

Strategic Implementation to Enhance Green Industry Practices in SMEs: Lesson Learned from Thailand

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Abstract

For decades, global communities focus on transforming into greener economy, particularly industrial sector. Several approaches have been executed to drive green industry policy. Green industry certification scheme is among the voluntary measure widely adopted to endorse the entrepreneurs that successfully mitigate environmental impacts and enhance sustainable production. The scheme has a good progress in implementation in large conglomerates and international cooperation firms. However, adoption rate of green industry in Thailand particularly in SMEs is only 1.03% of the registered manufacturing sector SMEs in 2016. SMEs have potential high impacts according to the operational diversity and the proportion in the industrial sector. This study aims to identify strategic approaches to enhance green industry adoption in Thai SMEs. The study investigated the potentials and constraints for SMEs by SWOT analysis together with the data from the extensive review, in-depth interview, and questionnaire base survey. The result revealed that majority of SMEs have positive perception with green industry and express intention to adopt green industry. Although, SMEs' capability in internal resource especially budget, green technology knowledge remains major weakness as well as absence of appropriate regulatory incentive. The key opportunity is arising from the global SDGs and the 20-year national strategy focusing on green economy and sustainable development. The future strategy recommendation for policy makers is to promote the implementation of economic based incentives including sustainable procurement, voluntary green product certification scheme, together with pragmatic regulation mechanism i.e. green product law, product tax to close the gap of green industry practices implementation and sustainable growth for SMEs.

Keywords: Green industry; Green strategy; Small and medium enterprises; SWOT; Sustainable production

1. Introduction

Enhancing environmentally friendly production and consumption become key drivers to achieve long term sustainability within the essence of social and economic development. Among one of 17 goals of sustainable development that United Nations has been set since 2015, is the twelfth goal to promote and empower sustainable production and consumption patterns in any

levels. Focusing on green industry concept or environmentally friendly production is an important mechanism to drive the industrial economy to achieve such sustainable development goals (UNIDO, 2018). To reduce the industrial ecology from unsustainable production, the green industry strategy needs to be addressed by the industrial sector. The green industry objective is to operate

with sustainable production with social and environment consideration into business operations through the more efficient use of energy and raw materials, innovative practices and applications of new green technologies (UNIDO, 2011).

Green initiatives has continuously promoted for the past decade, such as environmental management system, eco-label (Na and Na, 2015), environmental performance, LCA, greening the supply chain (Lee, 2009), environmental accountability (Sáez-Martínez *et al.*, 2016), and new one circular economy practices (Zamfir *et al.*, 2017) that can contribute to the green industry policy implementation (Luan *et al.*, 2016; Schoenherr and Talluri, 2013; Roy *et al.*, 2013; Frey *et al.*, 2013). Green industrial development principle can not only help reduce environmental and social impact but also enhance long term adaptation strategy for business firms. Many countries in European applied green industry strategy to rebalance economic after economic crisis in late 2005 and now there is the progression of circular economy practice in large and small enterprises. SMEs from Italy and Poland minimize waste by recycling or circulate waste to another company (Zamfir *et al.*, 2017). SMEs from Belgium, Spain, France, Ireland, The Netherlands, Austria, Sweden, and Romania, use renewable energy, redesign to minimize raw materials or use recycled materials to increase their environmental performances (Jové-Llopis and Segarra-Blasco, 2018).

In Asia, Korea, Japan and China were the exemplary country adopted green industry strategy into national policy framework. Greening of traditional industries was the one of four strategies which Korea set up under green growth policy framework in 2009. The government put significant emphasis on research and development of green technologies (Shapira *et al.*, 2014; Mathews, 2012). In the same year, green innovation was identified as a key driver for future growth strategy of Japan. China also proposed green development strategy in 12th Five-Years Plan 2011-2015 (Peng and Sun, 2015) which focused on transformation of traditional industry by implement resource efficiency, recirculation, green technology, and renewable energy.

Thai government ratified Manila Declaration on Green Industry (GI) in 2009. After that, Ministry of Industry defined new criteria for Thailand green industry development. It consists of 5 levels of development of business operation to be more environmentally - friendly and sustainable, as shown in Figure 1 (Ministry of Industry, 2017). Criteria level 1 - 3 is similar to the adoption of environmental management system of the ISO 14001. While, Level 4 is equivalent to social accountability and environmental accountability principles that are relevant international standards as ISO 26000. Level 5 is equivalent to the green supply chain management and beyond to circular economy. The 5 - level green industry criteria is the requirement of the voluntary scheme of green industry certification. The total amount of green industry certified entrepreneurs from 2011 to 2016 were 28,120 entrepreneurs. It was about 20.4% of the registered factories and 1.03% of the registered SMEs in manufacturing sector at the end of 2016.

