36

Int. J Sup. Chain. Mgt   Vol. 5, No. 2, June 2016

Environmental Stewardship Issue among Malaysian Manufacturing Firms

Mohamad Ghozali Hassan[#1], Norani Nordin[*2], Hasbullah Ashari[*3]

[#*] *School of Technology Management and Logistics, Universiti Utara Malaysia,*
06010 UUM Sintok, Kedah, Malaysia

[#1]ghozali@uum.edu.my
[2]rani@uum.edu.my
[3]h.ashari@uum.edu.my

Abstract — Since the fourth industrial revolution is embryonic also known as the automation and machine era, the issue of industrial waste and pollution have become more pressing. This is because manufacturing firms are known to have the highest pollution. It has made the issues of environmental stewardship vital for both developing and developed countries. However, the implementation of the concept of environmental stewardship differs from country to country and from one manufacturing firm to another. Notwithstanding, this issue is vital for the human environment. Therefore, this paper investigated the issue of environmental stewardship among Malaysian manufacturing firms. Data were collected from 104 manufacturing firms of various production types. The findings of this study revealed that environmental stewardship culture among Malaysian manufacturing firms is low. Thus, the study identified 18 strategic steps to improve environmental stewardship culture among Malaysian manufacturing firms. These identified strategies will contribute to ensuring sustainable manufacturing practices through which industries can improve the manufacturing practices in order to offset the negativity on the environment.

Keywords: *Environmental Pollution; Environmental Stewardship, Manufacturing Firms; Sustainable Manufacturing; Environmental Regulation; Sustainable Practice*

1.   Introduction

In recent times, human activities have been found to endanger not only animals but also humans. This is evident in the recent trends of climate change which has been predicted to have enormous consequences on humans if preventive measures are not applied [1]. In order to provide these measures, the concept of environmental stewardship has been explored [2].

According to Environmental Protection Agency [3], environmental stewardship is the obligation regarding

environmental quality shared by every one of those whose activities influence the environment reflected as both a worth and a practice by people, companies, groups, and government associations. Positive stewardship conduct shows acknowledgment of this obligation through the nonstop change of environmental execution to accomplish quantifiable results and practical results. Positive environmental stewardship is communicated in both values and practice [4]. The qualities are admiration for the environmental, on which life depends on; acknowledgment of individual and hierarchical obligation regarding environmental quality; and acknowledgment of the need to support the environment for future era's environment for future generations [5], [6].

This concept creates an environmental awareness and consciousness where governments have begun to regulate industrial activities with environmental protection in mind [7], [8]. However, the extent of this concept differs from country to country [9]. Likewise, manufacturing firms have been identified as one of the largest environmental pollutants [10]. This is because manufacturing firms process their raw materials into useful goods whereby some of the by-products of manufacturing waste materials left over or substances produced by the manufacturing process itself may be harmful to the environment. These waste and substance contribute to air and water pollution. The unchecked appropriation of stewardship by manufacturing firms is to be faulted for the environment's degrading.

37

Int. J Sup. Chain. Mgt   Vol. 5, No. 2, June 2016

For instance, many manufacturing processes involve heating raw materials to transform them into more useful forms. Oil refining, for example, is a process called fractional distillation that heats petroleum to high temperatures to separate it into various grades of gasoline and other petroleum products. Doing so releases sulfur dioxide into the air. Other manufacturing types use heat from coal or diesel furnaces to provide steam power to run the plant. Burning these fuels can also release pollutants into the air and water which causes huge environmental pollution [11], [12]. Thus, the issue of environmental stewardship should be vital and compulsory for all manufacturing firms. Therefore, this study will investigate the culture of environmental stewardship within Malaysia manufacturing firms.

