

The greening of suppliers—in the South East Asian context

Purba Rao*

Asian Institute of Management, Joseph R. McMicking Campus, 123 Paseo de Roxas Street., 1260 Makati City, Philippines

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Abstract

As South Asia is becoming an important manufacturing hub in the world, as a supplier of goods/services to several global players, the concept of ‘greening the suppliers,’ is assuming greater relevance. While more and more companies in this region are embracing the concept of ‘greening,’ this process has not been accompanied by sufficient research studies to provide insight into the extent and the nature of the implementation of the ‘greening’ process that is taking place in this region. This paper aims to provide an understanding of the extent of ‘greening’ that has been implemented and the underlying reasons for Asian companies to increasingly adopt it.

The study, conducted across Philippines, Indonesia, Thailand, Malaysia and Singapore, identifies initiatives commonly taken by the companies in their greening endeavours and on the driving forces for these companies to take these environmental initiatives. It then clusters the companies with respect to the type of initiatives taken and the major driving forces considered by them. The analyses performed reveal the major driving forces that are responsible for the increasing endeavours in the greening of the suppliers. © 2004 Elsevier Ltd. All rights reserved.

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1. Introduction

Corporations, in seeking to fulfil their social responsibilities, have set in motion several initiatives to alleviate the undesirable environmental impacts of their operations. These initiatives include, among others, the implementation of waste reduction procedures, installation of pollution control mechanisms and the substitution of hazardous raw materials with environmentally more friendly ones.

However, it must be noted, that these initiatives are often piecemeal, reactive solutions to environmental hazards created by the companies themselves. There are very few companies that integrate their environmental initiatives with the corporations’ long-term strategic direction. This is reflected in their careful identification and monitoring of the products’ environmental impacts, at each stage of the full-scale product stewardship process.

A close look at environmental initiatives implemented by companies across the world suggests that some companies are going beyond achieving and maintaining a high level of environmental standards not only by ensuring that their suppliers attain these standards but also by assisting them in doing so.

This new realm of corporate environmental initiative, known as the “greening of suppliers,” refers to the greening of the inbound logistics in the supply chain, wherein, suppliers are urged to refrain from the use of environmentally hazardous materials in their operations and are encouraged to adopt environmental management systems.

The traditional starting point of “greening the suppliers,” initiatives has been the Environmental Management Standard (EMS) under ISO 14001, which encourages a company to incorporate policies that ensure its suppliers are aware of environmental practices and possible environmental liabilities. The “greening of suppliers” initiative may also take the form of a monitoring and mentoring process beginning with activities that are aimed at assessing the extent to which the supplier practice environment friendly processes. These

* Fax: +632-817-9240/+632-994-1407/+632-893-4595.

E-mail address: purba@aim.edu.ph.

assessments may be administered through questionnaires and on site evaluations. Based on the findings, the companies may then explore the possibility of holding environmental awareness seminars for their suppliers and assist them in the designing of green attributes for their products [1].

2. Why go for greening of suppliers

The importance of supply chain management in improving the overall corporate environmental performance has long been recognized in environmental standards such as BS 7750, ISO 14000 system of standards and the parallel European Union's EMAS. Also research shows that the negligence of 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 among others [1].

To be able to effectively manage and minimize the negative impacts on the environment created at different points of the supply chain, it is important to understand where the maximum intervention is required. 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 by the greening of the purchasing function, which is at the beginning of the supply chain. This primarily refers to the use of environmentally friendly raw materials. In order for the lead company to be able to ensure that only environmentally friendly raw materials are used in the production processes, it is essential for it to closely monitor the production processes of all of its suppliers. This would include making sure that the suppliers use environmentally friendly materials and production methods, that the use of energy is free of emissions and that the mode of delivery and transportation is pollution free. Inseparable from the topic of environmentally related issues in the supply chain, the aspects of social responsibility at different phases of the supply chain is also emerging as one of the critical issues in today's world. For instance, in order for a company to remain competitive, the companies often urge their suppliers to lower their prices. To be able to do this, the suppliers may resort to paying their workers lower wages for longer hours that are often performed in unsanitary and unhealthy working conditions. Characteristically, women and children are the most vulnerable. [Full Voice, Issue 4, a publication of The Body Shop]. Thus, in addition to an environmentally sound supply chain, socially responsible supply chain issues need also to be considered by companies in this region.

So, in effect a major part of the inbound logistics of the greening of supply chain could be achieved if the suppliers can be 'greened'. The use of the environmentally sound raw materials by all suppliers would help to

ensure minimum emissions and generation of hazardous products provided the production methods employed by them are also clean and green.

