

Determinants of Green Practices in the Petrochemical Sector: An Empirical Study

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Abstract

This paper discusses the determinants of green practices and incorporates some empirical findings from a recent study in the petrochemical sector in the Republic of Trinidad and Tobago. The study was comprised of a survey and follow-up interviews with senior executives who participated in the survey. Of fourteen companies involved, the findings affirmed that the investigation of accidents, provision of an emergency response, employee training, decreasing the production of wastes, and pre-treating wastes before disposal should be stressed. Government requirement, the economic reasons and public pressures were the driving forces of green practices. The five most important determinants identified include performance evaluation, financial justification, impacts on company, management leadership and operations integration. Implementing environmental management systems as a feasible approach to green practices in the petrochemical sector was explored. The findings provide guidance that helps organisations to accommodate the determinants of green practices into achieving sustainable environmental goals.

Key Words : Environmental management practices, industry

1. Introduction

Because of increasing environmental regulations, government pressure, international certification standards, changing customer demands and managers recognising pollution as waste, firms are now developing environmental policies for their manufacturing plants and supply chain partners while at the same time managing compliance with new regulations [1, 2]. Environmental management or 'green' practices help organisations to strengthen their capabilities in attaining environmental performance and eliminating pollutions and wastes. These practices employ cleaner production (CP) and environmental management systems (EMSs) to monitor and improve

environmental performance [3]. CP is concerned with continuous, incremental improvement of environmental attributes of products, processes and operations [1,4]. This has a strong bearing on production processes, product structures, raw materials and energy consumption [2]. An EMS builds upon the quality management concepts and integrates cleaner production into the design and manufacture of environmental-friendly products and processes [5,6]. There are various environmental management system standards currently adopted by different regions and countries. Eco-Management and Audit System (EMAS), CSA-Z750-94, BS 7750 and the ISO 14000 series are typical examples to help organisations develop EMSs, regardless of their size and business types [7,8].

Many studies suggested that organisations provided quality and environmentally friendly goods and services could have greater potential to capture larger market shares and returns [2,9]. Adoption of environmental management practices has become an integral part of business strategy driven by customer requirements, competitive pressures and resource conservation [10]. This paper discusses an EMS approach to environmental-friendly operations and investigates the determinants that drive organisations to achieve their environmental goals. Empirical findings were acquired via a recent study on the environmental management practices in the Republic of Trinidad and Tobago (T&T) in the Caribbean.

2. Environmental Management Systems and ISO 14000 Series

An environmental management system is an integral part of overall management system that includes organisational structure, planning, activities, responsibilities, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy [11,12]. It serves as a systematic approach to address environment protection and utilise organisational resources for corporate environmental goals. The system helps organisations to develop and carry out a set of work procedures and methodologies for improving environmental performance [2,8]. Generally speaking, these procedures and methodologies address several important areas below:

1. Positive prevention, optimum utilisation of resources and cost reduction;
 2. Compliance with environmental legislation;
 3. Promoting awareness of pollution prevention;
 4. Formulating contingency plans;
 5. Enhancing training and management; and
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6. Improving the corporate image.

Environmental regulatory bodies and regulated organisations are seeking efficient guidelines and programmes to monitor and improve environmental performance [13,14]. The ISO 14000 series of standards is comprised of two main groups, which have been launched in 1996. These standards are designed to help organisations to formalise a management process, and to evaluate the effectiveness of their activities, operations, products and services in the improvement of the environmental and safety performance [7,14]. The first group (i.e. ISO 14001 and ISO 14004) is to provide guidelines and principles for the establishment and operation of an EMS [12]. The second group (i.e. ISO 14010, ISO 14011 and ISO 14012) is to provide guidelines for environmental auditing, and analysing and characterising the environmental attributes of products [15,16,17]. Table 1 provides a list of ISO 14000 series standards.

