A Supply Chain Environmental Sustainability Model for Micro-Enterprises in the Philippine Food Industry

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Abstract

Micro enterprises are key contributors in nation building in terms of job creation and income generation. The sector of micro enterprises, along with other small sized enterprises, is very important in the economic development of all countries in the world. In today's business world of complexities and competitiveness, micro enterprises need to adapt appropriate strategies to grow and become sustainable. In this context, the concept of sustainable supply chain management in the operation strategy of micro enterprises is apparently a vital function along with quality management that impact business performance. The objective of this study is to identify the relationships of sustainability drivers to quality management practices and supply chain practices that both impact supply chain environmental sustainability performance of Philippine micro enterprises, particularly in the food service industry. Thus, it is fittingly of interest to have a supply chain environmental sustainability model for foodservice micro-enterprises incorporating sustainability factors and significant relationships among these factors and practices in quality management and supply chain management. The paper uses Structural Equation Modeling (SEM) and data from 454 survey respondents from the foodservice micro enterprise sector to analyze the posited relationships and strength of interrelationships of different factors for a good model fit.

Keywords
Micro Enterprises, sustainable supply chain management, supply chain practices, quality management practices, sustainability factors, Structural Equation Modeling

1. Introduction

Green supply chain management (GSCM) has been acknowledged as a key factor to promote organizational sustainability and is evolving into an important approach for organizations in emerging economies to manage their environmental responsibility. Yet, despite their importance for easing environmental degradation and providing economic benefits, study of the drivers that influence green supply chain initiatives in an emerging economy is still an under-researched area (Hsu, Choon Tan, Hanim Mohamad Zailani & Jayaraman, 2013).

Business firms concerned with sustainable development have a good reputation and environmental image in its industry. By covering all its three aspects - economic, environmental and social, its implementation proposes that micro-enterprises can become a profitable firm while mitigating damages in the environment. Business activities pose a significant threat to the environment in terms of carbon monoxide emissions, discarded packaging supplies, scrapped materials, improper disposal of wastewater and other forms of pollution resulting from their supply chain and quality management practices (Wisner JD, Tan K-C, Leong GK, 2012).

Improving supply chain environmental sustainability performance will be both a challenge and an opportunity in a business. The role of the sustainability drivers is crucial in motivating firms to adopt green supply chain initiatives and facilitate their adoption. Firms in emerging countries need to realize that green supply chain initiatives and

sustainable practices can result in significant benefits not only to their firms but also to the society at large – the incentives to achieving supply chain environmental sustainability performance (Hsu, et.al, 2013).

With the continuous growth in the number of micro-enterprises in the country, the environmental risk becomes higher, with waste streams off the individual supply chains increasing the environmental burden. With the entrepreneurial nature of most micro-enterprises, quality management and supply chain practices are given more emphasis than the environmental sustainability concern of their operations (Geng, Mansouri, &Aktas, 2017). In an emerging economy like the Philippines, only a few businesses practice GSCM due to the lack of awareness of sustainability and concern for the environment (Aguilar, Borromeo, Pereja & Guia, 2019). Hence, greening the supply chain, quality management toward sustainability, environmental innovation and sustainable development are still concepts, or only at the regulatory compliance level if ever implemented, that further require visible management commitment and a more concrete approach in the management of all product processes – raw material purchasing, product manufacturing, waste management (Kainuma and Tawara, 2006), activities of which are governed by supply chain and quality management policies and practices..

The research aims to answer the question of "What factors will drive Philippine food service micro enterprises to improve their supply chain environmental sustainability performance?" As such, the study aims to achieve the following objectives:
1. To assess supply chain and quality management practices of Philippine food service micro enterprises;
2. To determine the significant sustainability factors affecting supply chain and quality management practices that influence the supply chain environmental sustainability performance of Philippine food service micro enterprises; and
3. To recommend a model for the Philippine food service micro-enterprises in improving supply chain environmental sustainability performance.

The study focuses only on the supply chain and quality management practices of micro enterprises in the food service sector. It considers the sustainability factors gathered from the review of literature on green supply chains, operations strategy and sustainable development. The study would benefit food service micro enterprise players and management with a model on how to improve supply chain environmental sustainability performance with cognition of driving factors of sustainability and their relationships with supply chain and quality management practices as part of operations strategy.

