1. Government sets environmental regulations (Likert scale 1 to 5)* 2. Government regularly monitors our environmental regulation practices (Likert scale 1 to 5)* 3. We are very particular on environmental regulations (Likert scale 1 to 5)*	R = 1, if R (average value) > 3; R = 0, if R (average value) ≤ 3	0.8865
Government Support (GS)	1. Government provides financial support for adopting green practices (Likert scale 1 to 5)* 2. Government encourages us for adopting green practices (Likert scale 1 to 5)* 3. Government supports training manpower to develop green practice skills (Likert scale 1 to 5)*	GS = 1, if GS (average value) > 3; GS = 0, if GS (average value) ≤ 3	0.6231
Infrastructure Support (IS)	1. We have infrastructure facilities to support green practices (Likert scale 1 to 5)* 2. Our firm uses the existing infrastructure for green practices (Likert scale 1 to 5)* 3. Whenever possible we use eco-friendly infrastructure (Likert scale 1 to 5)*	IS = 1, if IS (average value) > 3; IS = 0, if IS (average value) ≤ 3	0.5324

Variable	Description of variable	Measurement of variable	Cronbach's α
Environment related attitudes and awareness factors (EAA)			0.8653
Attitudes (AT)	1. As a firm, our management is positive toward environment (Likert scale 1 to 5)* 2. Our employees are positive toward environment (Likert scale 1 to 5)* 3. Customers prefer environment-friendly products (Likert scale 1 to 5)*	AT = 1, if AT (average value) > 3; AT = 0, if AT (average value) ≤ 3	0.8965
Awareness (AW)	1. We are aware of good environmental practices (Likert scale 1 to 5)* 2. Customers are aware of good environmental practices (Likert scale 1 to 5)* 3. We as a firm value green practices (Likert scale 1 to 5)*	AW = 1, if AW (average value) > 3; AW = 0, if AW (average value) ≤ 3	0.6543
Cost saving and benefits (CB)	1. Recycling practices benefit our frim (Likert scale 1 to 5)* 2. We adopt cost saving operation (Likert scale 1 to 5)* 3. We always try to minimize wastages (Likert scale 1 to 5)*	CB = 1, if CB (average value) > 3; CB = 0, if CB (average value) ≤ 3	0.8457

*Note:**All the independent variables are measured in Likert scale (1 to 5 as follows): Strongly Disagree (1); Disagree (2); Neutral (3); Agree (4); and Strongly Agree (5). And then they are converted into dummy variables as indicated in the third column of this table.

Source: Authors' conceptualization and field survey, 2019

Table 3: Descriptive Statistics and Pearson Correlation Matrix of the Variables

Variables	Mean	SD	RA	COP	COX	OS	HR	FS	CP	R	GS	IS	AT	AW
RA	3.64	0.662	1											
COP	4.61	0.672	0.431	1										
COX	3.82	0.621	0.321	0.231	1									
OS	4.07	0.645	0.523*	0.354**	0.523	1								
HR	3.42	0.842	0.532**	0.632**	0.524*	0.623**	1							
FS	2.65	0.723	0.532*	0.235	0.231	0.322	0.235*	1						
CP	3.52	0.632	0.324	0.236	0.365	0.253	0.366*	0.452**	1					
R	4.23	0.523	0.231	0.258*	0.235*	0.623	0.254	0.235*	0.366	1				
GS	3.56	0.852	0.325	0.362**	0.244	0.256	0.254*	-0.235*	0.215*	0.412*	1			
IS	3.65	0.325	0.532	0.564	0.332	0.362	0.421	0.325	0.255	0.326	0.334*	1		
AT	4.52	0.532	0.231*	0.635	0.532	0.253	0.234*	0.512	0.334	0.423	0.245	0.245	1	
AW	4.32	0.652	0.356**	0.423*	0.425*	0.254	0.256*	0.335	0.422	0.364*	0.366	0.325*	0.326*	1
CB	4.25	0.596	0.325*	0.356**	0.236*	0.142	0.564*	0.231**	0.338*	0.854*	0.642*	0.421*	0.457*	0.856**

Notes: * Correlation is significant at the 1% level; ** Correlation is significant at the 5% level