Therefore, the greening of suppliers is a major concern among many purchasing managers in leading edge companies. In fact in a 1994 survey of US companies purchasing managers considered environmental and regulatory costs as their second most important economic concern [1] and this environmental concern would surely lead to the greening of suppliers. [11] examine the gap between theory and practice of green supply by recognizing the desirability of the green supply chain and the slow implementation of the concept in practice. In order to explain this mismatch, the authors conduct a two-phase survey of green supply activities in UK. In the first phase, senior managers in 24 business units were interviewed and in the second, questionnaires are sent out to key respondents in the operating units of the same business units. Based on the data, the authors conclude that firms are fully aware of the potential benefits from greening suppliers and are implementing appropriate packages of green supply activities within their own corporate environmental procurement and performance context.

This is also a desired feature on the part of customers and other stakeholders of the lead company, who often do not draw a line between a company and its suppliers and often hold the lead company responsible for the environmental liabilities of their suppliers.

It can be seen that the concept of "Greening the Supply Chain," is highly dependant on the assessment of suppliers for their environmental performance and then conducting business activities with only those that meet the regulatory standards set by the lead companies. In fact, the driving forces for implementing the concept within the company operations comprise "reactive regulatory reasons to proactive strategic and competitive advantage reasons" [2]. These evolving concepts also include working collaboratively with suppliers on green product designs, holding awareness seminars, helping suppliers establish their own environmental programs and so on. Because of the emphasis on suppliers, the greening of the supply chain is considered to be synonymous with the greening of suppliers.

The greening of the supplier can create several advantages for the lead company. This can allow the company to integrate and align its supply chain activities making its operation more efficient and cost-effective. For instance, waste minimization techniques such as mass balance auditing applied to company activities as well as supplier activities can result in substantial cost savings. The cost savings can be passed on to the consumers. In addition, the partnership that evolves between the company and its suppliers can lead to increased efficiency in their combined operations, greater product quality and environmental innovation in

the creation of green products. The greening of suppliers can lead to increased market share, enhanced competitiveness, improved financial performance, an enhanced corporate image, increased brand equity of the product and the fulfilment of the company's social and environmental responsibilities.

3. Greening of suppliers in the South East Asian context

The concept of “greening of suppliers” is gaining popularity in South East Asia for several reasons. Firstly, as stated in the introduction, company leaders are beginning to realize that their customers as well as other stakeholders do not make a distinction between the environmental performances of the company and that of their suppliers. Secondly, global companies are now attempting to demonstrate their commitment to corporate social responsibility efforts by including suppliers and other business partners in the greening process. Thirdly, in the global economy, South Asia is emerging as an important supplier hub to the global giants, since many goods and services can be procured in this region at a relatively cheaper cost than if they were produced in Europe, or the Americas. Also, the global companies are increasingly indicating their preference in doing business with companies that display continuous improvements in the environmental performance of their own activities as well as those of their suppliers.

In the South East Asian region, companies like Ford Motor Company, Texas Instruments Philippines, Nestle Philippines, and Nestle Indonesia etc. are attempting the “greening of their suppliers” by holding awareness seminars, assessing their environmental performance and doing business with those that meet the standards. Some of these companies have developed specific environmental criteria, such as the amount of recyclable/reusable materials in their products, and require such procedures in their supplier contracts. Others utilise detailed checklists for their suppliers to ensure that they ensure environmental protection and safety for their employees. For instance there are companies in Indonesia which not only utilise a very detailed checklist including environmental requirements from suppliers but also send company internal auditors to check the operations of suppliers on site for cleaner production practices.

In order to green the supply chain, from the practitioners' point of view, companies have integrated several environmental concepts to incorporate the environmental responsibility as part of their overall strategic mission. Some of these concepts include green purchasing; total quality management in terms of

employee empowerment, customer focus, continuous improvement and zero waste; life cycle analysis; environmental marketing and so on.

The extent to which these initiatives have succeeded or led to organizational performance improvements is yet to be determined. However, the leading edge companies that have integrated environmental strategies into their corporate mission are going for the greening of their supply chains in a very aggressive and exemplary manner.

For instance, Ford Motor Company has demanded that all its suppliers with manufacturing facilities, comprising about 5000 companies worldwide, must obtain a third party certification of EMS (Environmental Management System) for at least one of their plants by the end of 2001, and for all plants by 2003. To help the suppliers establish their own Environmental Management System, Ford offers awareness seminars and training for its suppliers to assist them to be like any world-class organization and to attain their goal of environmental excellence.