2. Methodology

The study is guided by the following conceptual framework (Figure 1). The key concepts in the framework include sustainability factors and its posited relationships with supply chain practices and quality management practices that impact on the supply chain environmental sustainability performance of micro-enterprises.
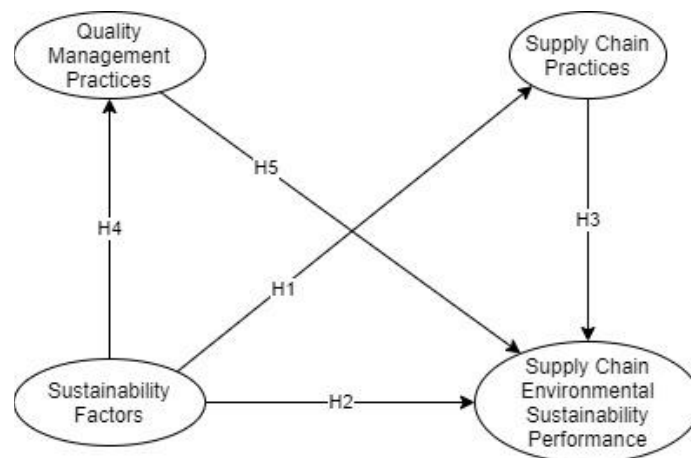

Figure 1. Conceptual Framework

In order to achieve the objectives of the study, the framework (Figure 1) will operationalize the conduct of the study. The research proposes that the supply chain performance among micro-enterprises in the Philippine food service industry will be more effective and more efficient through the use of the application of sustainability factors over supply chain practices. This leads to the following hypotheses:

H1: There is a significant relationship between sustainability factors and supply chain practices.
H2: There is a significant relationship between sustainability factors and supply chain environmental sustainability performance.
H3: There is a significant relationship between supply chain practices and supply chain environmental sustainability performance.
H4: There is a significant relationship between sustainability factors and quality management practices.
H5: There is a significant relationship between quality management practices and supply chain environmental sustainability performance.

In a study by Iqbal, Kang & Jeon, (2019) on zero waste strategy for green supply chain management, zero waste policy is provided by introducing a secondary supply chain for food products and a closed-loop supply chain is adopted for recycling of packaging waste. The results in their study obtained minimization of cost and energy consumption as well as a complete removal of waste from the system which proves that the sustainability practices such as waste management affects supply chain performance. This finding is used in the logic of the study as shown in Figure 1.

To assess the supply chain and quality management practices of micro enterprises in the Philippine food service industry, a survey questionnaire was adopted as the primary research instrument intended specifically for those who are directly involved in the company's operations specifically in the areas of supply chain and quality management. Hence, the survey focuses on sustainability factors, quality management practices, supply chain environmental sustainability performance, and the capability of supply chain capability and practices. Specifically, the survey respondents were limited to supply chain managers, supply chain supervisors, and other food service owners and management staff. With a 5-point Likert scale, the respondents were asked to indicate the level of agreement to statements about the relationships of indicators of the factors, drivers and practices as covered by each of the five hypotheses posited above.

Following is a tabulated summary of the indicators and measures corresponding to the survey questionnaires. The items are coded to refer to the indicator variables that would be reflected in the operational model using SEM.

Table 1. Indicators and measurement items

Indicator	Items	Measures	Supporting References
Supply Chain Environmental Sustainability Performance	SCESP1	Green Supply Chain Management (GSCM) will minimize the environmental risk in an organization's supply chain	Hsu et al. (2013)
	SCESP2	Environmental standard affects the performance and image of firms in the same supply chain	Cousins et al. (2004); Christmann & Taylor (2001)
	SCESP3	Green Supply Chain Management (GSCM) will help reduce waste and pollution	Hsu et al. (2013)
	SCESP4	Identifying the flow of materials and energy in industrial and consumer activities will develop a more holistic biological system approach to environmental management	Pohlmann et al. (2019)
	SCESP5	It is useful to differentiate between the focal company and primary stakeholders to create a self-sustaining production system	Pohlmann at al. (2019)
	SCESP6	Pollution prevention can lower cost and increase efficiency	Huo et al. (2019)
	SCESP7	Suppliers must be environmentally sustainable partners	Raul et al. (2019)
	SCESP8	There is a need to be written about environmental objectives, policy statements, and procedures to implement a corrective action plan	Raul at al. (2019)
Quality Management Practices	QMP1	Hitting economical profitability measures is an intricate matter for the sustainability field	Bastas & Liyanage (2018)
	QMP2	Process improvement methods are used to ensure stable and capable processes.	Lin et al. (2005)
	QMP3	Quality Management (QM) practices could be integrated in the supplier participation programs to provide needed collaboration	Lin et al. (2005)

