

Greening of Suppliers/In-bound Logistics – In the South East Asian Context

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This chapter presents findings on the greening of the supply chain, which is taking place in the growing manufacturing region that is South East Asia. Empirical research using a survey questionnaire as the research instrument is undertaken for a regional area encompassing the Philippines, Indonesia, Malaysia, Thailand, and Singapore. The objective of this paper is to present the findings of this survey research which identify major issues in this greening process and business practice. The focus of this chapter, from a larger study, is primarily on the in-bound logistics practices of various South East Asian manufacturing firms.

11.1 Introduction

It is expected that a major portion of the world's manufacturing will be taking place in South East Asia creating many job and service opportunities in this part of the world. Yet, this growth in manufacturing will also bring about substantial environmental burden in terms of the generation of various environmentally harmful wastes. This phenomenon poses tremendous challenges for South East Asian governments, communities, and industry of this region. While economic growth is so urgently needed in this region, environmental sustainability and the health of millions of people in this part of the world can no longer be ignored. This challenge is even made larger by Asia's expanding population with a resultant increase in consumption and pollution. Yet, there is another trend, which is being observed in Asia today – this refers to the large manufacturing organizations subcontracting and delegating smaller modules of the manufacturing process to small and medium enterprises. These small and medium enterprises, which constitute critical elements of the supply chain, do not have the resources and capabilities, which the large organizations have and thus often end up being the largest polluters of the environment. This happening recently has been observed and many large corporations, who pride themselves on environmental and socially responsibility, have started encouraging, guiding and even funding their suppliers to be green.

The importance of supply chain management in improving the overall corporate environmental management has long been recognized in environmental standards such as BS 7750, ISO 14000 systems of standards, and the parallel European Union (EU) regulation on eco-management and audit. Also research has observed that the pollution and waste generated by the supply chain can contribute to global problems like climate change, global warming, ozone layer depletion, and acid rain if not addressed properly [Min and Galle, 1997]. One of the most effective ways of addressing environmental problems in the supply chain is to focus on waste prevention and control at the source through the greening of the purchasing function. This focus refers to the greening of suppliers, making sure that the raw materials they use are environmentally friendly, the production process they employ are clean, and green, the use of energy minimized, and the mode of delivery and transportation they adopt are relatively pollution free.

A major part of the in-bound logistics of the greening of supply chain could be achieved if the suppliers could be encouraged to turn become green. This is also a desired feature on the part of customers and other stakeholders of the industrial customer, who often do not draw a line between a company and its suppliers and often hold the end company responsible for the environmental liabilities of their suppliers. The greening of suppliers is also a major concern among many purchasing managers in leading edge companies. In a 1994 survey of U.S. companies, purchasing managers considered environmental and regulatory costs as their second most important economic concern. [Min and Galle, 1997] and this environmental concern has led to the greening of suppliers as well.

Greening the supply chain may be understood by industry as screening suppliers for their environmental performance and then doing business with only those that meet the regulatory standards. In fact, the driving forces for implementing the concept into the company operations comprise “reactive regulatory reasons to proactive strategic and competitive advantage reasons” (Sarkis, 1999). These evolving concepts also include working collaboratively with suppliers on green product designs, holding awareness seminars, helping suppliers establish their own environmental program and so on.

Formulation of a strategy to achieve a greening of suppliers and in-bound logistics is a challenge. This may be partly due to increased material cost and limited availability of qualified suppliers because of the need for non-traditional material and parts. Also, sometimes the recycled materials become more costly than the original virgin material because of the processing involved. Many times, industrial customers, with quality in mind, require the materials they buy to be made out of new or virgin material rather than out of reused material. Cox et al. (1998) observed that managers, including purchasing managers felt that recycled materials were more expensive. Over and above this barrier, many felt that they would have to continue to use new materials because their customers would like them to use it.

11.2 Brief Review of Literature

In their case based research on integrating suppliers into environmental management process, Walan, Handfield and Melnyk (1998) have observed two evolving trends in the business today. The first trend pertains to how environmental issues are becoming an intrinsic part of strategic planning agendas, perhaps due to stricter regulation and stronger requirement for environmental accountability. The second trend refers to the companies integrating their supply chain to bring down the operating costs and improve customer service. Combining these two trends it appears that companies must now involve suppliers and purchasers to contribute towards the environment performance of the system as a whole and thereby address the purchasing function's impact on the environment by using and obtaining environment friendly materials for the product design, improve and green suppliers' production process, evaluate suppliers using environment criteria and greening of all of the inbound logistics process. They have also explored the importance of management's commitment to the environment friendly performance in the supply chain and 'to move beyond environment compliance to achieve a proactive supply chain'.