According to Thai twenty-year national strategy for green and sustainable growth, Small and Medium Enterprises (SMEs) have been among key sectors to promote green concept adoption. How to enhance SMEs and transform into greener production enterprise depends on many factors. There are still gaps to understand including relevant ecosystem behavior, stakeholders background and engagement, reasonable incentive to trigger the green transformation. This research aims to investigate the strengths, weaknesses, opportunities, and threats of green industry transformation in Thai manufacturers and to develop strategic recommendation for promoting green industry. The research analysis based on the data collection from the extensive review, questionnaire survey and in-depth interview. This research methodology used the power SWOT techniques to analyze the situation and the internal and external factors influencing environmentally friendly production of SMEs in Thailand. The information analyzed from SWOT analysis was used to develop strategies for planning and development to increase the rate of adoption of environmentally friendly production and sustainable operations in SMEs.

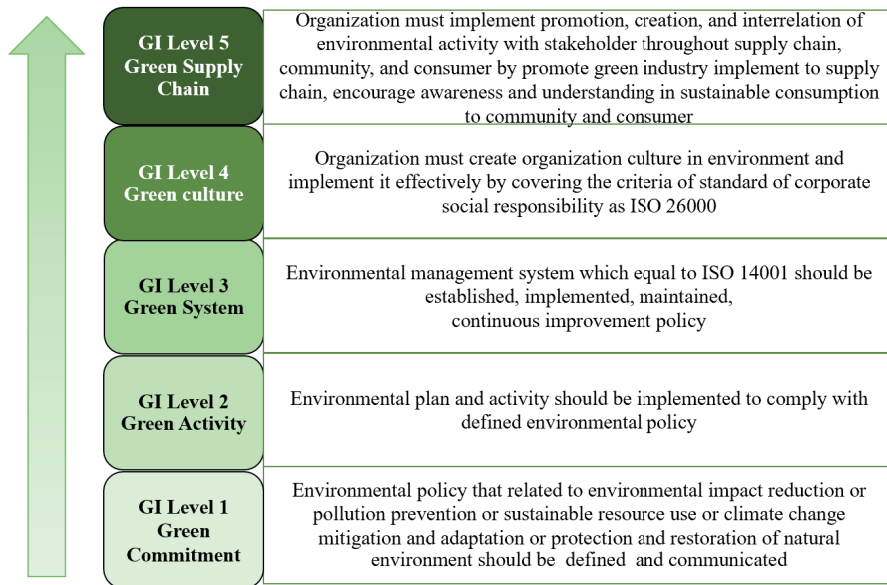


Figure 1. 5-Levels of Green Industry Development Criteria (Ministry of Industry, 2017)

2. Methodology

This study was conducted to investigate the strengths, weaknesses, opportunities, and threats (SWOT) of implementation of GI in Thai SMEs in the sector of electronic products and electrical equipment. This sector is the one of the promoted industrial sectors according to the National Industrial Development Plan B.C. 2555-2574 and the top ten rank of exporter. The methodology was shown in Figure 2. SWOT analysis has become a standard approach for analyzing internal environments and external environment of the organization and is a well-known strategy planning tool. SWOT is applied to a large number of researches in several areas (Ghazinoory *et al.*, 2011) such as organization management, marketing planning, health, education, information technology, forest, green energy (Lu *et al.*, 2013; Dongmin *et al.*, 2018), waste management (Shahba *et al.*, 2017), environmental resource management (Crane *et al.*, 2017) and green industry (Patnaik & Poyyamoli, 2014; Nikolaou *et al.*, 2011).

The extensive review of the policy history and development of green industry in Thailand was investigated. The inputs data come from various sources of government and academic which provided necessary information to perform the qualitative analysis. The current achievement and

challenge of green industry implementation of Thai entrepreneurs was analyzed. The data collection sources and key findings were summarized in Table 1.

In-depth interview

In-depth interviews performed to gather the information and the ideas from the key stakeholders. Eight national experts from government, academics, industry, and independent organizations in the field of green industry were invited to an in-depth interview one by one, and duration for each interview conducted in 30-50 minutes. The main research questions developed for in-depth interview mainly derived from the SWOT analysis, covered 4 main aspects as follow:

Question 1. What are the strengths of green industry certified SMEs when adopting green industry principle?