Table 1. List of ISO 14000 series standards

Organisation Level:	Standards Reference
<ul style="list-style-type: none"> ■ Implementing environmental management systems (EMS) 	ISO 14001:1996 ISO 14004:1996 ISO/TR 14001
<ul style="list-style-type: none"> ■ Conducting environmental auditing and other related investigations 	ISO 14010:1996 ISO 14011:1996 ISO 14012:1996 ISO/WD 14015
<ul style="list-style-type: none"> ■ Evaluating environmental performance 	ISO/DIS 14031 ISO/TR 14032 ISO 14050:1998
Products and Services Level:	
<ul style="list-style-type: none"> ■ Using environmental declarations and claims 	ISO 14020:1998 ISO/DIS 14021 ISO/FDIS 14024 ISO/WD/TR 14025
<ul style="list-style-type: none"> ■ Conducting life cycle assessment (LCA) 	ISO 14040:1997 ISO 14041:1998 ISO/CD 14042 ISO/DIS 14043 ISO/TR 14048 ISO/TR 14049
<ul style="list-style-type: none"> ■ Addressing environmental aspects in products standards 	ISO Guide 64:1997 ISO 14050:1998

An ISO 14001 EMS is built with the core elements basically from proven management systems such as the ISO 9000 series [8,13]. The ISO 14001 standard has five major sections, as compared to eight sections of the ISO 9001 standard [7,18]. The five sections in the environmental standard are environmental policy, planning, implementation and operation, checking and corrective action, and management review. According to Aboulnaga [5],

1. The environmental policy relates to the current and potential environmental impact of a firm's products and services, consumed material, pollution prevention and waste reduction.
2. Planning includes identifying the controllable environmental aspects, legal requirements applicable to its operations, objectives and targets for various environmental aspects, and an environmental management program to achieve its objectives.
3. Implementation and operation includes the following: roles, responsibilities and authorities of employees reviewing performance of the environmental system; training, awareness and competence; controlled documentation of core elements and reference to related environmental documents; operational control; and emergency preparedness for handling accidents.
4. Checking and corrective action includes monitoring and measurements for continuous improvement, tracking performance with its objectives and targets, calibration and maintenance of monitoring equipment, taking corrective or preventive action, keeping records and EMS audits.
5. Management review entails review of the EMS by management for its continuing suitability and effectiveness.

The ISO 14001 standard provides a management system framework for planning, developing and implementing strategies and related programmes. Specifically, ISO 14001 calls for organisations to conduct the environmental affairs within a structured management programme. It stresses on continual improvement and requires the organisation to evaluate its current and potential environmental exposures in terms of impact and compliance with legislation [13]. The third-party certification of ISO14001 EMS has become the baseline to meet the customer expectation and requirement as regards to the environmental performance of an organisation [8].

3. An Empirical Study

In 2002, the authors conducted an empirical study to acquire the views from industry practitioners on the 'green' practices in T&T. The country is situated in the Caribbean Sea

between 10°-11.5°N latitude and 60°- 62°W longitude. It is classified as a Small Island Developing State (SIDS) with a relatively significant industrial sector, based principally on the petroleum and petrochemical industries. These include petroleum refining, natural gas liquification, methanol and ammonia/urea production, as well as steel and cement plants. The study based on the petrochemical sector. The production processes and consumption of petrochemical products if not properly managed could be a major source of wastes and emissions that would bring undesirable impacts on the environment. The study was comprised of an industry survey and personal interviews with respondents. Its population frame was using the database of company members registered in the Trinidad & Tobago Chamber of Industry and Commerce (2002). The survey included a total of 75 registered companies in this sector. A set of questionnaire was addressed directly to senior executives of the targeted companies. Participants were then invited to attend a post-survey interview to verify the empirical findings and affirm the determinants of green practices in the sector.

3.1 Respondents Profile

Fourteen replies were received giving a response rate of about 19 percent. Participants were advised that they could respond on a confidential or anonymous basis. Five firms opted for anonymity. The degree of non-response was given detailed consideration in order to eliminate any source of bias with the sample. All firms were contacted by telephone to ascertain the reasons for non-response. The most frequent reasons were 1) lack of time to complete the survey, 2) a reluctance to divulge information, 3) company policy not to participate in surveys, and 4) a refusal to participate with no particular reason given.