Walton, Handfield and Melnyk (1998) have observed how companies traditionally have always tried not to take environment issues too seriously and in many cases adopted the practice of continuing to pollute and pay a small fine. When regulation got stricter following major environmental mishaps and public outcry, they adopted the practice of controlling pollution after it is produced—the end-of-the-pipe approach. They gradually realized that instead of the above reactive approach, if they reduced/minimized the production of pollution at the source, before it was produced, it did help to save cost. In the next step they started to appreciate what tremendous marketing advantage and competitive edge it brought and started implementing proactive approaches to environmental performance in the form of EMS (Environmental Management Systems) and greening of the supply chain.

Thus to explore the role of suppliers in environmental management the authors of this paper considered five case studies in the furniture industry where the manufacturing process had significant environment implications. In these case studies the authors found that some of the companies were indeed working with suppliers to reduce emissions, monitoring the waste streams from suppliers, helping them to set up their environmental programs and even extend technical supports to suppliers to help them with conservation of natural resources.

In order to achieve overall environmental performance of the supply chain system the authors came up with a list of ten environmental supplier evaluation criteria such as:

- Public disclosure of environmental record
- Toxic waste and pollution management
- Hazardous waste management
- ISO 14000 certification
- Reverse logistics program and so on.

In exploring green purchasing strategies Min and Galle (1997) considered a survey analysis for selected industry groups, which were heavy producers of scrap and waste materials. With a sample of 527 responses they found the key factors affecting buying firm's choice of suppliers as:

- Potential liability for disposal of hazardous materials
- Cost for disposal of hazardous materials
- State environmental regulations
- Federal environmental regulations
- Cost of environmentally friendly goods

Since purchasing is at the beginning of the green supply chain, green marketing efforts have to be tied up with the company's environmental goals and its purchasing activities. Min and Galle also found that green purchasing contributed significantly to source reduction of pollution in terms of recycling, reuse and low-density packaging and to waste elimination in terms of scrapping or dumping, recycling sorting for non toxic incineration and bio degradable packaging.

Regarding barriers and obstacles to green purchasing Min and Galle found high cost of environmental programs, uneconomical recycling and uneconomical reusing to be the top three most important barriers. Lack of management commitment, lack of buyer awareness, lack of supplier awareness, lack of company wide environmental standards or auditing programs come next. Finally the lack of state and federal regulation constitute the last set of barriers for effective green purchasing in the supply chain.

Sarkis (1999) provides a comprehensive view of the state of research in this evolving topic, tracing the work of researchers, who have investigated both conceptually and empirically, the issues involved, the reasons for incorporating these practices and also the way they have been practiced in different organizations. According to him the supply chain system should include Purchasing and in-bound Logistics, Production, Distribution (outbound logistics and marketing) and reverse logistics. He also shows how firms focus on Total Quality Management (TQM) with its emphasis on improving product quality, zero defects, customer satisfaction, training and employee empowerment etc. and integrate it with environmental management resulting in Total Quality Environmental Management (TQEM). This integration to TQEM enables the organizations to move towards the source reduction of pollution philosophies and improves environmental performance, marketing advantage and corporate image so that the company moves on to the world-class status.

For the Purchasing sector, Sarkis considers general green purchase practice, vendor selection and in-bound logistics. For green purchasing he mentions the work of Drumwright (1994) who conducted a field study of 10 organizations and attempted to determine why organizations go for green purchasing and what the characteristics of such organizations were. Green Purchasing comprises a number of environmentally based initiatives such as supplier environmental questionnaire, supplier environmental Audit and Assessments, environmental criteria on approved supplier list, requiring supplier to undertake independent environmental certification, jointly develop cleaner technology /processes with suppliers, engage

suppliers in Design for environment, product/process innovation etc. (Lamming, et al. 1999; Lloyd, 1994)

To make these initiatives effective and successful the organization needs to integrate them with long-term strategic relationships of the organization, early involvement by the supplier and customer, building trust and early involvement of the supplier in designing for environment.