Question 2. What are the weaknesses of green industry certified companies when adopting green industry principle?

Question 3. What are the opportunities of green industry certified companies when adopting green industry principle?

Question 4. What are the threats of green industry certified companies when adopting green industry principle?

Table 1. Data Inputs for Extensive Review

No.	Content	Key information
1	Related policy document <ul style="list-style-type: none"> - The 20-year national strategy - National economic and social development plan - National industrial development plan 	On 13 October 2018, Thailand announced the 20-year national strategy, which is established in accordance with the framework of SDGs. This plan consists of 6 strategies: Security, Competitiveness enhancement, Human resource development, Social equality, Green growth, Rebalancing and public sector development. Green growth strategy set the target is sustainability in three pillars by adopt green economy in the National Economic and Social Development Plan to promote sustainable production and consumption in accordance with green industry, green procurement, green product, and green awareness. The vision framework “Towards a balanced and sustainable creative industry” was set in the Industrial Development Plans to promote environmentally friendly production in accordance with the green and eco industry guidelines and circular economy practice.
2	Government report and academic report <ul style="list-style-type: none"> - Registered small and medium size enterprise (SMEs) database - Pamphlet of green industry - Report of green industry promotion - Green industry certified entrepreneurs name list database 	Office of small and medium size enterprise promotion reports the status of the registered Thai SMEs database. In the period of ten years, the SMEs in all sector increase in term of number and export value. The number of SMEs in the year 2019 was 3,105,096. Ministry of Industry reports the situation of green industry promotion via Green industry website. The total number of green industry certified entrepreneurs from 2011 to 2017 was 30,476 entrepreneurs. A significant part of entrepreneurs were certified in level 1, level 2, and level 3. The number of entrepreneurs certified at green industry level 4 and level 5 were still limited. In the first five years after the certification program began, the number of green industry certifications at all level increased at the beginning of the program and then started to decrease in the seventh year.

Questionnaire based survey

The questionnaire for this study was divided into four main sections. The first section consisted of questions used to elicit demographic information concerning the SMEs such as product category, number of employees, capital and operation period, and green industry certification status. The second section consisted of twenty statements in total that were used to examine environmental policies and activities. The third section consisted of questions used to investigate the barrier of green industry implementation. The last section included the questions to evaluate

the factors that support the decision making to become green industry. The questionnaire was in Likert-scale choices and close-ended.

A list of prospective informants was obtained from the registered SMEs database from Office of small and medium size promotion (OSMEP). There are 3,688 SMEs registered in electrical sector and electronic products and electrical equipment sector at the end of 2016. Yamane formula was then used to calculate the require sample size in this study. Total of 1,300 questionnaires were mailed together with a cover letter to the sampling SMEs from November 2017 to April 2018. A total returned questionnaire are

179 questionnaires with a response rate ~13.8% in which some SMEs have adopted some level of green industry practices.

SWOT analysis and strategy development

The analysis of strengths and weaknesses uses the principles of PRIMO-F analysis. The analysis of opportunities and treats uses the principles of PESTLE. Focus group meetings were organized to discuss SWOT issues for issue prioritization and brainstorm for strategic recommendation. The prioritizing criteria were obtained from a brainstorming meeting of experts who have experience in green industry and environmental management system (EMS) from the government sector, SMEs, academics and independent organizations. The criteria are implementation budget, related law and policy, the possibility of success, stakeholders recognize the importance, and the urgency and severity of the concerning issues. The group focus shared their opinions, insight discussion and suggestions on the strategy to close the gap of Green Industry practices implementation in Thai SMEs.