2. Methodology

This study made use of survey research based on a quantitative approach using Malaysia manufacturing industry as the study population. A total of 104 registered manufacturing companies with the federation of Malaysian manufacturers (FMM) were selected for this study. The manufacturing industry was chosen because they represent one of the major contributors to environmental degradation in Malaysia [13] and contributes hugely to both infrastructural and economic development of the nation [14], [15]. A mail survey questionnaire technique was used to collect data from the selected respondents of this study, which are the operation managers, manufacturing managers and the environmental, safety and health managers of manufacturing firms in Malaysia. Data were collected and analyzed by using SPSS version 20.

The study selected manufacturing companies consisting of the Electrical and Electronic industry which represents the major percentage (29.8%) of the respondents' industrial sector. Rubber and plastic industries have 14.4% representation of the respondents, food and beverages have 8.7% representation, while the Textile, wearing and apparel industry has 1.9 % representation. More so, the Paper and allied industry are represented by 5.8%, Chemical, and allied products have 8.7% representation, Basic metallic parts industry is represented by 4.8%, Transport equipment industry has 6.7% representation, while the industry categorized as others have 19.2% representation which was within the range of recycling

industry, medical equipment, and precision. Table 1 and 2 summarized the study companies' demographic profiles.

Table 1. Category profile of Companies

	Frequency	%
Food products and beverages	9	8.7
Textile, wearing apparel	2	1.9
Paper and allied products	6	5.8
Chemical and allied products	9	8.7
Rubber and plastics	15	14.4
Basic metallic parts	5	4.8
Electrical, electronic, computing machinery parts	31	29.8
Transport equipment	7	6.7
Others	20	19.2

Table 2. Certification profile of Companies

	Frequency	%
ISO 9001	22	21.2
ISO/TS 16949	4	3.8
QS 9000	2	1.9
ISO 14001	50	48.1
Other	26	25.0

Based on Table 1 and 2, the frequency analysis of the certification of the companies revealed that majority of the companies (48.1%) are certified in Environmental Management System (ISO 14001). 21.2% of the companies have been certified in quality management (ISO 9001), only 1.9% of the companies have quality system (QS 9000) certification, 3.8% of the companies are certified in ISO/TS 16949 while 25% of the companies have other certification which ranges between Halal certification, integrated management system certification. In respect of the company ownership, 38.5% of the companies are privately owned and also, 38.5% are multinational companies. 15.4% of the companies are foreign owned while 3.8% are both state-owned enterprises and joint venture. With respect to the size of the companies, this is measured by the number of full-time employees of the company. The majority of the companies are large (51.9%), having more than 251 full-time employees. 22.1% of the companies are medium sized with full-time employees between 151 and 250 employees while those companies with full-time employees ranging between 51 and 150 are represented by 26%. These results indicate that the sample companies are

38

Int. J Sup. Chain. Mgt   Vol. 5, No. 2, June 2016

financial, technically capable and also have expertise capability to provide needed environmental stewardship.

The study respondent consists of 11.5% operations managers, 12.5% production/manufacturing managers, 37.5% environmental/health and safety managers while 38% were top management executives as presented in Table 3.

Table 3. Demographic profile of the Respondents

Position	Frequency	%
Operation	12	11.5
Production/manufacturing	13	12.5
Environmental/ Health and safety	39	37.5
Others	40	38.5

In addition, the demographic analysis result revealed that 14.4% of the respondents are less than one year of employment in their current position. The majority of the respondents (42.3%) are between one to five years in their position. 13.5% were between six to ten years in their current position while, 28.9% have spent more than 10 years in their current position. More so, the largest percentage (43.3%) of the respondents has spent between one to five years in their current company. 28.8% have been with their companies for more than 10 years. 15.4% have spent between six to ten years in their companies while those percentages of the respondents with less than one year in their company are 12.5%. The indication of this result is that the respondents are the appropriate personnel and in the right position to understand the issue of environmental stewardship in their respective companies.

3. Findings

Based on the descriptive analysis as presented in Table 4, implementation of pollution reduction practices has the highest rating with 3.00 while natural habitat has the lowest. This finding shows that issues of natural habitat management such as protection and sustainable forest conservative are not given such concerns compare with pollution and emission.