The sample demographics of the survey are given in Table 2. In terms of number of people employed, about 86 percent of surveyed companies were small and medium-sized enterprises (SMEs) employing less than 200 people. Only two were considered as large companies employing more than 200 people. According to the official statistics, a great majority of registered companies in T&T were SMEs. This reflected from the survey responses that the company sizes were properly distributed, with largest proportion having between 20 and 99 employees. One large company was a multinational corporation and employed more than 500 people in and outside T&T. Besides, two SMEs have overseas branches or subsidiaries for marketing and distribution of their products, with one employed less than 20 people and another less than 100 people, respectively.

Most surveyed companies (about 79%) have been established more than ten years, except three fell between 6-10 years ago in T&T. The majority of surveyed companies were locally

owned, with two joint ventures and two foreign-based companies. The sample showed that companies with longer year of establishment were more willing to participate the study. This can be explained that many of them are exporters and distributors. Their products need to adhere to internationally environmental standards and requirement. These companies manufacture and market a wide range of products, from oil and natural gas to industrial chemicals, agricultural chemicals (e.g. pesticides, fungicides), household chemicals (e.g. soaps, cleaners), and other personal care items. Their operations include the use of chemicals of some form or as part of their primary outputs, and involve storage and transportation of petrochemical products.

Table 2. The Sample Demographics

Respondent Profiles	Results (n=14)	
	In T&T	Outside T&T
Number of Employees		
1-19	2 (14.3%)	1 (7.1%)
20-99	7 (50.0%)	1 (7.1%)
100-199	3 (21.4%)	-
200-499	1 (7.1%)	-
Over 500	1 (7.1%)	1 (7.1%)
Years of Establishment		
6-10 years	3 (21.4%)	
Over 10 years	11 (78.6%)	
Principal Products		
Industrial Chemicals	5 (35.7%)	
Agricultural Chemicals (e.g. pesticides, fungicides, and fertilisers)	5 (35.7%)	
Household Chemicals (e.g. soaps, bleach, and cleaners)	4 (28.6%)	
Ownership		
Local capital	10 (78.6%)	
Foreign capital	2 (14.3%)	
Joint Venture	2 (14.3%)	

3.2 Green Practices Reported

Half of surveyed countries had an environmental policy, while only four companies have designated functions (i.e. a department, a division and/or position) that were responsible for dealing with environmental issues (see Table 3). All respondents claimed that they have been reducing or eliminating the use of environmentally unfriendly materials, using safe disposal

of wastes and emissions, and training workers to handle wastes and emissions. Besides, a great majority of surveyed companies were reducing the production of waste products (i.e. 93%), using recycled materials (i.e. 93%), and reducing energy consumption (i.e. 86%) in line with company goals to improve operational efficiency and reduce environmental costs.

About two thirds of respondents opted to reduce consumption of raw materials. For those companies involved in blending, it would be undesirable to reduce material consumption because this would lead to reduced production. About 57 percent of companies processed wastes into saleable goods or for energy generation. Many respondents advertised their company (i.e. 57%) and products (i.e. 50%) as being environmentally friendly. Evidence shows a positive public attitude toward green practices. Many companies were concerned about protecting the environment, but some did not engage in any simple practices (e.g. labeling environmentally friendly products).

Table 3. Green Practices Reported in Survey Companies

Having Environmental Policy		
Yes	50.0%	
No	50.0%	
Establishing a Function Responsible for Environmental Affairs		
Yes	71.4%	
No	28.6%	
Employing Green Practices in:	Yes	No
1. Reducing/eliminating the use of environmentally unfriendly materials	100%	-
2. Using Safe disposal of wastes and emissions	100%	-
3. Training workers to handle wastes and emissions	100%	-
4. Reducing the production of waste products	92.9%	7.1%
5. Using recycled materials	92.9%	7.1%
6. Reducing energy consumption	85.7%	14.3%
7. Reducing raw material consumption	64.3%	35.7%
8. Further processing of waste/by-products	57.1%	42.9%
9. Advertising the company as environmentally friendly	57.1%	42.9%
10. Advertising the product as environmentally friendly	50.0%	50.0%
11. Labeling the product as environmentally friendly	35.7%	64.3%