Source: Original data collected through field survey, 2019

Table 4: Regression Results

Explanatory variables	Coefficient	t-value	Std. error
Technological factors (T):			
Relative advantage (RA)	0.136*	3.982	0.3420
Compatibility (COP)	0.124**	2.653	0.0467
Complexity (COX)	-0.114**	2.853	0.0399
Organizational factors (O):			
Organizational support (OS)	0.532**	2.652	0.2005
Human resource (HR)	0.453*	4.562	0.0992
Firm size (FS)	0.123	1.124	0.1094
Business environment related factors (BE):			
Customer pressure (CP)	0.063	1.024	0.0615
Regulation (R)	0.563*	3.586	0.1570
Government support (GS)	0.186**	3.002	0.0619
Infrastructure support (IS)	0.145**	2.998	0.0484
Environment related attitudes and awareness factors (EAA):			
Attitudes (AT)	0.685**	3.265	0.2098
Awareness (AW)	0.758*	4.362	0.1737
Cost saving and benefits (CB)	0.545**	3.002	0.1815

Notes: * $p < 0.01$, ** < 0.05, N = 342, Adj $R^2 = 0.624$
Source: Original data collected through field survey, 2019

All the variables except firm size (FS) and customer pressure (CP) are found statistically significant. Importantly, all the technological factors are statistically significant, which indicates that relative advantage, compatibility, and complexity have significant impact on the green practice adaptation decision of manufacturing SMEs in Sri Lanka. However, technological complexity has a negative impact on GPA, while the other two factors influence it positively. This indicates that SMEs have to spend some time to understand technological complexity. Good understanding of green practice technology will enhance the adaptation of green practices. Also, making technology simple and clear can help SMEs to adopt green practices.

All the organizational factors except firm size (FS) are statistically significant and have positive sign. As Zhu et al. (2008) highlighted, organizational support and quality of staff are highly influential factors in regard to the adoption of GSCM practices. Evidence from other countries suggests that organizational support plays significant role in implementing green practice adoption decisions (Lin and Ho, 2011). Quality of human resource or staff depends on the level of education, skills, and experience of the staff. This also depends on the learning and training environment of SMEs. Staff training improves quality of human resources (Murphy and Poist, 2003), which in turn facilitates green practices adoption. However, as said, firm size is not a significant variable. Contrary to our study, Reyes-Rodriguez et al. (2016) found size of the firm as a significant factor in adoption of green practices by SMEs.

Except customers' pressure (CP), all the business environment related factors are statistically significant and have positive influences on the dependent variable. Among them, regulation (R) is the key factor that determines adoption of green practices. Most of the SMEs interviewed adopted green practices due to regulatory requirements. Business companies in Sri Lanka have to get a certification from Sri Lanka Environmental Authority for business registration. Environmental policies in Sri Lanka are very strong and well established. The government provides various specific supports to SMEs only when the latter comply with the stringent conditions of the adoption of

green practices. Since most of the SMEs suffer from lack of financial and technological resources and capacity, government support is vital for them. Therefore, government support as well as regulatory obligations directly and positively influence SMEs' green practice adoption decisions. Though customer pressure (CP) has a positive sign, it is not a significant variable. In the case of logistics companies in Malaysia, Ibrahim et al. (2018) found similar results. According to them, this is due to the lack of encouragement from the customers on green initiation. In this regard, it is to be noted that average customers are mainly concerned about prices, and firms focus more on cost efficiency than green effects.

The factors pertaining to environment related awareness and attitudes have positive signs and are statistically significant. Awareness of the owners and employees about the environment has positive influence on decisions regarding adoption of green practices. Prior studies discovered a positive relationship between awareness about environmental issues and the efforts of green practices by SMEs (Gadenne et al., 2009). Attitude is also a statistically significant variable and has a positive sign. Owners who are concerned about the environmental issues and have positive attitudes are willing to adopt green practices. However, though some studies support the findings of the current study (Park and Kim, 2014; Schaper, 2002), some other studies did not find a relationship between environment related attitudes of the owners and green practices (Gamba and Oskamp, 1994; Lansana, 1992). Green practice adoption decisions always have a link with costs and benefits. This supports the findings of Ramakrishnan et al. (2015). Business firms always have a profit motive and they are ultimately concerned about how to increase profits.