Again, there has been another new concept in greening of supplier (SCEM) in using the system of environmental mentoring for the suppliers, which has recently been introduced and researched in this field of study [Hines and Johns 2001]. While the usual method of using questionnaires, using environmental criteria in evaluating suppliers or demanding certified EMS from them were gaining widespread acknowledgement in the industry, this new method of bringing about the greening of suppliers is emerging to be very useful. This concept of environmental mentoring refers to the development of a more fundamental relationship between the customer and the supplier and this culture goes beyond monitoring and evaluating and goes to the realm of guiding and supporting the suppliers. In order to make this happen, it really involves a sea change in attitudes by larger companies who try to build much closer working relationship with their suppliers, providing guidance, advice and assistance and sharing their knowledge and skill with them. That does this to improve the quality of the product and the operational efficiency of their technology and also with the goal of achieving world-class status and remaining competitive (Jenner, 1997:8). Research also brings out the strengths and weaknesses of Mentoring and Partnering method (Hines and Johns, 2001), the strengths being that the concept is proactive, non threatening, sharing benefits, building teamwork and so on, while the weakness comprises cost and resource investments, lack of physical facilities, need for mentoring skills, right people and so on.

Noting these research findings, various practices and issues let us take a look at how Asian-Pacific companies are dealing with greening of their supply chains.

11.2 South East Asia Issues and Study Questions

The numerous issues listed above plus some specific to the region are identified. A number of questions do arise and which will be addressed here. The following is a listing.

- What are the most prevalent initiatives, which are undertaken by companies in this region, in order to green their suppliers?
- To what extent do the companies urge their suppliers and contractors to incorporate environmental management into their operations?
- What are the driving forces/motivators for incorporating greening of the supplier chain in these companies?
- What are the problems and obstacles involved in the process of greening the suppliers?

Studying these concerns in this regional setting will help to determine how this concept can be successfully incorporated into companies.

11.4 Research Design

To investigate the concerns regarding the state of greening of the supply chain, an empirical research study was pursued. Using a survey questionnaire as the research instrument. The questionnaire was divided into different sections, encompassing basic information, environmental awareness, and greening the suppliers.

In the basic information section, the questionnaire asked about the industry the company is in, main manufacturing activity, the size of workforce and other organizational characteristics. In the awareness portion, the questionnaire investigates the company's and the employees' knowledge regarding environmental issues outside of the company. In the greening of suppliers portion the questionnaire investigates extensive issues regarding the topic starting from motivators, driving forces, obstacles and challenges encountered, to importance of the key factors that affect a buying firm's choice of suppliers.

The survey population included all manufacturing companies registered with the Management Association of the Philippines. The questionnaire was mailed to all of these companies, about 500 in all including Philippines, Indonesia, Thailand and Malaysia. The mailing was carried out in the second half of year 2000 and a second set was sent out by the first half of year 2001.

11.5 The Results From The Survey Research

The final sample size was 48 companies, with 28 respondents from the Philippines, 8 from Indonesia, 7 from Thailand 7 from Malaysia and 1 from Singapore. They were all manufacturing companies engaged in electronics and semi conductors, automation, metalworking, chemicals, food textiles and pharmaceuticals. This is not the great response rate, but some evaluation of these companies may still be carried out. 42% of the sample comprised small and medium enterprises (SMEs) 58% comprised large enterprises. Where the definition of small and medium enterprises are those having less than 500 employees.

11.5.1 Environmental Awareness

Regarding environmental awareness, the respondents were asked to rate the company's knowledge of environmental issues outside the company, the employee's knowledge of environmental issues inside the company, and the employee's knowledge of environmental issues outside the company, on a 4-point scale from Not knowledgeable to Very Knowledgeable.

85% of the companies said that they were knowledgeable enough or very knowledgeable regarding their knowledge of environmental issues outside the

company. Again 85 % of the companies said that their employees were knowledgeable or very knowledgeable regarding environmental issues inside the company. However, only 54 % of the companies said that their employees were knowledgeable or very knowledgeable regarding environmental issues outside the company. 14.5 % of the companies said that they did not have any environmental awareness programs and 8.5 % said that their environmental awareness program were under development. 3.5 % of the companies said that all of their departments have environmental awareness programs and 33.75 % said that some of their departments have initiated their own environmental awareness programs.