Nestle Philippines is also known to conduct seminars and to provide technical assistance to its suppliers and contractors to help them implement an “EMS that is consistent with Nestlé's Environmental Management System (NEMS)”. Nestle hopes this initiative will help its suppliers have a fully functioning and effective EMS, thereby leading to judicious use of raw materials, the conservation of water and energy and the minimization of waste [3].

This initiative of urging suppliers and contractors to meet certain standards of environmental performance is among the 16 principles of environmental management listed in the “Business Charter for Sustainable Development” adopted by the International Chamber of Commerce in November 1990. It emphasizes the need for contractors and suppliers to ensure that their environmental practices are consistent with those of the enterprise and encourages wider adoption of these principles.

In Taiwan, greening the suppliers is being implemented in a very innovative manner to promote industrial waste minimization (IWM) among small and medium enterprises. As is widely known, the SMEs are typically unregulated and have limited financial resources. The companies in these sectors often serve as suppliers to large firms. A Corporate Synergy System (CSS) model describes the large firms as agents of change who use their clout to ensure adoption of environment friendly practices by their suppliers. The CSS is initiated, organized and maintained by a large company, called the central firm, which coordinates the transactions between upstream suppliers called satellite firms and the downstream buyers [4]. This model substantially contributed towards greening of industry in Taiwan and is being widely publicized in seminars and talks.

In Taiwan, many large companies have leveraged on this partnering system to enhance their competitiveness in the international market, improve the quality of their products, improve environmental performance and reduce their production costs. The satellite firms are also eager to participate in the system that allows them to satisfy their buyers, preserve their business networks and obtain referrals from other buyers. The central firm rewards the satellite firms by providing special credits, free staff training on quality and environmental performance and relaxed audit requirements. Also, under the sponsorship of Industrial Development Bureau (IDB), which comes under the Ministry of Economic Affairs, several commercial banks are assisting firms in implementing industrial waste minimization (IWM) projects by providing low interest loans and financial incentives. Thus, “treating suppliers as part of the extended family, Taiwanese firms have succeeded in the implementation of waste minimization among small and medium enterprises” [4].

Within the next few years many other companies in this region are expected to undertake greening of suppliers as part of their commitment to continuously improve their environmental performance. These companies are likely to focus not only on their first tier suppliers but also those further down in the supply chain. These efforts have the potential to cascade the greening process to large sections of the industry.

Recent studies have forecast that over the next few years, a majority of world’s manufacturing will occur in Asia. According to the current trends, a large part of this manufacturing will take place in the SMEs, small and medium enterprises. Through sub-contracts handed out to them by larger companies. Thus, the SMEs, who are suppliers or suppliers of the suppliers, have to turn green so as to make the whole production process environment friendly [5].

In order to encourage many companies in this region to adopt this concept, it is important to have a grasp of the driving forces, which are leading the companies to undertake these initiatives. This will help other companies to realize the importance of greening the suppliers and to understand how this can be translated into benefits for their own businesses.

4. Working towards greening of suppliers: the research question

The process of greening the suppliers and inbound logistics is a challenging task. The reason for this can be partly attributed to the non-traditional nature of the materials required to be used in the processes. This leads to several problems like the difficulty in sourcing such materials, as they may be used by only a few suppliers. The limited availability of such qualified suppliers can

lead to increased material costs. Sometimes the recycled materials become more expensive than the original virgin materials because of the processing costs involved. Then, many times customers require the materials they buy to be made out of new or virgin material rather than out of reused material [6]. All these issues make ‘greening the suppliers’ a difficult proposition.

In light of these challenges, a research study was designed to address the following concerns about ‘greening of the suppliers’ and inbound logistics, especially pertaining to companies in the South East Asian region.

1. What are the most prevalent initiatives, which are being undertaken by companies in this region, in order to green their suppliers? This would include answering some of the following questions—Do they hold awareness seminars for the suppliers? Do they guide their suppliers to set up their own environmental management systems (EMS)? Do they actively inform suppliers about the benefits of environmental friendly production technologies? Do they send company auditors to monitor and assess the environmental performance and compliance of their suppliers? Are they able to arrange for funds to help their suppliers with their environmental programs?
2. To what extent do the companies encourage and assist their suppliers and contractors to incorporate Environmental Management Systems in their operations?
3. What are the driving forces and motivators for incorporating greening the supplier programs in these companies? Is this because of the customer pressure, enhanced brand image and reputation, competitiveness social and environmental responsibility or due to some other motivations?