Conclusions

Towards achieving sustainable development by combating environmental issues, green practices have become critical concerns all over the world; and this burning issue is highlighted directly and indirectly in many clauses of SDGs. Firms are internally as well as externally under pressure to engage in environmentally responsible and eco-friendly operations, and thus to adopt green practices. Some of the manufacturing SMEs that have been studied in urban areas in Sri Lanka carry out green practices throughout their supply chain.

This study conducted a questionnaire survey of 342 manufacturing SMEs located in urban areas of Sri Lanka with the objective of studying green practice adoption by SMEs. Theoretically, the determinants are classified into technological factors, organizational factors, business environment related factors, and awareness and attitude related factors. The research findings reveal that external factors such as regulatory pressure, government support, relative advantage, compatibility of green practices and internal factors such as organizational support, quality of human resources, awareness, attitudes and cost and benefits have significant and positive influences on green practice adoption by urban manufacturing SMEs in Sri Lanka. Meanwhile, complexity has a negative influence on adoption of green practices. However, firm size and customer pressures are not statistically significant as far as adoption of green practices by manufacturing SMEs is concerned.

The results of the present study have practical implications for the work of researchers, managers, business owners and policymakers for advancing green practice adoption in manufacturing SMEs. First, the government may provide greater support for capacity building, technology transfers and creation of an enabling business environment in addition to being a regulator. Technological complexity negatively impacts on adoption of green practices. Government and other relevant organizations can support SMEs in capacity building through seminars and trainings. They can also develop funding programs for SMEs dedicated to green initiatives. Second, customer awareness

about the importance of green concepts should be created. Third, most studies of green adoption have focused on manufacturing firms. Therefore, researchers should pay additional attention to the service sector as well. Researchers have paid very little attention to cost-effectiveness of green practices (Rao and Holt, 2005). Finally, green practices in different countries may lead to different conclusions and policy implications. Therefore, future studies can employ the same model to different countries and can focus on comparative studies.

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References

Adeogun, A., A.M. Ajana, A. Ayinla, M.T. Yarhere, and M.O. Adeogun (2008), "Application of logit model in adoption decision: A study of Hybrid Clarias in Lagos State, Nigeria", *American Eurasian Journal of Agricultural and Environmental Science*, 4(2): 468-472.

Ajin, B.S., T. Raju, and A.S. Prasanth (2015), "A comprehensive study on implementation of lean manufacturing in coir based SMEs in Kerala", *International Journal of Engineering Trends and Technology*, 30(1): 8-12.

Ajzen, I. (1985), "From intention to actions: A theory of planned behavior", New York: Springer-Verlag.

Arun, C., and P.K. Noble (2017), "Factors affecting the implementation of green manufacturing: A case study analysis in an automotive industry", *International Research Journal of Engineering and Technology,* 4(6): 1945-1948.

Awa, H.O., B.C. Emecheta, and U. Ojiabo (2012), "Integrating TAM and TOE frameworks and expanding their characteristic constructs for ecommerce adoption by SMEs electronic commerce (EC)", Proceedings of Informing Science & IT Education Conference (InSITE).

Baines, T., S. Brown, O. Benedettini, and P. Ball (2012), "Examining green production and its role within the competitive strategy of manufacturers", *Journal of Industrial Engineering and Management*, 5(1), 53-87.

Bohdanowicz, P. (2005), "European Hoteliers' Environmental Attitudes: Greening the Business", *Cornell Hotel & Restaurant Administration Quarterly,* 46(2): 188–204.

Čekanavičius, L., L.R. Bazytė, and A. Dičmonaitė (2014), "Green Business: Challenges and Practices", *Ekonomika*, 93(1): 74-88.

Chiet, C.W., N.T. Ching, S.L. Huat, M. Fathi, and T.J. Tzuu (2019), "The Integration of Lean and Green Manufacturing for Malaysian Manufacturers: A Literature Review to Explore the Synergies between Lean and Green Model". In IOP Conference Series: *Earth and Environmental Science*, 268(1): 120-166.