	QMP4	Top management provides the necessary leadership in enabling conditions for Total Quality (TQ).	Lin et al. (2005)
	QMP5	Reports about cost of quality and other indicators should be kept for analysis of processes	Lin et al. (2005)
	QMP6	High quality can be achieved through a robust quality design	Korada et al. (2018)
	QMP7	Quality control must extensively be used to control variation of food products within a tolerable level	Korada et al. (2018)
	QMP8	It is necessary for the retailers to create their own brand standard	Korada et al. (2005)
Sustainability Factors	SF1	Interpersonal relationships among members can improve collaboration	Dania et al. (2018)
	SF2	The ability to adjust strategies and resources is relevant	Boeck & Wamba (2008); Fynes et al. (2005)
	SF3	Preparation for unplanned disruptions is essential	Ivanov & Sokolov (2012)
	SF4	Diversity of the resource structure is valuable	Meng (2012)
	SF5	Organizations should identify areas which need improvement and take actions to expand it	Dania et al. (2018)
	SF6	The demographic and environmental conditions (DE) directly affect the security of food as the population increases day by day	Sharma et al. (2018)
	SF7	The government plays an important role in achieving food security	Sharma et al. (2018)
	SF8	Packaging is used to enhance the food security and minimizes the risk of contamination	Sharma et al. (2018)
Supply Chain Practices	SCP1	A strategic partnership is entered into to promote shared benefits among parties	Li et al. (2006)
	SCP2	Committed customer relationships are the most sustainable advantage	Noble (1997); Tan et al. (1998)
	SCP3	The key to a seamless supply chain is making available undistorted and up-to-date data at every node	Childerhouse & Towill (2003); Balsmeier & Voisin (1996); Towill (1997); Turner (1993)
	SCP4	There is reluctance within organizations to give away more than minimal information	Mason-Jones & Towill (1997)
	SCP5	Suppliers are selected based on their capacity to meet the needs of the enterprise	Lin et al. (2005)
	SCP6	Products should be produced on an as-needed basis in very small batches	Beamon (2003)

The questionnaire consists of five sections: (1) Demographic Information (age, job title/designation, and company type), (2) Supply Chain Environmental Sustainability Performance, (3) Quality Management Practices, (4) Sustainability Factors, and (5) Supply Chain Practices.

The use of the Structural Equation Modeling (SEM) approach was appropriate since secondary data from micro enterprises hardly exist. SEM analyzes the structural relationships between measured indicator variables that are coded in the above table and latent constructs and estimates multiple and interrelated dependence. A consequent path analysis will determine a model fit from which a final operational framework will the basis for discussion of the model parameters and the significant factors and practices affecting supply chain environmental sustainability performance.

3. Results and Discussion

A total of 454 respondents answered the survey and Table 2 summarizes the demographics of said respondents associated in running and maintaining micro enterprises in the foodservice industry.

Table 2. Descriptive Statistics of the Survey Respondents (n = 454)

Characteristics	Category	n	%
Age	20-29	114	25.11
	30-39	141	31.06
	40-49	117	25.77
	More than 50	82	18.06
Job Title/Designation	Business Owner/Entrepreneur	123	27.09

	Management Staff	37	8.15
	Operations Personnel	294	64.76
Company Type	Micro-Enterprise	217	47.80
	Large Enterprise	237	52.20