3. Results and Discussion

The research analyzed external and internal factors and level of their influences that relevant key stakeholders would face when promoting GI adoption. The internal factors consist of the strengths and weaknesses, and the external factors are related to the opportunities and the threats. According to factor-rating method used to prioritize SWOT factors, the method consisted of steps which are list of factors involved in consideration, assigning weight to factors, assigning scores in each factor (scores in the range 1 to 10), evaluating SWOT issues with predefined scores, calculating weight scores by multiplying weight values with evaluations for each factor. Focus group meeting of expert was set up to brainstorm selection criteria for use in rating process. Five criteria selected include (1) Implementation budget is the amount of budget to handle the weakness or threats or to create future opportunity, (2) Law and Policy is the issue related to national policy and current legislation, (3) The success possibility is factors to formulate strategies and take action,

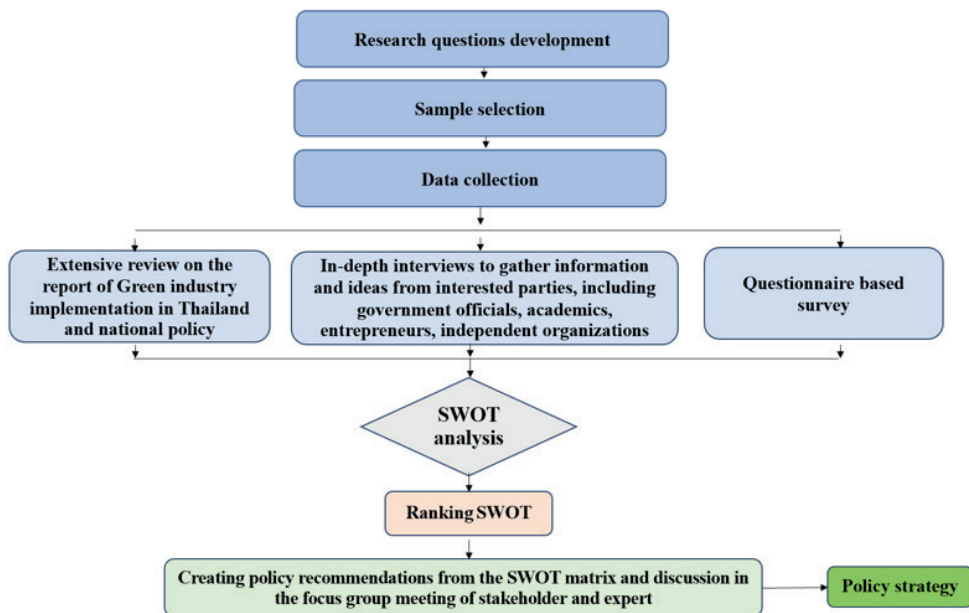


Figure 2. Study Methodology Flowchart

(4) Stakeholders priority is the relevant degree to their business, and (5) Urgency is factors to be critically managed. The committee discussed the relative importance of each criterion, assigned weights as decimals that total sum to 1 when all criteria are considered altogether. Team members with knowledge about all options rate the factor on a scale of 1 - 10, where a 10 means the SWOT factor scores on top of a dimension and a 1 means the SWOT factor scores are at the bottom. The factor-rating analysis allows a team to compare factor on multiple dimensions, which are weighted to reflect their relative importance. The data from the extensive review, in-depth interviews and questionnaire base survey was analyzed to identify SWOT. The results of SWOT ranking are shown as Table 2 to Table 5.

Based on the analysis of various strengths using the method of factor-rating, there are summary of strengths in order 1 - 4, as presented in Table 2. The key strength is that SMEs have good perception in GI (S1) with a weighted score of 6.36, credible of GI certification scheme (S2) with a weighted score of 5.96, large number of Thai SMEs cause broadly promote GI (S3) with a weighted score of 5.57, GI certification create an image of SMEs (S4) with a weighted score of 3.51.

Table 3 shows the results from the rating analysis of all weaknesses in various issues. The key weaknesses that have priorities 1 - 4

are (1) the absence of appropriate regulatory regime (W1) which weighted score 6.59, (2) SMEs lack knowledge in environmental management, technology and innovation in accordance with GI principles (W2) which weighted score 4.11, (3) SMEs lack budget for investment in environmental management (W3) which weighted score 4.05, (4) Environmental management activities of SMEs have not been progressed to lead to sustainability (W4) which weighted score 3.69.

The analysis of various opportunity factors using the factor-rating method shows that the most significant opportunity factors (as summary in Table 4) are as following: the 20-year national strategy focus on green economy (O1) and consumers and interested parties require GI (O2) which respectively weighted score 7.11 and 6.38.

The factor-rating analysis of various threat factors presents in Table 5. The most important threats are T1: Lack of GI knowledge management and T2: Limit of environmental awareness of the public. The respectively weighted score is 7.11 and 6.59.

Together, when integrating all key factors, Figure 3 summarizes all key factors based on positive and negative impacts of the internal and external factors. Details of each factors are discussed below. This prioritization can be useful inputs for developing strategic recommendation.