Costello, M. (2008), "13 Steps to Green Your Business", *Business and Economic Review*, 54(4): 6-9.

DCSSL (2017), "Final Report for Construction, Trade and Services (Formal Sector)", Economic Census, Department of Census and Statistics, Colombo, Sri Lanka.

DCSSL (2015), "Non-Agricultural Economic Activities in Sri Lanka", Economic Census, Department of Census and Statistics, Colombo, Sri Lanka.

Dixon-Fowler, H.R., D.J. Slater, J.L. Johnson, A.E. Ellstrand and A.M. Romi (2013), "Beyond 'does it pay to be green?' A meta-analysis of moderators of the CEP–CFP relationship", *Journal of Business Ethics*, 112(2): 353-366.

Dubey, R., S. Bag, and S.S. Ali (2014), "Green supply chain practices and its impact on organizational performance: An insight from Indian rubber industry", *International Journal of Logistics Systems and Management,* 19(1): 20-42.

Dües, C.M., K.H. Tan, and M. Lim (2013), "Green as the new lean: how to use lean practices as a catalyst to greening your supply chain", *Journal of Clean Production*, 40(2): 93-100.

Esty, D.C. and A. Winston (2009), *Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage*, New Jersey: John Wiley and Sons.

Etzion, D. (2007), "Research on Organizations and the Natural Environment, 1992-Present: A Review", *Journal of Management,* 33(4): 637–664.

Farias, L.M.S., L.C. Santos, C.F. Gohr, L.C. de Oliveira, and A.M.H. da Silva (2019), "Criteria and practices for lean and green performance assessment: systematic review and conceptual framework", *Journal of Cleaner Production*, 23(2): 32-45.

Gadenne, D.L., J. Kennedy, and C. McKeiver (2009), "An Empirical Study of Environmental Awareness and Practices in SMEs", *Journal of Business Ethics*, 84(2): 45–63.

Gamba, R.J., and S. Oskamp (1994), "Factors Influencing Community Residents' Participation in Commingled Curbside Recycling Programmes", *Environment and Behaviour,* 26(5): 587–612.

Garza-Reyes, J.A., V. Kumar, S. Chaikittisilp, and K.H. Tan (2018), "The effect of lean methods and tools on the environmental performance of manufacturing organizations", *International Journal of Production Economics,* 200(3): 170-180.

Gerrans, P., and B. Hutchinson (2000). "Sustainable Development and Small to Medium-sized Enterprises: A Long Way to Go". In *Small and Medium-Sized Enterprises and the Environment*, R. Hillary (Ed.), pp. 75–81, Sheffield: Greenleaf Publishing Limited.

Hartini, S., and U. Ciptomulyono (2015), "The relationship between lean and sustainable manufacturing on performance: Literature review", *Procedia Manufacturing*, 4: 38-45.

Haden, S.P., J. Oyler, and J. Humphreys (2009), "Historical, practical, and theoretical perspectives on green management: An exploratory analysis", *Management Decision*, 47(7): 1041-1055.

Ibrahim, I.B., and H.S.B. Jaafer (2016), "Factors of environment management practices adoptions", *Social and Behavioral Science*, 224(4): 352-359.

Jayarathna, B.C.P., and C.N. Wickramasinhe (2019), "Determinants of green supply chain practices of manufacturing companies in Sri Lanka", *International Journal of Productivity and Quality Management,* 28(1): 103-127.

Knol, W.H., J. Slomp, R.L. Schouteten, and K. Lauche (2018), "Implementing lean practices in manufacturing SMEs: Testing 'critical success factors' using necessary condition analysis", *International Journal of Production Research*, 56(11): 3955-3973.

Kauffman, R.J., and E.A. Walden (2001), "Economics and electronic commerce: Survey and directions for research", *International Journal of Electronic Commerce*, *5*(4): 5-116.

Koirala, S. (2018), "SMEs: Key drivers of green and inclusive growth", Annual conference on *inclusive solution for the green transition*", 27-29 December, 2018, OECD, https://www.oecd.org/greengrowth/GGSD_2018_SME%20Issue%20Paper_WEB.pdf.