Survey data was analyzed using SPSS and then AMOS 23 application with the Maximum Likelihood estimation approach to run SEM to determine causal relationships between the latent variables construct (Hair, 2010; Martinez et al., 2019; Torres et al., 2019). Figure 2 and Figure 3 illustrate the initial SEM model with four latent variables with one exogenous latent variable (Sustainability Factors) and three endogenous latent variables (Quality Management Practices, Supply Chain Practices, and Supply Chain Environmental Sustainability Performance).
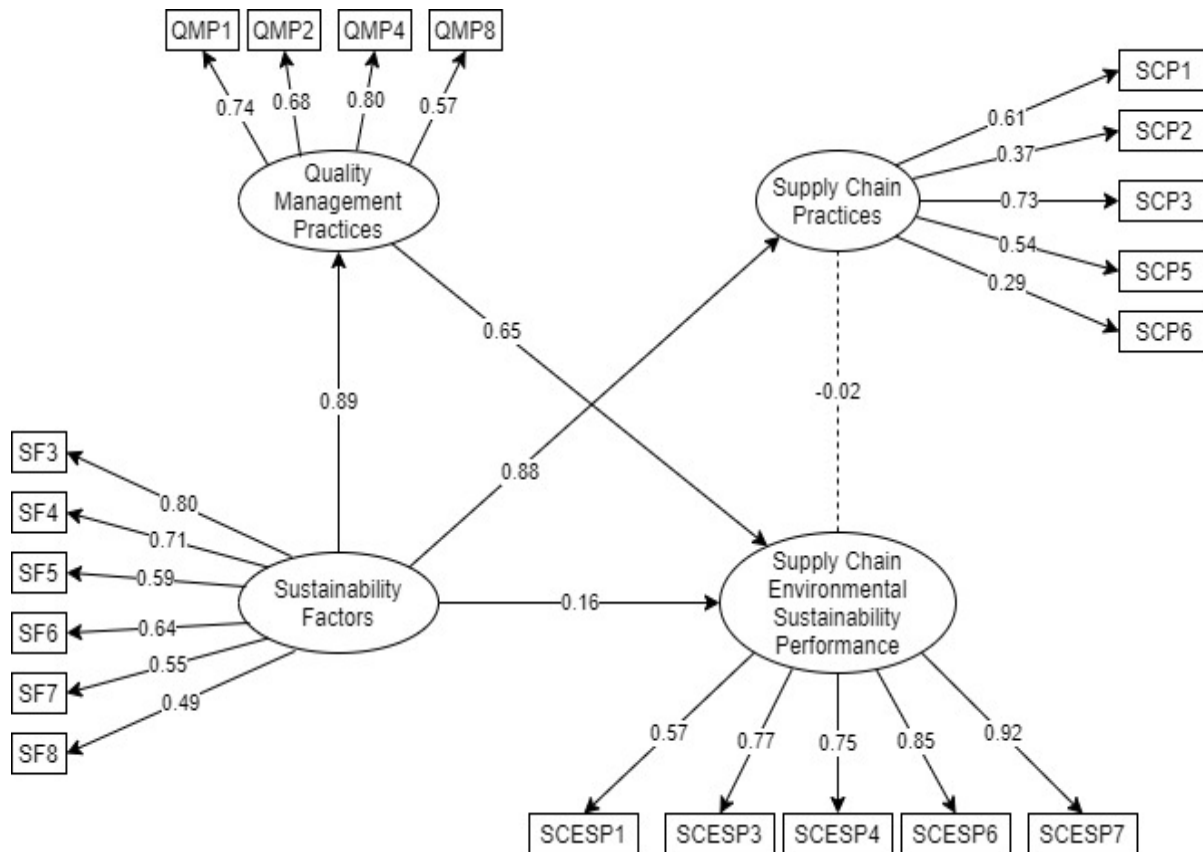

Figure 2. SEM Model of Supply Chain Environmental Sustainability Performance
for Micro Enterprises in the Philippine Food Service Sector