3.3 Determinants of Green Practices

The survey asked the respondents to comment on three groups of determinants, namely 1) the components, 2) the push and pull factors, and 3) the criteria of green practices. A five-point Likert scale of rating was used ranging from 1, the least agreed, to 5, the most agreed. After calculating the mean ratings and standard deviations for sub-elements of these determinants, they were then ranked. The key findings are summarised in Table 4. It shows that the mean ratings for 14 components ranged from 3.00 to 4.64, for 5 factors were 3.86 to 4.29, and for 15 criteria were 2.93 to 4.79, respectively. The standard deviation ranged from 0.43 (i.e. performance evaluation) to 1.27 (i.e. reformulating environmentally friendly products).

3.3.1 Components of Green Practices

Ten out of 14 components of green practices had a mean rating of 4.0 or above. A great majority of respondents agreed or strongly agreed (mean=4.64) that investigation of accidents, provision of an emergency response, and employee training were necessary for the adoption of green practices. This helps organisations to prevent and mitigate accidents with respect to the requirements of an ISO 14001 EMS. Decreasing the waste production (mean=4.5) and pre-treating them before disposal to the environment (mean=4.5) were receiving considerable support from respondents. These seemed to be more cost-effective for companies than setting up recycling systems. Many surveyed companies also claimed that adopting hazardous material management (mean=4.36), modifying environmentally friendly processes and using less harmful raw materials (mean= 4.29) were important in their operations. Besides, reformulation of environmentally friendly products (mean=4.07) and reuse of used materials and wastes (mean=4.00) received considerable support despite that they might require costly process changes.

On the other hand, incineration of used materials to recover useful energy (mean= 3.00) received least support, and some respondents argued that in doing so could even produce more harmful emissions. Similarly, the use of renewable energy resources (mean=3.36) also received little support. This could be explained by the high cost of the practices when compared to the relatively low cost of electricity in T&T. Electricity in Trinidad is produced using natural gas, which in itself is a relatively environmentally friendly system. Besides, the ratings on recycling used materials and waste (mean=3.93), reducing energy consumption (mean=3.86) were comparatively not high, due possibly to the nature of the petrochemical products. For instance, some surveyed companies have very little waste, while others produce wastes that could not be reused or recycled in an economically feasible way.

3.3.2 Pull/Push Factors of Green Practices

As shown in Table 4, about 86 percent of respondents agreed or strongly agreed that government policies requirements (mean=4.29), prospect of reduced costs, e.g. taxes and legal expenses (mean=4.21), and customers request (mean=4.14) pushed them to adopt green practices. Owing to the presence of varied product ranges, there was a wide distribution of opinions on the effect of common industry practices (mean= 3.86). About 29 percent of respondents held neutral view and one company disagreed it. Notwithstanding four companies were either disagreed or held a neutral view, pressure from the public (mean=3.86), including the media, interest groups, and local environmental groups was also an influential factor.

3.3.3 Criteria of Effective Practices

Adopting green practices has positive implications on performance evaluation, financial justification and impacts on company. The survey findings (see Table 4) show that all respondents rated performance evaluation (e.g. increased market share and profitability) as the leading criterion (mean=4.79). Besides this, most surveyed companies were aware the significance of reduced environmental costs and legal expenses, improved image and employee morale, and increased competitiveness. Financial justification (mean=4.64) and impacts on company (mean=4.57) became the two most important criteria indicated by respondents for effective green practices.

To implement green practices effectively in their organisations, the respondents stressed the importance of management leadership (mean=4.57) and operations integration (mean=4.36) at all levels. Another three criteria, objectives and targets (mean=4.21), logistics control (mean=4.21) and product and process design (mean=4.10), also had a high mean rating. Beside, many respondents stressed the improvement in products and processes (mean=3.93) and the provision of education and training (mean=3.86) that help organisations to eliminate potential negative environmental impacts and promote operations integration. They also adopted recycling, reuse and remanufacturing (mean=3.71) to promote effective selection and utilisation materials.