In industry it is often believed that larger companies have greater environmental awareness and undertake their own environmental initiatives. We wanted to test this concept based on the data collected in the research. In the questionnaire the size of the company was measured in terms of the number of employees. A Chi square test of independence was used to check if the size of the company had any effect on

- (B1) Company's knowledge of environmental issues outside the company
- (B2) Employee's knowledge of environmental issues inside the company
- (B3) Employee's knowledge of environmental issues outside the company

The results of the tests show that size did not have any impact on the company's, or employees', awareness regarding internal or external environmental issues.

11.5.2 Training Awareness Programs

Next the research proposed to check on whether the environmental awareness programs, adopted by the company have any effect on the company's as well as employee's awareness towards environmental issues both outside and inside the company. The level of implementation of environmental awareness programs in the company ranged from no awareness programs to all departments has their own awareness programs. The Chi square test of independence was applied.

It was found that the environmental awareness programs have significant effect/ impact on company's awareness to environmental issues outside the company and also to employee's awareness of the environmental issues outside the company. Yet, the awareness programs didn't seem to have significant impact on employee's knowledge of environmental issues inside the company. This result could be explained by the fact that most of the training programs talk about environmental issues which are global and general in nature and do not really deal with what is happening inside their own operations.

11.5.3 Greening of Suppliers

For the greening of suppliers issue, first an evaluation of the significant driving forces, which lead companies in South East Asia to go for greening of suppliers, was carried out. For this purpose, first all of the important motivators for incorporating greening of the suppliers were identified from the literature and various practicing companies. Table 11.1 summarizes the motivators.

Table 11.1. Motivators and driving forces for greening the supply chain

| | |
|--|---|
| 1. Customer Pressure | 8. Improved relations with communities |
| 2. Avoid potential export limitations | 9. Enhanced brand image and reputation |
| 3. Environmental improvement | 10. Competitiveness |
| 4. Reduced operating costs | 11. Corporate Social and Environmental responsibility |
| 5. Increased productivity and quality | 12. Access to capital |
| 6. Capturing workers' knowledge | 13. Financial performance improvement |
| 7. Improved relations with authorities | 14. Increase in market share |

The significance of each of the motivators and their impact upon the greening of suppliers initiative was also studied. Linear Discriminant Analysis (LDA) was used to study these relationships. LDA is briefly described in the next section, with results following. For each of the above motivator indicators the respondents were asked to give their ratings on a 4-point scale, from not important to very important. The respondents were then asked to check which of the items shown in Table 11.2, would the company have undertaken in their effort to green their suppliers.

Table 11.2. Initiatives on greening of suppliers

| |
|---|
| 1. Holding environmental awareness seminars for suppliers |
| 2. Guiding/helping suppliers to establish their own environmental programs |
| 3. Bringing together suppliers in the same industry to share their know how and problems |
| 4. Informing suppliers about the benefits of environment-friendly production technologies |
| 5. Urging suppliers to take environmental actions |
| 6. Choice of suppliers by environmental criteria |
| 7. Requiring suppliers to adopt environment friendly practices |
| 8. Arranging funds to help suppliers for their environment programs |
| 9. Sending company auditors to appraise environmental performance and compliance of suppliers |

While the importance and significance of the greening of suppliers is gaining wide spread acceptance and acknowledgement, it is also true that the process does face many hurdles and obstacles, especially in developing countries. To understand which obstacles become critical to the companies who want to implement the concept, the respondents were also asked to assess the role played by the obstacles listed in Table 11.3.

Table 11.3. Obstacles to green supply chain management

| |
|---|
| 1. Lack of interest on the part of suppliers |
| 2. Lack of supplier financial resources |
| 3. Lack of supplier manpower resources |
| 4. No competitive advantage |
| 5. No resources to help suppliers |
| 6. Difficult to organize |
| 7. Lack of governmental support |
| 8. Lack of technical knowledge to help supplier |
| 9. Too costly |

For evaluating the critical obstacles, here also we would use a LDA, which is now briefly discussed.