Kowtha, N.R., and T.W.I. Choon (2001). "Determinants of website development: A study of electronic commerce in Singapore", *Information and Management*, 39(3): 227-242.

Lansana, F.M. (1992), "Distinguishing Potential Recyclers from Non-recyclers: A basis for Developing Recycling Strategies", *Journal of Environmental Education*, 23(2): 16–23.

Lin, C., and Y.H. Ho (2011), "Determinants of green practice adoption for logistics companies in China", *Journal of Business Ethics*, 98 (3): 67-83.

Lin, C., Y.H. Ho, and S.H. Chiang (2009), "Organizational determinants of green innovation implementation in the logistics industry", *International Journal of Organizational Innovation, 2*(1): 3-13.

Lo, M.S. (2013), "Effects of supply chain position on the motivation and practices of firms going green", *International Journal of Operations & Production Management*, 12(2): 32-49.

Mafini, C., and W.V. Loury-Okoumba (2018), "Extending green supply chain management activities to manufacturing small and medium enterprises in a developing economy", *South African Journal of Economic and Management Sciences,* 21(1).

Matt, D.T., and E. Rauch (2013), "Implementation of lean production in small sized enterprises", *Procedia CIRP,* 12: 420-425.

Meera, B.L., and P. Chitramani (2016), "Causal Effect of Between Lean and Green Supply Chain Management Practices on Environmental Performance of Manufacturing Firms", *International Journal of Management and Business Studies,* 6 (2): 29-35.

Miller, G., J. Pawloski, and C. Standridge (2010), "A case study of lean, sustainable manufacturing", *Journal of Industrial Engineering and Management*, 3(1): 11-32.

Ministry of Sustainable Development (2018), "Sri Lanka Voluntary National Review on the Status of Implementing Sustainable Development Goals", Government of Sri Lanka, Colombo, Sri Lanka. Available at: https://sustainabledevelopment.un.org/content/documents/19677FINAL_SriLankaVNR_Report_30Jun2018.pdf

Moorthy, M.K. (2012), "Green practices: Perception of Malaysian SME owners/managers", *International Journal of Academic Research in Economics and Management Sciences*, 1(3): 103-123.

Murphy, P.R. and R.E. Poist (2003), "Green Perspectives and Practices: A Comparative Logistics Study", *An International Journal of Supply Chain Management*, 8(2): 122–131.

Nicholls, S., and S. Kang (2012), "Going Green: The Adoption of Environmental Initiatives in Michigan's Loading Sector", *Journal of Sustainable Tourism,* 20(7): 953–974.

Nunnally, J.C. (1978), *Psychometric Theory*, New York: McGraw-Hill.

Park, J., and H.J. Kim (2014), "The Impact of Top Management's Environmental Attitudes on Hotel Companies Environmental Management", *Journal of Hospitality & Tourism,* 38(1): 95–115.

Peng, Y., and S. Lin (2008), "Local Responsiveness Pressure, Subsidiary Resources, Green Management Adoption, and Subsidiaries' Performance: Evidence from Taiwanese Manufacturers", *Journal of Business Ethics*, 79 (1/2): 199-212.

Premaratna, S.P., R.Y.H. De A. Seneviratne, K. Dissanayake, S. Ranwala, N. Melegoda, and A. Fernando (2021), "Drivers of lean manufacturing practices in Sri Lankan SMEs: A preliminary results", *Working Paper Series 2,* Colombo: Faculty of Graduate Studies, University of Colombo. Available at: https://fgs.cmb.ac.lk/wp-content/uploads/Working-Paper-Series-2.pdf.

Ramakrishnan, P., H. Haron, and Y.N. Goh (2015), "Factors Influencing Green Purchasing Adoption for Small and Medium Enterprises (SMEs) in Malaysia", *International Journal of Business & Society*, 16(1): 39–56.

Rao, P. (2007), "Greening of the Supply Chain: An Empirical Study for SMES in the Philippine Context", *Journal of Asia Business Studies*, 12(3): 43-56.

Rao, P., and D. Holt (2005), "Do green supply chains lead to competitiveness and economic performance?", *International Journal of Operations & Production Management*, 25(9/10): 898-916.