On the other hand, teamwork (mean=2.93) was the least important criteria as commented by respondents. This was followed by employee involvement (mean= 3.57), communication and feedback (mean= 3.64), and materials/waste control (mean= 3.64). Many respondents held a neutral view towards employee involvement (i.e. 43%), product and process development (i.e. 36%), and teamwork (i.e. 36%). Besides, some companies disagreed teamwork (i.e. 36%) and communication and feedback (i.e. 21%) as criteria for effective green practices.

Table 4. Identification of Green Determinants

Determinants of Green Practices	Degree of Agreement*					(n = 14)	
	1	2	3	4	5	Mean	SD
I . Components							
1. Investigating causes and effects of accidents	-	-	7.1%	21.4%	71.4%	4.64	0.63
2. Provision of emergency response for accidents	-	-	7.1%	21.4%	71.4%	4.64	0.63
3. Training employees in handling materials	-	-	7.1%	21.4%	71.4%	4.64	0.63
4. Decreasing the production of wastes and emissions	-	7.1%	7.1%	14.3%	71.4%	4.50	0.94
5. Pre-treating wastes before disposal	-	7.1%	7.1%	14.3%	71.4%	4.50	0.94
6. Adopting hazardous material management	-	7.1%	7.1%	28.6%	57.1%	4.36	0.93
7. Modifying environmentally friendly processes	-	-	7.1%	50.0%	42.9%	4.36	0.63
8. Using less harmful materials	-	7.1%	21.4%	7.1%	64.3%	4.29	1.07
9. Reformulating environmentally friendly products	7.1%	7.1%	7.1%	28.6%	50.0%	4.07	1.27
10. Reuse of used materials and waste		7.1%	14.3%	50.0%	28.6%	4.00	0.88
11. Recycling of used materials and waste	7.1%	7.1%	7.1%	42.9%	35.7%	3.93	1.21
12. Reducing energy consumption	7.1%	7.1%	21.4%	21.4%	42.9%	3.86	1.29
13. Using renewable energy sources	-	14.3%	57.1%	7.1%	21.4%	3.36	1.01
14. Incineration of used materials to recover energy	-	35.7%	42.9%	7.1%	14.3%	3.00	1.04
II . Push/Pull Factors							
1. Government policies and requirement	-	7.1%	7.1%	35.7%	50.0%	4.29	0.91
2. Prospect of reduced costs (e.g. taxes, legal expenses)	-	7.1%	7.1%	42.9%	42.9%	4.21	0.89
3. Requested by customers	-	7.1%	7.1%	50.0%	35.7%	4.14	0.86
4. Common industry practice	-	7.1%	28.6%	35.7%	28.6%	3.86	0.95
5. Pressure from the public (incl. media, interest groups)	-	7.1%	21.4%	50.0%	21.4%	3.86	0.86
III. Criteria							
1. Performance evaluation (e.g. market share, profitability)	-	-	-	21.4%	78.6%	4.79	0.43
2. Financial justification (incl. environmental costs)	-	-	7.1%	21.4%	71.4%	4.64	0.63
3. Impacts on company (e.g. image, competitiveness)	-	-	7.1%	28.6%	64.3%	4.57	0.65
4. Management leadership	-	-	7.1%	28.6%	64.3%	4.57	0.65
5. Operations integration	-	7.1%	7.1%	28.6%	57.1%	4.36	0.93
6. Objectives and targets	-	7.1%	21.4%	14.3%	57.1%	4.21	1.05
7. Logistics control	-	7.1%	14.3%	28.6%	50.0%	4.21	0.97
8. Product and process design	-	7.1%	28.6%	7.1%	57.1%	4.14	1.10
9. Product and process improvement	-	7.1%	35.7%	14.3%	42.9%	3.93	1.07
10. Education and training	-	7.1%	21.4%	50.0%	21.4%	3.86	0.86
11. Recycling, reuse and remanufacturing	-	7.1%	28.6%	50.0%	14.3%	3.71	0.83
12. Materials/waste control	-	14.3%	28.6%	35.7%	21.4%	3.64	1.01
13. Communication and feedback	7.1%	14.3%	21.4%	21.4%	35.7%	3.64	1.34
14. Employee involvement	-	7.1%	42.9%	35.7%	14.3%	3.57	0.85
15. Teamwork	7.1%	28.6%	35.7%	21.4%	7.1%	2.93	1.07