Table 4. Descriptive Analysis of the Constructs

Constructs	Min	Max	Mean	Std. Dev
Environmental Stewardship	0	4	2.50	.890
Emission	0	5	2.47	1.046
Resource Consumption	0	5	2.48	.972
Pollution	0	5	3.00	1.257
Natural Habitat	0	5	2.06	1.718

Further analysis on non-applicable environmental stewardship practices likewise depicts that natural habitat has the highest repeated frequencies (all the three dimensions have 32, 33 and 41 respectfully). Although, renewable energy consumption has the highest frequency while application of new technology in manufacturing operations under technologic advancement has the lowest frequency. Summarize of findings for the non-applicable environmental stewardship practices are presented in Table 5.

Table 5. Non-applicable Environmental Stewardship Practices

Items	Freq	%
EMISSION		
Non-treated waste water	41	39.4
Treated waste water	36	34.6
Reusable waste produced	22	21.2
Recyclable waste produced	10	9.6
Re-manufacturable waste produced	31	29.8
Disposal waste by landfill	24	23.1
Waste energy emission (in form of heat, vibration, etc)	27	26
Air emission	19	18.3

39

Int. J Sup. Chain. Mgt   Vol. 5, No. 2, June 2016

Cont'd **Table 5**. Non-applicable Environmental Stewardship Practices

Items	Freq	%
RESOURCE CONSUMPTION		
Specific virgin material used	10	9.6
Specific recycled material used	12	11.5
Specific reused material used	12	11.5
Specific remanufactured material use	20	19.2
Fluid consumption (including cleaners, lubricants, oils, coolants, etc.)	7	6.7
Reclaimed or recycled packaging material from suppliers	14	13.5
Non-renewable energy consumption	29	27.9
Renewable energy consumption	44	42.3
Recycled water used	31	29.8
Land used	34	32.7
POLLUTION		
Hazardous substances	11	10.6
Green House Gases	26	25
Noise emission	2	1.9
Acidification substances	36	34.6
Particulate emission	16	15.4
NATURAL HABITAT		
Biodiversity management conservation of protected areas)	32	30.8
Policies to conserve and protect surrounding natural habitats	33	31.7
Habitat management (habitats protected or restored, especially forests and sustainable forests)	41	39.4
TECHNOLOGICAL ADVANCEMENT		
Applies new technology for manufacturing operations	4	3.8
Add high-efficiency resources	6	5.8
Add high-efficiency technology	5	4.8
Applies the experience of the R&D personnel for the benefits of process or product development	10	9.6
Invest adequate monetary resource into R&D projects in sustainable product/process	11	10.6
Invest adequate time resources into R&D projects in sustainable product/process	11	10.6
Establishes organization's level in innovative concept through Patent	14	13.5
Establishes organization's level in innovative concept through publishing scientific papers	18	17.3

4. Discussion

Environmental stewardship has four dimensions namely emission, resource consumption, pollution and natural habitat conservation. The result of the descriptive analysis on environmental stewardship revealed a mean value of 2.50 with a standard deviation value of 0.890 indicating that the practices of environmental stewardship within the context of this study is to the medium extent. Though, the result revealed 3.8% of the sampled companies notified emission reduction as not applicable. However, as shown in Table 4, emission reduction has a minimum value = 0, maximum value = 5, mean value = 2.47, while the standard deviation result =1.046. The indication of this is that there is a limited practice of emission reduction among Malaysian manufacturing companies. In addition, the descriptive analysis of the resource consumption revealed that resource consumption reduction is not applicable in 2.9% of the sample companies. Though, the result shows a mean value of 2.48 and standard deviation value of 0.972. The result indicates that resource consumption is generally practiced at limited extent among Malaysian manufacturing companies.