11.6 Linear Discriminant Analysis

This statistical technique is used for analyzing data in a format that is similar to traditional regression analysis. There is a criterion or dependent variable and a number of independent variables. The dependent variable, in a two-group discriminant analysis scenario, can take up only two values, 1 or 0. For instance, let us say that we would like to determine, out of all of the items included in the list of possible motivators, which are the ones, which significantly affect the implementation of greening of suppliers in a company. In such a scenario all of the items in the list of motivators become the independent variables and the dependent variable can be called a “greening of suppliers index”, which can take up a value of ‘1’ if the company has implemented the greening of suppliers and a value of ‘0’ otherwise, that is if it has not.

The discriminant analysis model involves a linear combination of variables of the following form:

$$D = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \dots + B_kX_k .$$

Where $X_1, X_2 \dots X_k$ are motivators such as customer pressure, reduced operating costs, increase in market share, etc., each of which has been rated by the respondent companies on the 4-point scale.

The dependent variable, D , which is also called discriminating variable or grouping variable may be measured as follows:

Consider the 9 items in greening of suppliers, Table 11.2. Each of these items are checked by the respondent company if it had implemented one of these items. If the respondent did check it, the item would have a measure of value 1 and 0 otherwise. We added up all of these 9 items, the total would have a maximum value of 9 and a minimum value of 0. We then defined our “greening of suppliers index”, D , as ‘1’ if this total came out to be more than 50%, that is more than 4.5 and ‘0’ if the total is less than 4.5. Hence we were considering a two-group discriminant analysis scenario.

The model is run on SPSS 10.0, the software gives a statistic called Wilk’s Lambda, for the overall model along with a chi-square value. The overall significance of the Wilk’s Lambda must be less than 5 % for the model to be acceptable. A multistage approach is used where if any independent variable has a Wilk’s Lambda with a significance of more than 5 %, it is dropped from the model and the model is run again. After all independent variables having Wilk’s Lambda with unacceptable significance of more than 5 % are dropped, one looks at the Wilk’s Lambda of the overall model again. If this has changed to an acceptable value, having a significance less than 5 %, the model is accepted and the surviving independent variables are accepted as critical independent variables, significantly affecting the grouping variable. These critical independent variables are able to most effectively distinguish the dependent variables into the two categories of ‘1’ or ‘0’.

11.6.1 Applying Linear Discriminant Analysis on the Motivators/Driving Forces

Using all of the items in Table 11.1 as independent variables and using the “greening of suppliers index” as ‘ D ’ the grouping variable we ran the LDA. For the overall model the Wilk’s Lambda had a significance of .432. This result is not statistically significant. For the individual independent variables, the Wilk’s Lambda and the significances emerged as shown in Table 11.4.

Looking at the Wilk’s Lambda for independent variables in Table 4, there are many independent variables Authority (Improved relations with authorities), Reduce (Reduced operating costs) etc, which have Wilk’s Lambda with significance of more than 5 %. So the model was run again, this time dropping the independent variables, which had significance of more than 5 %. The final value of the Wilk’s Lambda, for the overall model after dropping insignificant variables came out to have an acceptable significance of .02.

The final individual independent variables with their Wilk’s Lambda’s are shown in Table 11.5.

Table 11.4. Tests of equality of group means for LDA of independent variables

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|-----------|---------------|-------|-----|-----|------|
| AUTHORITY | .979 | 1.001 | 1 | 46 | .322 |
| BRAND | .898 | 5.218 | 1 | 46 | .027 |
| CAPITAL | .983 | .772 | 1 | 46 | .384 |
| COMMUNIT | .938 | 3.034 | 1 | 46 | .088 |
| COMPETE | .972 | 1.305 | 1 | 46 | .259 |
| CUSTOMER | .909 | 4.586 | 1 | 46 | .038 |
| ENVIRON | .926 | 3.661 | 1 | 46 | .062 |
| EXPORT | .964 | 1.698 | 1 | 46 | .199 |
| FINANCL | .975 | 1.182 | 1 | 46 | .283 |
| MKTSHARE | .958 | 2.003 | 1 | 46 | .164 |
| PRODUCE | .841 | 8.670 | 1 | 46 | .005 |
| REDUCE | .971 | 1.374 | 1 | 46 | .247 |
| SOCIAL | .921 | 3.968 | 1 | 46 | .052 |
| WORKER | .895 | 5.397 | 1 | 46 | .025 |

Table 11.5. Final LDA model for discriminating motivator factors

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|----------|---------------|-------|-----|-----|------|
| Customer | .909 | 4.586 | 1 | 46 | .038 |
| Produce | .841 | 8.670 | 1 | 46 | .005 |

Since both the independent variables have significance levels less than 5 % and the overall Wilk's Lambda is also acceptable, the finalized model emerges as:

$$D = -2.291 + .087 \text{ Customer} + .764 \text{ Produce}$$

Hence the critical motivator variables that significantly affect the greening of supply chain initiative are Customer Pressure and Increased Productivity and Quality.