Remarks:

*Based on a 5 - point Likert scale, i.e. 1 - Strongly disagree; 5 - Strongly agree

n - Sample size; Mean - Mean of responses; SD - Standard deviation

4. Interviews and Findings

In order to consolidate the empirical information obtained and to gain further insights on current green practices in the petrochemical sector, a post-survey interview of respondents was conducted. All participating organisations were invited and three interviews were successfully conducted. Some reasons reported from those companies refusing the interview were senior management being lack of time and/or having company policy not to participate. The interviews used the semi-structured, open-ended type of questions to solicit expansive responses of industry practitioners on green practices in the I sector. The main purposes were to reaffirm the participants' intent and views regarding the determinants (including components, push/pull factors and criteria) that affect green practices in their companies. Of three interviewed companies, one has had its EMS in place. The second company was in the process of getting their ISO 14001 EMS certified, while the third is considering the application for the ISO 14001 registration. A summary of the interview findings of individual companies is presented separately below.

4.1 Company A

Company A is a state-owned company that represents the amalgamation of companies, operating under more or less the same management structure throughout its history. This is a large company employing more than 500 people in the country. The company has obtained certificates of environmental clearance for projects and a noise certification for land drilling areas. Its production operations were compliance to the Water and Air Pollution Acts and the Trinidad & Tobago Bureau of Standards. The company is currently in the process of setting up an ISO14001 EMS system in one of four geographical areas as a pilot project. The person interviewed was the manager responsible for the project.

The Health, Safety and Environment (HSE) department of the company looks after the environmental needs in both departmental and corporate levels. Employees are aware the company's environmental policy that is available to the public. Senior management has initiated the pilot project and has committed to support green practices with readily resources. Employees in the pilot area received relevant training on green practices that is provided by company personnel and outside experts or consultants.

Since many of its local and overseas customers do not demand the company to compliance with specified EMS standard, the company also does not request the suppliers and contractors to meet the same requirements. In responding public pressure, the company

has been taking a reactive approach to environmental protection. Both workers and contractors are aware the procedures outlined in the company's safety plan. Specific references to environmental aspects are included in the company's general documentation file. Other geographical areas are using separate documents. System reviews, testing and documentation take place in the pilot area.

The company performs Environmental Impact Assessments on its operations and products. An environmental control/awareness system is tailored for each project. Systems for accident investigation are in place, and investigation criteria include an evaluation of the impact that the accident can have on the environment. This is required by the Ministry of Energy and Energy Industries, to which reports must be submitted. Complaint can be made to the HSE department or through a hotline set up by the company. The waste disposal systems of the company also meet the international standards. Used papers in the offices are examples of reusable wastes, which are sold to local recyclers.

Moreover, the most obstacle in the EMS project was to mesh employees from different backgrounds into one where environmental responsibility was a priority. With positive culture change, employees become accustomed to express accountability for their actions. The company expects that better environmental performance (including lower environmental costs and fewer incidents) can be achieved from the EMS. This can bring cost savings through the avoidance of the necessity for costly cleanups.

4.2 Company B

Company B is the local subsidiary of a multinational corporation with business concerns in the oil and natural gas sector. The company owned by its parent company is based in the United Kingdom. It had started local operations for less than ten years, and presently employed less than 200 people in T&T. The company has the Health, Safety, Security and Environment Department dedicated to environmental responsibility. It has obtained certificates of environmental clearance, and complied with the proposed air and water effluent specifications. The company has obtained ISO14001 certified in 2002, and was the first offshore energy company to achieve this certification in T&T. A cross-functional committee was set up to maintain the EMS. Senior management is committed to green practices, and resources are easily available. The environmental policy is explicitly stated and available to the public.

The company is aware the impact that its operations can have on the environment. It has a rigorous documentation procedure. Documentation includes specific references to environmental aspects, and an environmental report is available to the public. Provisions are made for the receipt of complaints from external parties. The company requires suppliers to have an EMS system in place. It has liaised closely with the Ministry of Energy and the local energy industries. As part of the tendering process, contractors are required to be environmentally responsible and aware of its environmental policy. The company also assists its clients in setting up EMS.