Reyes-Rodríguez, J.F., J.P. Ulhøi, and H. Madsen (2016), "Corporate Environmental Sustainability in Danish SMEs: A Longitudinal Study of Motivators, Initiatives, and Strategic Effects", *Corporate Social Responsibility and Environmental Management*, 23(4): 193–212.

Roberts, S, and J. Tribe (2008), "Sustainability Indicators for Small Tourism Enterprises: An Exploratory Perspective", *Journal of Sustainable Tourism*, 16(5): 575–594.

Sajan, M.P., P.R. Shalij, A. Ramesh, and A.P. Biju (2017), "Lean manufacturing practices in Indian manufacturing SMEs and their effect on sustainability performance", *Journal of Manufacturing Technology Management,* 28(6): 772-793.

Sawhney, R., P. Teparakul, A. Bagchi, and X. Li (2007), "En-Lean: A framework to align lean and green manufacturing in the metal cutting supply chain", *International Journal of Enterprise Network Management*, 1(3): 238-260.

Schaper, M. (2002), "Small Firms and Environmental Management: Predictors of Green Purchasing in Western Australian Pharmacies"*, International Small Business Journal,* 20(3): 235–251.

Scupola, A. (2003), "The adoption of internet commerce by SMEs in the south of Italy: An environmental, technological and organizational perspective", *Journal of Global Information Technology Management,* 6(1): 52-71.

Siegel, R., J. Antony, J.A. Garza-Reyes, A. Cherrafi, and B. Lameijer (2019), "Integrated green lean approach and sustainability for SMEs: From literature review to a conceptual framework", *Journal of Cleaner Production*, 240(9).

Stopper, M., A. Kossik, and B. Gastermann (2016), "Development of a sustainability model for manufacturing SMEs based on the innovative doughnut economics framework", Proceedings of the International Multi Conference of Engineers and Computer Scientists (IMECS 2016), Vol II.

Thanki, S., K. Govindan, and J. Thakkar (2016), "An investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy process (AHP) approach", *Journal of Cleaner Production,* 135(3): 284-298.

Tilley, F. (1999), "The gap between the environmental attitudes and the environmental behaviour of small firms", *Business Strategy and the Environment*, 8(4): 238-248.

Tiwari, R.K., and J.K. Tiwari (2016), "Green lean manufacturing: Way to sustainable productivity improvement", *International Journal of Engineering Research and General Science*, 4(6): 243-262.

Tornatzky, L.G., and T. Fleischer (1990), *The process of technological innovation*, Lexington, MA: Lexington Books.

Tzschentke, N., D. Krik, and P.A. Lynch (2004), "Reasons for Going Green in Serviced Accommodation Establishments", *International Journal of Contemporary Hospitality Management,* 16(2): 116–124.

Wadhwa, R.S. (2014), "Quality green, EMS and lean synergies: Sustainable manufacturing within SMEs as a case point", *International Journal of Computer Science Issues*, 11(2/2): 114-119.

Weng, Hua-Hung, J.S. Chen, and P.C. Chen (2015), "Effects of Green Innovation on Environmental and Corporate Performance: A Stakeholder Perspective", *Sustainability,* 7(5): 4997–5026.

Yacob, P., and M.K. Moorthy (2012), "Green Practices: Perception of Malaysian SME Owners/ Managers", *International Journal of Academic Research in Economics and Management Sciences*, 1(3): 103-111.

Yacob, P., L.S. Wong, and S.C. Khor (2019), "An empirical investigation of green initiatives and environmental sustainability for manufacturing SMEs", *Journal of Manufacturing Technology Management*, 30(1): 2-25.

Yoon, C. (2011), "Theory of planned behavior and ethics theory in digital piracy: An integrated model", *Journal of Business Ethics*, 100(1): 405-417.

Zhu, K., and K.L. Kramer (2005), "Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry". Available at: http://eds.b.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=292ed5f5-4750-4ec3-b369-196b1ac1bd69@sessionmgr110&vid=2&hid=106.

Zhu, Q., J. Sarkis, J.J. Cordeiro, and K.H. Lai (2008), "Firm-level correlates of emergent green supply chain management practice in the Chinese context", *The International Journal of Management Science*, 36(4): 577-591.