After an initial run that produced relatively good results and due to a sizable number of respondents from large enterprises in the same food service sector, it was deemed to have two more but separate SEM runs were made, one each for micro enterprises and another for large enterprises. To ensure validity and reliability of the results for a better model definition with higher confidence, a comparison of the two resulting SEM models yielded robustness with practically the same significant factors and relationships, except for the relationship between supply chain practices and supply chain environmental sustainability performance.
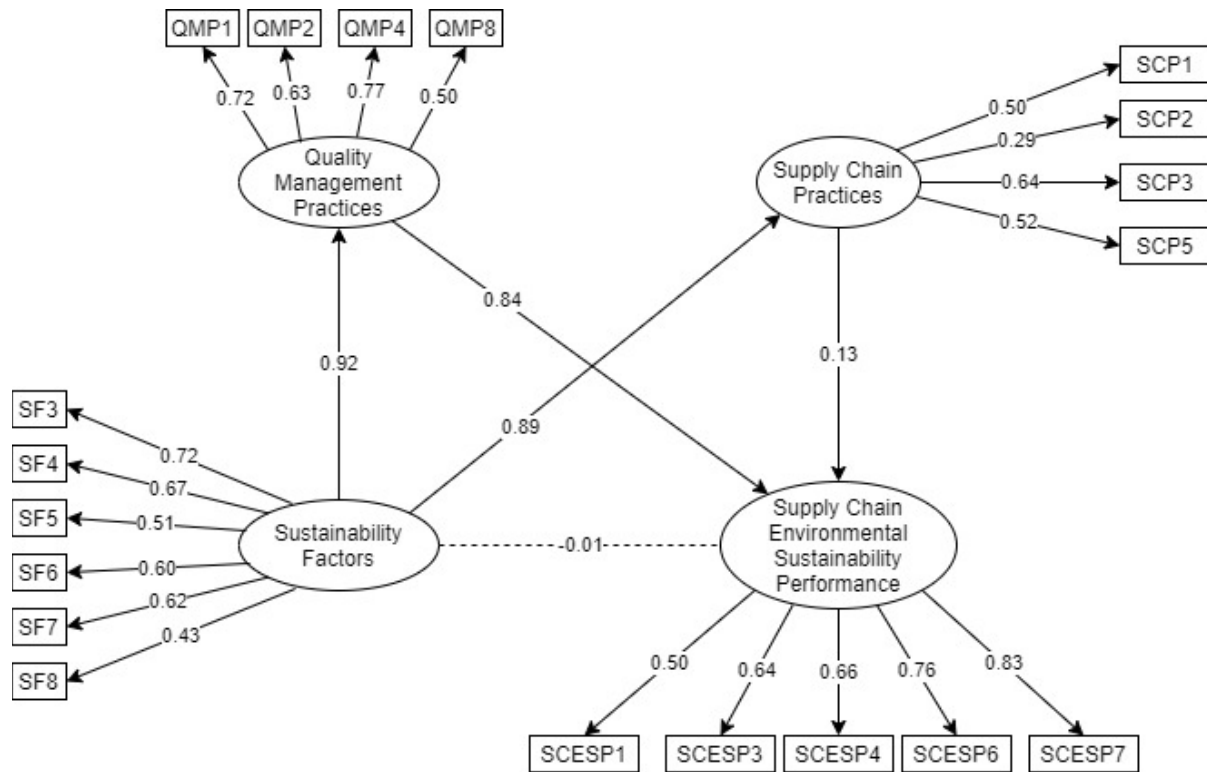
Figure 3. SEM Model of Supply Chain Environmental Sustainability Performance
for Large Enterprises in the Philippine Food Service Sector

Following some of the previous studies that utilized the SEM approach (Lin et al., 2018, 2019; Miraja et al., 2019), some modification indices were applied to enhance the model fit. All measures for the goodness of fit in both enterprise sizes were better than the suggested minimum cutoffs, indicating that the specified model's hypothesized constructs were excellent representation of the observed data. Overall for both sets of data, the resulting models are a good fit to use for the posited relationships of the constructs used in the study.

Table 3. Model Fit

Goodness of fit measures of the SEM	Parameter Estimates (Micro-Enterprises)	Parameter Estimates (Large Enterprises)	Minimum cutoff	Suggested by
Incremental Fit Index (IFI)	0.926	0.917	>0.90	Hair (2010)
Tucker Lewis Index (TLI)	0.910	0.896	>0.80	Abbas et al. (2020)
Comparative Fit Index (CFI)	0.924	0.915	>0.90	Hair (2010)
Goodness of Fit Index (GFI)	0.871	0.882	>0.80	Gefen et al. (2000)
Adjusted Goodness of Fit Index (AGFI)	0.830	0.839	>0.80	Gefen et al. (2000)
Root Mean Square Error of Approximation (RMSEA)	0.065	0.065	<0.07	Steiger (2007)

Table 4 below shows the direct, indirect, and total effect of each path based on the final SEM model for food service micro-enterprises which is the focus of this study. It confirms all the hypothesized relationships except for the relationship between supply chain practices (SCP) and supply chain environmental sustainability performance (SCESP).

Table 4. Direct Effect, Indirect Effect, Total Effect (micro-enterprises)

No.	Path	Direct effect	P-value	Indirect effect	P-value	Total effect	P-value
1	QMP → SCESP	0.653	0.005	-	-	0.653	0.005
2	SF → QMP	0.892	0.001	-	-	0.892	0.001
3	SF → SCP	0.881	0.001	-	-	0.881	0.001
4	SF → SCESP	0.158	0.601	0.568	0.601	0.726	0.601
5	SCP → SCESP	-0.017	0.932	-	-	-0.17	0.932

In comparison, results summarized in Table 5 below showed the direct, indirect, and total effect of each path based on the final SEM model for food service large enterprises with all hypothesized relationships significant, leading to a very important insight on the difference as regards supply chain practices between the micro and large enterprises.