The company has an incident response management plan, accident investigation systems, and systems for the mitigation of the effects of accidents. Investigation criteria include environmental aspects, and systems are reviewed and updated with respect to the ISO 14001 requirements. The major form of reuse and recycling is the sale of waste papers and glasses to local recyclers. There is no other form of waste disposal system.

The company conducts workshops for training workers in environmental safety and responsibility. Lacking management commitment and employee involvement is seen as the greatest impediment in green practices. The company expects benefits from reducing environmental impacts, saving costs, and improving public image. Its environmental preservation efforts have been recognised by the Environmental Management Authority (EMA) and the Ministry of the Environment in T&T. The parent company provided motivation by presenting an annual award for environmental performance to best performing subsidiaries.

4.3 Company C

Company C is a locally owned company and produces industrial chemicals for customers in hospitals and the hospitality sectors. This SME has been in existence for more than ten years, and presently employs less than 100 people. Senior management is committed to green practices. Employees are expected to deal with chemicals to avoid spills and exhibit responsibility in daily tasks, including environmental responsibility. However, the company has neither explicitly stated environmental policy nor formal training on green practices that are to be provided to employees.

The company has rigorous documentation procedures to ensure the quality of their products, but have no specific references to environmental aspects. For instance, the company requires quality specification sheets with shipments to ensure the quality of its

products so that it claims to know how to deal with any accidents. It does not have any disaster preparedness plan. The company admits that if implementing EMS can help meeting legal requirement and gaining more large contracts. It is presently considering the application for the ISO 14001 EMS registration. However, the company also argues that the high costs and the available resources in a company of its size as prohibitive factors to establish EMS.

5. Discussions and Conclusion

Design and manufacture of eco-friendly products, environmental protection and management are increasingly recognised as a strategic means to succeed in competitions in national, regional and global arena. To sustain a competitive leverage towards a "greener" environment, petrochemical companies have to transform their operations from compliance to competitiveness. These include first, to plan for green practices; second, to implement the practices with respect to organisational resources, constraints and conditions; and third, to evaluate the impact of the practices. These issues are interdependent and can hardly be addressed in isolation from one another.

This paper identifies the determinants of green practices with reference to the petrochemical sector in T&T. The empirical findings affirm that most participating companies agreed the increasing importance of green practices in the petrochemical sector in T&T. There are several main components identified of green practices including investigation of accidents, provision of an emergency response, employee training, decreasing the production of wastes, and pre-treating wastes before disposal. The driving forces for adopting green practices include government requirement, the economic reasons and public pressures. The five most important determinants include performance evaluation, financial justification, impacts on company, management leadership and operations integration.

Drawing upon the interviews with practitioners, implementing ISO 14001 EMS is a feasible approach to green practices in the petrochemical sector. This provides practitioners with a practical guide to managing and safeguarding their environmental performance. The ISO 14001 standard sets forth the procedures of management flows, and addresses the environmental policy, the implementation and monitoring, and continuous improvement of operations with documentation control and auditing system. However, the approach cannot be applied mechanically to guarantee a success in any particular industry or organisation. In maintaining and improving green practices in organisations, the management role is to strengthen the environmental consciousness and

facilitate efforts of various groups throughout the organisation. People training and education is an investment in the corporate commitment to green practices that allows the corporate philosophy to be lived.

The empirical findings incorporate the practitioners' views in the petrochemical industries on what is needed for green practices. It gives some indication as to the factors that could motivate them to adopt such practices and integrate them into their daily operations. These views can provide references for the government to enact industry policies on environment issues and insights for fostering green practices in the petrochemical sector. Further research is needed to validate the importance of determinants identified and investigate the extent to which the employment of green practices contributes towards achieving sustainable development in both large enterprises and SMEs.

Acknowledgements

The authors wish to thank to the School for Graduate Studies and Research at the University of the West Indies for the financial support from under the Campus Research and Publication Fund Project (Ref. CRP.3BV).

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