Furthermore, Table 4 revealed that pollution reduction practices among the surveyed companies have a mean value = 3.0 and a standard deviation value = 1.257 indicating that manufacturing companies in Malaysia have implemented the practices of pollution reduction to a certain extent. Even though just 1.9% of the companies have not seen pollution reduction as applicable, the result of the standard deviation shows that the practices have not been evenly implemented among the companies. Concerning the natural habitat conservation, it was shown in the descriptive analysis result that a large proportion (31.7%) of the Malaysian manufacturing companies does not view the conservation of the natural habitat as applicable in their field. The mean value is 2.06 and the standard deviation is 1.718. This indicates that natural habitat conservation practices are in limited extent among Malaysian manufacturing companies and the practice has not been evenly adopted to be used in the Malaysian manufacturing. More so, the descriptive analysis indicates that technology advancement shows a mean value of 3.19 and a standard deviation value of 1.119, which indicates that technological advances in sustainable manufacturing in Malaysia have been practiced to a

certain extent. However, the advancement of these technologies has not been fully initiated by manufacturing firms in Malaysia.

Additionally, this study revealed that environmental stewardship index of sustainable manufacturing practices is not applicable to some of the companies. Table 5 depicts non-applicable environmental stewardship within Malaysian manufacturing firms. The results show that non-treated wastewater emission is not applicable in 41 (39.4%) of the companies and treated waste water emission in not applicable to 36 companies. In the aspect of resource consumption, the use of the specific virgin material is not applicable in 10 out of 104 companies, specifically recycled and reused material in 12 companies, specific remanufactured materials in 20 companies and consumption of fluid materials including cleaners, lubricants, and oil are not applicable to 7 companies. Regarding pollution, reduction of hazardous substances is not applicable in 11 out of the 104 sampled companies, 26 companies stated the reduction of Greenhouse. In addition, analysis shows that a biodiversity management of the natural habitat is inapplicable in 32 out of the 104 companies, policies to conserve and protect the natural habitat does not relate to 33 companies, while 41 out of the 104 companies indicated that they do not apply habitat protection or restoration, especially forests and sustainable forests is not applicable to them. Table 6 summarized the findings on environmental stewardship based on its four constructs.

Table 6. Summary of environmental stewardship in Malaysia manufacturing firms

Constructs	Implementation Level	Awareness Level
Environmental Stewardship	Average	Low
Emission	Average	Average
Resource Consumption	Average	Low
Pollution	Average	Average
Natural Habitat	Low	Average

5. Recommendation and Conclusion

This study has been able to explicitly point out that the culture of environmental stewardship among Malaysia manufacturing firms is low (as presented in Table 6) whereas many of these firms acclaimed to have implemented some form of environmental

protection while some were not considered (as presented in Table 5). Thus, this study recommends the following policies and regulations implementation in order to enhance the level of environmental stewardship within the country manufacturing firms:

i. Concentration-based pollution discharge controls
ii. Pollution levy fee
iii. Environmental labeling system
iv. Clean-up campaign
v. Mass-based controls on total provincial discharge
vi. Non-compliance fines
vii. Environmental awareness campaign
viii. Environmental impact assessments (EIA)

ix. Discharge permit system
x. Cleaner production
xi. Air pollution index
xii. Sulfurs emission fee
xiii. Water quality disclosure
xiv. Administrative permission hearing
xv. Subsidies for energy saving products
xvi. Regulation on refuse credit to high-polluting firms
xvii. Environmental compensation fee
xviii. ISO 14000 system

These are important in order for firms to be able to reduce potential harm to the environment and energy efficiency. It will create a broad environmental perspective that balances advances in living standards and prosperity with potential impact on the planet and the well-being of future generations. To achieve this, there is a need for government and her regulatory bodies to enforce all environmental laws and regulations on all manufacturing firms in the country. Likewise, there is a need to create more awareness and alertness particularly among manufacturing firms and their management. Hence, there are still many works enveloped in this study. For instance, future studies can concentrate on environmental stewardship framework of sustainable manufacturing firms.

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