A study incorporating these issues in the south Asian context should provide useful data to assist in the implementation of ‘greening the suppliers’ concept in the Asian region. As stated earlier, an increasing portion of the world’s manufacturing activity will be performed in this region in the future. While this will spur economic growth and development, it may also be accompanied with potential environmental degradation. Therefore, if these suppliers are not included in the greening process, the potential environmental and human health costs can be huge.

5. Brief review of the relevant literature

Greening of suppliers as part of greening the inbound phase of the supply chain has become a new area of interest and research in the last few years. From a

piecemeal fragmented approach to seeking solutions to environmental problems at the initial production stages, the thrust has been to integrate environmental management into the key company strategy of the firms. Thus from the 'end-of-pipe,' short term solutions which companies normally resorted to, the move has been to integrate product stewardship processes where companies monitor, mentor and guide the environmental performance, not only of themselves, but also of their suppliers and business partners, taking care of the environmental impacts of their products and processes right from the conceptual phase till their use and disposal by the consumer.

As a more holistic approach to environmental management has evolved, a large body of research and documentation accompanied it. The work of Hines and John [7] examines the implementation of "greening of suppliers" with respect to the tools that are used. Their paper provides us with an overview of the drivers of environmental supply chain management and the implementation activities involved in the EMS under the ISO 14001 standard. An understanding of the paper provides insight into cost reductions through efficient and effective use of the supply chain, reduction in the purchasing cost through the use of more recycled materials and issues regarding avoidance of environmental risks and of environmental liability. The research of Hines and John provides an understanding of the mentoring process that is undertaken at the various stages of involving the supplier's activities with that of the company, like guiding them through relevant environmental practices, design for environment etc. The paper traces the supplier–company relationship from the initial involvement phase of the supplier to the process of supplier involvement brought about by the company through environmental questionnaires, site assessments, mentoring programs and partnering programs in which suppliers are included in the product design process, clean technology process and also environmental product content decision process.

Questionnaires have been part of the supplier assessment by companies over a long period but the assessment has been limited to quality, price and delivery of the goods by the supplier. Only recently, with the growth in environmental concerns, the questionnaire includes queries relating to environmental performance of the suppliers. Site assessments are carried out by several company auditors or by a third party. Some of the companies undertake this activity as part of their endeavour to 'green their suppliers'. The mentoring and partnering tools used in greening the suppliers are centred around the development of a close relationship between the customer and supplier which allows the lead company/customer to provide guidance in implementing EMS to its supplier (s), work together to improve efficiency, environmental product design etc.

Sarkis [2] undertakes a detailed study of each phase of greening the entire supply chain comprising inbound logistics, internal/production, outbound logistics and reverse logistics. His research also brings out anecdotal examples in each phase of the supply chain as well as emerging issues that encompass the supply chain such as the role of government, industry differences, and evolving organizational forms. For instance he relates the case of companies who have gone out of the way to include suppliers to join their planning processes to exchange ideas and work jointly to address environmental issues. He also relates cases of companies who develop principle of conduct which include environmental factors, who develop commitments to specific environmental improvements that are incorporated into their contracts with suppliers and so on.

The concept of greening of suppliers is closely related to the concept of green purchasing. Min and Galle [1] note that consumers are gradually beginning to favour green products. In order to make green marketing successful, a company has to integrate its environmental goals with its purchasing strategies and do a proper supplier selection. Based upon their survey, they concluded that the high cost of environmental programs appears to be the most predominant obstacle to green purchasing in US firms. In subsequent research conducted by them (2001) they also consider the effects of firm size on green purchasing as well as the major driving forces behind green purchasing implementation.

Geffen and Rothenberg [12] consider the prospects of achieving environmental performance improvements through unique partnerships with suppliers in an automotive paint process. They mention that prior to the 1980s the automakers' relationship with suppliers used to be characterized by an arms-length type of relationship that has recently changed to a close supplier–manufacturer relationship as witnessed in Japan's Auto industry. In this industry, supplier involvement is becoming important for innovations in product design and process. In their research, the authors establish the importance of suppliers in addressing manufacturing challenges and improving the environmental performance of the firms. They note that the forces driving the integration of Auto firms with their suppliers include the requirements of reduction of emission and hazardous waste through material substitution, pollution prevention and clean product design. The authors also recognize that involving suppliers as part of the organization helps in broadening the existing knowledge of manufacturing processes and makes it easier for the firm to adopt new technology and develop environmental innovation.

Dyer et al. [13], while referring to different models of supplier management, discuss the applicability of the arms-length model and the partnership model in US, Japan and Korea. While Japanese style partnership

models do have economic benefits, it has been observed that such relationships are difficult and costly to maintain. In some cases these close relationships restrict the buyer company by preventing movement away from inefficient suppliers.