Table 2. The Factor-Rating of Strengths

Criteria/Factor	Weighted	Score				Weighted score			
		S1	S2	S3	S4	S1	S2	S3	S4
Conform with national policy	0.39	7.50	7.50	7.50	2.50	2.93	2.93	2.93	0.98
Implementation budget	0.21	5.00	2.50	3.00	2.50	1.05	0.53	0.63	0.53
Possibility of success	0.25	4.50	5.00	3.00	3.00	1.13	1.25	0.75	0.75
Stakeholder recognize	0.21	6.00	6.00	6.00	6.00	1.26	1.26	1.26	1.26
Urgency	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	1.00					6.36	5.96	5.57	3.51

Table 3. The Factor-Rating of Weaknesses

Criteria/Factor	Weighted	Score				Weighted score			
		W1	W2	W3	W4	W1	W2	W3	W4
Conform with national policy	0.39	7.50	2.50	2.50	2.50	2.93	0.98	0.98	0.98
Implementation budget	0.21	5.00	2.50	5.00	2.50	1.05	0.53	1.05	0.53
Possibility of success	0.25	4.50	4.50	3.00	4.50	1.13	1.13	0.75	1.13
Stakeholder recognize	0.21	6.00	6.00	5.00	4.00	1.26	1.26	1.05	0.84
Urgency	0.05	4.50	4.50	4.50	4.50	0.23	0.23	0.23	0.23
Total	1.00					6.59	4.11	4.05	3.69

Table 4. The Factor-Rating of Opportunities

Criteria/Factor	Weighted	Score		Weighted score	
		O1	O2	O1	O2
Conform with national policy	0.39	7.50	7.50	2.93	2.93
Implementation budget	0.21	7.50	5.00	1.58	1.05
Possibility of success	0.25	4.50	4.50	1.13	1.13
Stakeholder recognize	0.21	6.00	5.00	1.26	1.05
Urgency	0.05	4.50	4.50	0.23	0.23
Total	1.00			7.11	6.38

Table 5. The Factor-Rating of Threats

Criteria/Factor	Weighted	Score		Weighted score	
		T1	T2	T1	T2
Conform with national policy	0.39	7.50	7.50	2.93	2.93
Implementation budget	0.21	7.50	5.00	1.58	1.05
Possibility of success	0.25	4.50	4.50	1.13	1.13
Stakeholder recognize	0.21	6.00	6.00	1.26	1.26
Urgency	0.05	4.50	4.50	0.23	0.23
Total	1.00			7.11	6.59

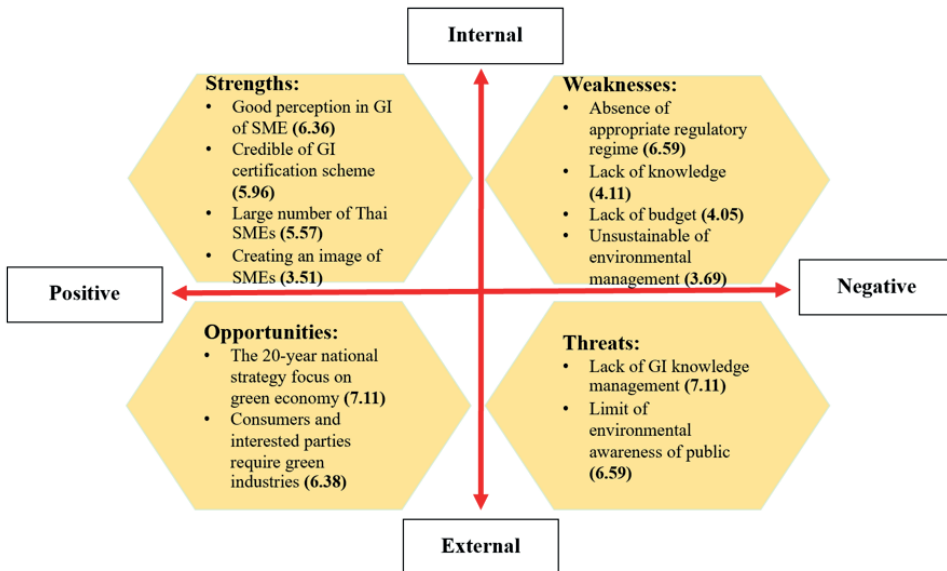


Figure 3. SWOT Analysis and Prioritization of Key Internal and External Factors

3.1 Strengths

Good perception in GI of SMEs (S1)

The survey results showed that 70% of SMEs accepted that GI is important and useful and showed the intension to conduct business in accordance with GI guideline. Furthermore, 65% of SMEs who adopted GI, they complied with level 3 or environmental management system. The results suggested that SMEs have a good perception with GI and they have the potential to set policies and goals to implement the GI in the advanced level. Since the policy is the key success factor as well as the concept of commitment and accountability identified in some ISO standards such as ISO 9001, ISO 14001, and ISO 26001. If the green policy was defined by top management, the GI implementation will be success.