11.6.2 Applying Linear Discriminant Analysis for Obstacles to Greening of Suppliers

In the process of implementing greening of suppliers, even leading edge companies face many challenges and obstacles, as summarized in Table 11.3. In order to determine the critical discriminatory items LDA is used here too. Before, for the Motivators /Driving forces we had used as the grouping variable a variable called

“greening of suppliers index” which took a value of ‘1’ if companies did demonstrate a propensity towards greening of suppliers, and ‘0’ otherwise. For the obstacles test, we wanted to develop a grouping variable that would capture the lack of propensity for a company to go for greening of suppliers. Hence this time we defined our grouping variable, $D' = 1 - D$, so that when a company lacks propensity to greening of their suppliers $D' = 1$ and $D' = 0$, otherwise.

For this model to apply, we would look at the significance of the model given by the Wilk’s Lambda for the overall model and also the individual Wilk’s Lambda for all of the independent variables from Table 11.3.

Upon the first run the Wilk’s Lambda for the overall model had a significance of .076. For the independent variables, the individual Wilk’s Lambdas are shown in Table 11.6.

Table 11.6. Tests of equality of group means for independent variables of obstacles for greening the supply chain

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|----------|---------------|-------|-----|-----|------|
| Govt | .997 | .118 | 1 | 46 | .732 |
| Interst | .846 | 8.382 | 1 | 46 | .006 |
| Manpower | .846 | 8.382 | 1 | 46 | .006 |
| Company | .900 | 5.086 | 1 | 46 | .029 |
| Costly | .974 | 1.233 | 1 | 46 | .273 |
| Organize | .948 | 2.544 | 1 | 46 | .118 |
| Resource | .935 | 3.193 | 1 | 46 | .081 |
| Technica | .984 | .765 | 1 | 46 | .386 |
| Financia | .839 | 8.836 | 1 | 46 | .005 |

Since the overall significance is greater than 5%, the model is not acceptable. Looking at the Wilk’s lambda of the individual independent variables, we dropped from the model all of the variables whose significance levels were more than 5%, like Lack of government support, too costly lack of technical knowledge to help the suppliers etc. After some iterations, the final overall significant model had an acceptable significance of .037. Table 11.7 shows the final discriminatory obstacle factors.

Table 11.7. Final significant results of obstacle independent variables and their significance

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|----------|---------------|-------|-----|-----|------|
| Interest | .846 | 8.382 | 1 | 46 | .006 |
| Manpower | .846 | 8.382 | 1 | 46 | .006 |
| Financia | .839 | 8.836 | 1 | 46 | .005 |

The critical obstacles which significantly lead to companies lack of initiatives to greening of suppliers are Lack of Supplier interest, Lack of supplier manpower resources and Lack of supplier financial resources.

Thus, most of the obstacles appear to be from the supplier who is lacking in interest, manpower and financial resources.

11.7 Corporate Green Supply Practice in South East Asia

The specific action plans taken by the companies in the initiative for greening of suppliers have already been summarized in Table 11.2. A frequency analysis will show us how prevalent these practices are. Table 11.8 provides the frequency distribution of these practices.

Thus we observe the most prevalent way in which companies are undertaking greening of suppliers is by evaluating and choosing suppliers using environmental criteria, where over 50% of survey companies are completing this practice. The next most prevalent action is urging the suppliers to take environmental actions, with 40% of the respondents practicing this activity.