Table 5. Direct Effect, Indirect Effect, Total Effect

No.	Path	Direct effect	P-value	Indirect effect	P-value	Total effect	P-value
1	QMP → SCESP	0.839	0.018	-	-	0.839	0.018
2	SF → QMP	0.92	0.001	-	-	0.92	0.001
3	SF → SCP	0.889	0.001	-	-	0.889	0.001
4	SF → SCESP	-0.009	0.982	0.891	0.982	0.882	0.982
5	SCP → SCESP	0.135	0.562	-	-	0.135	0.562

The following table summarizes the results of the hypotheses tests on the relationships posited for micro enterprises. It also better appreciated with a comparison against those for large enterprises, which was included since the models developed were robust when the sampled data was screened based on enterprise size.

Table 6. Hypotheses Test Results Summary

Hypothesis	Relationship		For Micro Enterprises	For Large Enterprises
	Between	and		
H₁	Sustainability Factors	Supply Chain Practices	Significant	Significant
H₂	Sustainability Factors	Supply Chain Environmental Sustainability Performance	Significant	Significant
H₃	Supply Chain Practices	Supply Chain Environmental Sustainability Performance	Not Significant	Significant
H₄	Supply Chain Practices	Quality Management Practices	Significant	Significant
H₅	Quality Management Practices	Supply Chain Environmental Sustainability Performance	Significant	Significant

4. Conclusion

Most, if not all, micro enterprises do not have a deliberate supply chain management plan that incorporate environmental sustainability into their supply chain practices. The survey and the SEM results would convey this finding, hence an insight would reveal that micro-enterprises having the entrepreneurial business nature tend to focus on customer traction, survival during the startup and profitability during its growth stage that the sustainable development concept and the need for environmental performance were not made as part and parcel of their operations strategy.

Unlike in large food service companies, it reflected in the SEM results that their supply chain practices, as well as, quality management practices, impact supply chain environmental sustainability performance. This is supplemented with the significant relationships of sustainability factors to both supply chain and quality management practices which lead to the significant relationships of all three to environmental sustainability performance of their supply chains.

Based on the SEM results and with the above-mentioned insights, the study produced a robust model as conceptualized with sustainability factors driving quality management practices and supply chain practices, all impacting directly and/or indirectly on supply chain environmental sustainability performance. Suffice it to say, with supply chain practices and quality management practices having a mediating relationship on the most important effect variable of supply chain environmental sustainability performance, then the robust model produced in this study can be regarded as an implementation platform for foodservice micro enterprises to integrate supply chain practices and quality management practices as driven by sustainability factors toward improvement of their supply chain environmental sustainability performance.

5. Recommendations

The supply chain environmental sustainability model for food service micro enterprises, as a robust model, which is already subscribed to by larger enterprises, can also be referenced to by other small scale enterprises in the whole sector of small and medium sized enterprises (SMEs) in the Philippines.

This will mean proper identification of selected driving factors to pursue environmental sustainability in their supply chains with the recognition that supply chain management is a key pillar of success of sustainable business competitiveness and growth. The nature of business operations and their target market must govern the integration of supply chain and quality management practices in improving supply chain environmental sustainability performance by implementing the 3 "Is" of continuous improvement, process innovation and employee involvement with the end in view of significantly contributing to the overall performance of the business firm.

In this regard, food service companies, being concerned with overall business performance over the long term, will have to incorporate environmental sustainability in their operations as a strategic initiative and a key result area. A good way to achieve this will be the use of the Balanced Scorecard (BSC) approach that will provide a strategy map with the following essential steps: Building employee awareness on sustainability as one of the company values through training and policy orientations; Designing sustainable processes that are environmentally friendly in terms of input material selection and waste reduction & disposal; Selling products and services that go beyond compliance with legal requirements in the light of environmental responsibility; and Establishing metrics based on functional KPIs on people, operations, marketing and financial dimensions linked to the company's vision and strategy.

On a national level, due to the acknowledgment that 99.6% of the enterprises in the country are micro, small, & medium enterprises (MSMEs), government agencies involved in its promotion, regulation and supervision should institutionalize environmental sustainability through coherent cross-sectoral policies with respect to economy, trade, resource utilization, infrastructure, environment and governance.

Future research in this area may include other latent variables deemed important aside from quality and supply chain factors related to environmental sustainability performance, such as human resource and culture management. Strategic planning and design thinking will be great areas to explore other contextual and operational factors since those two areas are more popular in resource-blessed large enterprises than in small scale firms from the MSME sector.

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