A credible certification of GI scheme (S2)

Ministry of Industry is the scheme owner of GI certification and provide the certificate to the entrepreneurs who operate the business comply with GI criteria. It should be noted that the certification is guaranteed to be reliable because the certification decision based on objective evidence which comply with the principles of conformity assessment. As well as the certification of ISO 14001 currently issued in 171 countries and there are more than 300,000 certifications that users used as a decisive factor in trading operations.

Since there are large numbers of Thai SMEs if incentivize properly can have significant potential to promote GI (S3)

SMEs are the main mechanism for enhancing the country's economic progress according to the national development policy. Thailand has a lot of SMEs that are increasing. In 2015, Thailand has a total of 2,766,126 SMEs, resulting in 41.10% of the GDP and 27.40% of the country's total export value. In 2019, the number of SMEs increase to 3,105,096. The nature of SMEs in the electronic products and electrical equipment manufacture sector is the production unit in the long supply chain. The production process is polluted, but low in concentrate and volume. As well as SMEs have a highly flexible internal management, as they have

only one executive then they can make quicker decisions. This finding indicated that SMEs have a high potential of developing a successful green organization and cause broadly promote GI. Similar findings were found in previous studies (Zamfir *et al.*, 2017; Jove-Llopis *et al.*, 2018; Lefebvre *et al.*, 2001).

Establish good reputation of SMEs cause by receiving GI certification (S4)

Regarding the questionnaire-based survey, 70% of SMEs agreed with if the business operation comply with the GI principles, they will receive more business benefits. Moreover Ministry of Industry (2018) found that the entrepreneurs who have received the GI Level 5 certification, they also achieved higher sustainability ranking of the world's top ranking organizations and got more profit. This finding suggested that GI certification is useful for SMEs in terms of creating a corporate good reputation, being environmentally friendly and socially responsible, which can increase competition opportunities.

3.2 Weaknesses

Absence of appropriate regulatory regime (W1)

Although Thai government have issued green growth policy which can support GI adoption. There are still some unscientific policies restricting their development. The law and regulations of environmentally friendly in the industry sector are also imperfect. Currently, there are no specific laws and regulations on enforces entrepreneurs to conduct environmental management by the GI concept. Interviewees from both government and industry and results from questionnaire-based survey reflected the same problem. Based on questionnaire survey, 75% of SMEs agreed that the strictness of the law and 65% agreed that the GI being defined as regulations affects the development of the organization to be a GI. Similarly, to the research on the drivers of conducting business in an ecologically sustainable manner, found that politics, legislation and other institutions are the drivers of ecological sustainable business (Gast *et al.*, 2017).

SMEs lack knowledge in environmental management, technology and innovation in accordance with GI principles (W2)

The questionnaire-based survey showed that 28% and 20% of SMEs agreed that the major barrier of GI implementation is environmental knowledge and skill of personnel and capability in access to GI technology and innovation. The findings suggested that the competency personnel capability is the significant obstacle to SMEs since Thai SMEs are entrepreneurs with a total employment of not more than 200 people. This result in line with Ghazilla *et al.* (2015) who pointed out that innovation technology and eco-knowledge are barriers to the implementation of green manufacturing practices in SMEs. Moreover, the organization resources and specific organization capabilities positively influence the adoption of environmental practices by smaller firms (Leonidou *et al.*, 2017).

SMEs lack budget for investment in environmental management in accordance with GI guidelines (W3)

The capability of financial resource is the significant obstacle to business operations of Thai SMEs. Because SMEs are entrepreneurs with an annual income of not more than 500 million Baht. Furthermore, the questionnaire-based survey showed that 35.5% of SMEs agreed that financial factors such as budget allowance is the the significance obstacles of GI adoption. Similarly, SMEs in foreign countries have found that budgets are an obstacle to operating environmentally friendly businesses (Leonidou *et al.*, 2017; Ghazilla *et al.*, 2015).