Table 11.8. Frequency of various green supplier practices by survey respondents

| Specific action in greening of suppliers | Percentage of companies who are carrying it out |
|--|---|
| Holding environmental awareness seminars for suppliers | 29.17 |
| Guiding/helping suppliers to establish their own environmental programs | 16.67 |
| Bringing together suppliers in the same industry to share their know how and problems | 14.58 |
| Informing suppliers about the benefits of environment -friendly production technologies | 33.33 |
| Urging suppliers to take environmental actions | 39.58 |
| Choice of suppliers by environmental criteria practices | 52.08 |
| Requiring suppliers to adopt environment friendly | 35.42 |
| Arranging funds to help suppliers for their environment programs | 4.17 |
| Sending company auditors to appraise environmental performance and compliance of suppliers | 18.75 |

11.8 Concluding Remarks and Implications of the Study

The above research helps to understand the dynamics of greening of suppliers within the South East Asian context and provides many important insights; some of which were expected and some were not. For instance, the result that size of the company did not have a significant impact on the companies' as well as employees' awareness to environmental issues might appear somewhat unexpected. This result is because it is expected that larger companies which are usually more well established than smaller organizations, to indulge in going beyond their own business and environmental goals to reach out and involve their suppliers and business partners becoming green. However upon discussing this result with industry experts it emerged that there were many companies, not necessarily large, who were making significant efforts in greening of suppliers. To give an example, Nestle Philippines has started an extensive greening of the suppliers program, holding environment awareness seminars, arranging site visits, guiding them through Environmental Management Systems. In a recent presentation organized by Nestle Philippines their major suppliers (first tier suppliers) presented their environmental initiatives and the benefits they achieved. In these presentations many suppliers who were small or medium enterprises, talked about trying to green their suppliers (second tier suppliers). Hence the small size of the first tier suppliers did not have any impact on their implementing greening of suppliers on their part.

The result that environmental awareness programs had significant impact on companies' and employees' awareness to environmental issues outside of the companies is expected because it only implied that awareness programs were effective in bringing up the awareness level. Yet the programs were not effective in the employees' awareness of environmental issues within the company. This may happen because typical awareness programs emphasize global and national environmental issues and not environmental aspects and impacts within the company. The training for environmental aspects and impacts is usually confined to members of specialized steering committees while general employees are only given awareness of broad based issues. This finding may now help top management within companies to modify the general nature of awareness programs to include environmental topics specific to company the employees are working for.

The result pertaining to the significance of motivating factors from the linear discriminant analysis, brings out that customer pressure and increased productivity and quality concerns are two critical factors leading companies to greening of suppliers initiatives. From discussions with various companies operating in this region this result does make sense. In this region many forward-looking companies are now involved in doing business with European, Australian and American companies, who are their customers. These customers urge the South East Asian companies to have a proper environmentally and socially responsible image, along with requiring a well-established environmental management system (EMS) in their operations. If the South East Asian companies have a supply chain that is environmentally questionable these customers would immediately cease to do

business with them. This explains why customer pressure is so important in leading companies to greening of the suppliers.

As for the urge to increase the productivity and quality, which also emerged as a critical factor in greening of suppliers, this is an internal reason leading companies towards this initiative. As has been widely observed, integrating and streamlining the company operations with those of the suppliers helps to improve productivity and quality by eliminating delays and inefficiencies and work stoppages on account of non-availability of raw materials, improper raw materials and so on. In many cases the environmentally hazardous components, if there are any, in the product can be eliminated by material substitution on the part of the supplier. Hence the urge to enhance productivity and quality in many instances does lead companies to green their suppliers and also integrate them into their business operations.

As for the obstacles in greening of suppliers the research identifies the three significant causes: lack of interest on the part of the suppliers, lack of supplier manpower resources and lack of supplier financial resources. This result indeed is very true in this regional setting because the suppliers in most cases are companies who are just attempting to survive, in the sense that their sole effort is geared to help their business performance. These companies have little interest in exerting effort that does not directly help their bottom line. Even when their customers do urge them to go for environment friendly production and operations, excuses are provided, typically relating to economic well being of the organization. It is also true that in many cases they neither have appropriate manpower nor availability of funds to carry on such initiative. This challenge, which creates an obstacle for suppliers to turn green, can be overcome only if they are convinced about the benefits of greening that again has to be carried out upon the initiative of the lead company.