Environmental management activities of SMEs have not been progressed to lead to sustainability (W4)

International Organization for Standardization (ISO) have reported that there are as many as 400 ISO standards are sustainable tools, includes environmental management standards which can be used as management tools for sustainable production achievement. But the questionnaire-based survey indicated that Thai SMEs in the electronic products and electrical equipment

manufacture rather adopt ISO standard in order to manage environment (10%). They implemented ISO standard for sustain related to greenhouse gas quantification, green label, and green supply chain management with minority (2%). This is different from SMEs in foreign countries that used a variety of environmental tools such as life cycle assessment, carbon footprint, eco label, circular economy for environmentally friendly manner and sustainability (Jové-Llopis *et al.*, 2018; Zamfir *et al.*, 2017; Lefebvre *et al.*, 2001; Jung, 2015; Wang and Chui, 2014).

3.3 Opportunities

The 20-year national strategy focus on green economy (O1)

In 2017, Thai administration set up the 20-year National Strategy in order to achieve the vision of “stability, prosperity, and sustainability”. A series of policies were established including: bio economy, circular economy and green economy. Green economy policy set the goal to promote sustainable production and consumption in accordance with green industry, green procurement, green product, and green awareness in the National Economic and Social Development Plan. Moreover “Towards a balanced and sustainable creative industry” is the vision framework. It was set in the Industrial Development Plans to promote environmentally friendly production in accordance with the green and eco industry guidelines and circular economy practice. This finding suggested that Thai national strategy support the application of GI principle by the entrepreneur. Nonetheless, government’s policy supports still stimulate GI, and there is no doubt that policy supports will be increasingly stronger in the future. Therefore, the formulation of strategies and plans for promotion of GI are in line with the national strategy, which will enable the program to be successful.

Consumers and interested parties require green industries (O2)

The survey result showed that 76% of SMEs agreed that consumers and stakeholders require GI and SMEs’ decision to adopt GI was affected by the need of consumers

and stakeholders. The result suggested that Thai society is increasingly aware of the environment. If there are more environmental requirements from the customers and market, it could cause positive effect on corporate environmental responsibility. Same as the establishment of a green procurement policy in both the private and government sectors in Thailand caused by the customer and market environmental requirements. Similar findings were found in previous studies (Hussey and Eagan, 2007; Sáez-Martínez *et al.*, 2016).

3.4 Threats

Lack of GI knowledge management (T1)

The questionnaire-based survey showed that 54% of SMEs agreed that technology and innovation affecting the development of GI. While 20% of SMEs agreed that capability in access to green knowledge and tools is the major obstacle. This finding suggested that knowledge management is the important factor in order to enhance GI adoption by SMEs. Since the implementation of GI principles requires technology and innovation. If without the proper technology and innovation, the development of environmentally friendly production will be done ineffectively. Previous studies also found similar results (Na and Na, 2015; Jung, 2015).

Limit of environmental awareness of the public (T2)

SMEs hardly have vision of sustainable. Therefore, SMEs usually sets a profit goal for their business and sometimes regardless of social and environmental responsibility. In addition, the consumers themselves lack awareness of participation in environmental protection, resulting in unfriendly consumption. As though, questionnaire-based survey shown that 23% of SMEs agreed that GI required by consumers and stakeholders is the major barrier. Since the environmental awareness of the public sector in Thailand is limit in specific community. Then the public need of GI could not activate the GI adoption by SMEs.

3.5 Policy and Strategies Recommendation

The policy recommendations are developed using information from SWOT matrix (summarized in Table 6) where the strengths, weaknesses, opportunities, and threats have been analyzed and prioritized. The focus group meeting of experts and stakeholders brainstormed and together developed policy recommendations, as following:

Table 6. SWOT Matrix and Green Strategy

External Factors	Internal Factors	
<p>Strengths: S1: Good perception in GI of SMEs S2: Credible of GI certification scheme S3: Large number of Thai SMEs cause broadly promote GI S4: Creating an image of SMEs cause by receiving GI certification</p>	<p>Weaknesses: W1: The absence of appropriate regulatory regime W2: SMEs lack knowledge in environmental management, technology and innovation in accordance with GI principles W3: SMEs lack budget for investment in environmental management W4: Environmental management activities of SMEs have not been progressed to lead to sustainability</p>	
<p>Opportunities: O1: The 20-year national strategy focus on green economy O2: Consumers and interested parties require green industries</p>	<p>SO Strategy: Adopt economic based mechanism: Incentives, sustainable procurement, voluntary green product certification scheme</p>	<p>WO Strategy: Adopt regulation mechanism: Green product law, product tax</p>
<p>Threats: T1: Lack of GI knowledge management T2: Limit of environmental awareness of the public</p>	<p>ST Strategy: Promoting green awareness for raising awareness and participation of the public sector</p>	<p>WT Strategy: Design specific program to enhance green knowledge</p>