In this research the motivating factors and obstacles to greening of suppliers were considered. However, research still needs to be carried out to examine the acceptability and feasibility of innovative systems of combining various companies and their suppliers in win-win situations so that production and its required inbound logistics work in unison. For instance many world-class companies are now contemplating integrating suppliers on a more permanent basis so that new product development, innovation in process design, material substitution to ensure cleaner production etc, could be achieved. Many such systems are already operating in different countries of this region and once their success is proven, these models can be replicated in other countries as well. However, before implementing such a model extensively, research has to evaluate the effectiveness of such a system.

References

- Chayod, B. (1999), Impact of ISO 14000 certified companies on Business Performance. (Thailand Environment Institute, Bangkok, Thailand).
- Christmann, P. and Taylor, G. (1999) 'Globalization and the Environment', Paper presented in the Greening of Industry Network Conference, Chapel Hill North Carolina.

- Cox, J., Sarkis, J. and Wells, W. (1999) 'Exploring organizational recycling market development: The Texas-Mexico border.' In: Charter M, Polonsky, M.J. (eds) *Greener Marketing :A Global Perspective on Greening Marketing Practice*, :Greenleaf Publishing: 381-394.
- Eriksson, K., Johanson, J., Majkgard A. and D. Deo Sharma, (1997) 'Experiential Knowledge and Cost In the Internationalization Process'. *Journal of International Business Studies*.327-354.
- Greeno, J.L. and Robinson, S.N. (1992) 'Rethinking Corporate Environmental Management'. *Columbia Journal of World Business* 27:222-232.
- Hart, S.L. (1997) 'Beyond Greening: Strategies for a Sustainable World' *Harvard Business Review*. January - February,: 66-76.
- Hayduk, L.A.(1987) *Structural Equation Modeling with LISREL: Essentials and Advances*. Johns Hopkins University Press. Baltimore.
- Hayes, B. E. (1998) , *Measuring Customer Satisfaction* , ASQ Quality Press , Milwaukee, Wisconsin .
- Hocking, R.W.D. and Power, S. (1993) 'Environmental Performance: Quality, Measurement and Improvement' *Business Strategy and Environment*. 2:19-24.
- ISO 14000 System of Standards, (1996). *Environmental Management Systems–Specification and Guidance for Use* . International Organization for Standardization, Switzerland .
- Luken, R. (1997) 'Trade Implications for Environmental Management Systems' paper Presented in APO World Conference on Green Productivity, Manila ,Philippines
- MCDonagh, P. (1994) 'Towards an Understanding of What Constitutes Green Advertising as a Form of Sustainable Communication'. Cardiff Business School, Working Paper in Marketing and Strategy.
- Min, H. and Galle, W. (1997) 'Green Purchasing Strategies : Trends and Implications' .*International Journal of Purchasing and Materials Management*;August:10-17.
- Ottman, J.E. (1992) 'Industry's Response to Green Consumerism'*Journal of Business Strategy*. 13 (4):3-7.
- Paton, B., (1999) 'Voluntary Environmental Initiatives and Sustainable Industry' Paper presented in the Greening of the Industry Network Conference, Chapel Hill, North Carolina.
- Peattie, K. and Ratnayaka, M.(1992) 'Greener Industrial Marketing' *Industrial Marketing Management*.21. 2:103-110.
- Peattie, K.J. and Notley, D.S.(1989) 'The Marketing and Strategic Planning Interface' *Journal of Marketing Management*. 4.3:330-349.
- Porter, M.E. and Van der Linde, C., (1995) 'Green and Competitive: Ending the Stalemate' *Harvard Business Review*. September – October:20-134.
- Power, S.T. and Cox, C. (1994) 'Value-Driven Organizations: A look at the New Corporate Environmentalism' *Greener Management International*. 5: 29-35.
- Rao, P. and Kestemont, M-P. (1998) 'The Environment Barometer: Doing Business in "Green" Asean' *The Asian Manager*. March-April:56-61.
- Sarkis, J., (1999) "How Green Is the Supply Chain ? Practice and Research." Graduate School of Management. Clark University.MA.
- Walley, N. and Whitehead, B. (1994) 'It's not Easy Being Green.' *Harvard Business Review*. 72.3: 46-52.
- Walter, I. (1982) "Environmentally Induced Industrial Relocation to Developing Countries" in S.J. Rubin and T.R. Graham (eds), *Environment and Trade*, Allanheld, Osmun Publishers.