I. Adopt economic based mechanism

As a result of highest weighted score of S1 and O1, the experts and stakeholders suggested that the government should adopt economic based mechanism related to the incentives to enhance GI adoption by SMEs. This finding indicated that if the incentive provided to SMEs and consumer, the incentive may persuade consumer increase the green need and then the consumer need force SMEs adopt GI. This result was in line with developed countries, Japan, who success implement economic-based incentives such as product charge, trade requirements to achieve new growth green strategy.

II. Adopt regulation mechanism

Regulation mechanism adoption was recommended by the experts and stakeholders based on the weighted score of W1 O1 and O2. According to the Porter hypothesis (Porter and Van der Linde, 1995), the demand for the GI concept can result from environmental regulations, then the appropriate laws regarding the GI could high potential for enforcement.. This finding indicated that the green electrical product law should be enacted to enforce SMEs to conduct business comply with GI principle. This law could enforce SMEs who produce electrical products shall comply with the GI criteria and must get the GI certification before receive the authorize for sale. If SMEs could not certify the GI, they should require to pay higher rate of product tax. This finding was consistent with the research conducted by Durdyev *et al.* (2018), Demirel *et al.* (2017), Rooij (2010) stated that developing countries use legal mechanisms to promote environmentally friendly strategy.

III. Promoting green awareness

To overcome the threat of limit environmental awareness, the government sector should lead to promote green awareness for raising awareness and participation of the public sector. This finding suggested that if the government promote public awareness concern the importance and benefits of GI as well as the values of environmentally friendly goods and services, it could encourage public sector change behavior to environmentally friendly consumer. Then the public awareness

may persuade SMEs implement GI. Similar findings were found in previous studies. (Huang *et al.*, 2018; Kim *et al.*, 2013).

IV. Design specific program to enhance green knowledge

To eliminate the constraints that SMEs lack knowledge, technology and innovation in environmental management, nonprogress and unsustainable environmental management activities of SMEs. The experts suggested that the knowledge of innovative environmental management tools should be designed. This finding indicated that the specific program of environmental management tools per international environmental management standards (ISO 14000 series) should be promoted to SMEs, academic and an independent organization by the national standard body. Since the national standard body who responsible for adopting ISO standard and encouraging the interested parties to use them, then this body have potential to design the specific program to enhance green knowledge according to ISO 14000 series for SMEs applied them for GI development and for knowledge management of other parties.

4. Conclusion

Although Thailand have established GI development criteria of 5-level, the GI adoption of SMEs faces a variety of bottlenecks. The power SWOT analysis demonstrates that there are several weaknesses when SMEs implementing GI practice such as lack of budget, green knowledge and skill, as well as the absence of appropriate law. The positive perception of SMEs in GI is a key strength. Such internal benefits related to GI practices can assist both economic and environmental performance of those SMEs. The long-term national strategy on green economy and GI need from consumers and interested parties are major opportunities in the future. However, GI knowledge management and public awareness post a great risk. Regulation mechanism and economic based mechanism should be implemented as a framework for effective GI to efficient manage resources and pollution.

Findings from this study are applicable for policy makers to adopt the strategy to enhance GI adoption of Thai SMEs in the sector of electronic products and electrical equipment. The voluntary agreement approach as green product certification scheme is recommended. According to the propose new scheme requirement, the manufacturers have to certify GI for the eligibility requirements of the green product certification. The green product certification could be set as the measure to promote sustainable procurement and can induce the demand of green product from the consumer. The green product certification can be a support measure for the enforcement of green product law and product tax. To enhance the GI knowledge management and green awareness, IOT technology should be used to create a platform which enable entrepreneurs to access green knowledge according to ISO 14000 series, including green technology and innovation and to promote green awareness. The enforcement of appropriate law and the application of economic mechanism can motivate SMEs to be more environmentally friendly production patterns.

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