From the preceding sections one may observe that there has been substantial research on how and why many companies in United States, Europe, Japan and Korea are stimulating the greening of their suppliers. Although, the concept has gained some familiarity in South East Asia, little empirical research has been performed in this region. It is the objective of this paper therefore to provide research insights into this very important topic which is slowly gaining popularity in this region. For this it would be the objectives of this paper to consider the following research questions/objectives:

- (a) to perform an assessment of the different kinds of “greening of supplier” initiatives that are being fostered by companies in this region;
- (b) to perform an evaluation of the driving forces for greening of the suppliers;
- (c) to perform a detailed grouping of the companies with respect to the reasons leading to the adoption of these initiatives.

In order to address these objectives, this author uses data from her empirical research conducted to evaluate the ‘greening of suppliers’ initiatives in the South East Asia region.

The results of the analyses are presented in [Section 6](#).

6. The empirical research

This section is comprised of two parts, the research methodology and the research findings.

6.1. The research methodology

In this section the author presents the detailed greening of supplier’s initiatives and the driving forces or the chief motivators for these. For this purpose, first the different initiatives to foster greening of suppliers on the part of corporations have been identified. To identify these initiatives the author conducted in-depth interviews with different companies in the Philippines who were known to have successfully implemented the greening of suppliers’ initiative, though the empirical research has been carried out over the whole region, the identification of different initiatives and the driving forces have been carried out in the Philippines. While these items were being identified, the author worked with various leading edge companies like Nestle

Philippines. An NGO, the Philippine Business for Social Progress, PBSP also contributed many significant insights. [Table 1](#) summarises these initiatives.

Next the driving forces/motivators were identified, again under the guidance of leading edge ISO 14001 certified companies. The author asked for the critical issues from these companies to determine what motivated them for going for the greening of supplier’s initiatives. The driving forces/motivators considered in the research are presented in [Table 2](#).

Subsequent to the determination of the specific initiatives and possible driving forces, an empirical survey was performed using a questionnaire as the research instrument.

6.1.1. Sampling frame

The survey instrument was administered to a population of several prominent companies registered with the Management Association of the Philippines. Hence, the sampling frame was the database provided by the Management Association of the Philippines.

6.1.2. Sample size

A random sample of 500 companies was selected spread over the Philippines, Indonesia, Malaysia, Thailand and Singapore was selected, having 100 companies in each of these countries. Thus it was more of cluster sampling rather than stratified random sampling.

6.1.3. Data collection

The questionnaire was mailed to each of the companies selected in the sample. The mailing was done in two stages: in the first half of year 2002 and in second half of year 2002. The questionnaire was divided into sections containing basic company information, the driving forces of greening suppliers and the specific actions undertaken by them. (Please see [Appendix 1](#)

Table 1
Some corporate initiatives to foster “greening of suppliers”

1. Holding environmental awareness seminars for suppliers
2. Guiding and helping suppliers to establish their own environmental management programs
3. Bringing together suppliers in the same industry to share their problems and knowledge about the adoption and implementation of environmental management practices and processes
4. Informing suppliers about the benefits of environmentally friendly production technologies
5. Urging suppliers to take environmental actions
6. Choosing suppliers on the basis of clearly stated environmental criteria
7. Requiring suppliers to adopt environmentally friendly practices
8. Arranging funds to help suppliers for their environment programs
9. Sending company auditors to appraise environmental performance and compliance of suppliers.

Table 2

Motivators and driving forces for corporate greening of the supply chain

1. Customer pressures
2. Avoid potential export limitations
3. Achieve environmental improvements
4. Reduced operating costs
5. Increased productivity and produce and service quality
6. Build upon the knowledge and enhancing environmental awareness among the workers
7. Improved relations with authorities
8. Improved relations with communities
9. Enhanced brand image and reputation
10. Improved competitiveness
11. Enhanced progress in implementing corporate social and environmental responsibilities
12. Improved access to capital
12. Improvement of financial performance
13. Increase in market share

for a copy of the Questionnaire utilised for this research.)

For the initiatives on greening the suppliers, the company was asked to rate the items/specific actions the company has undertaken to green the suppliers, also in terms of a four-point scale:

- Strongly disagree = 1
 Disagree = 2
 Agree = 3
 Strongly agree = 4

For the driving forces (Table 1) the respondent company was asked to rate each of them on a four-point scale:

- Not important = 1
 Somewhat important = 2
 Important = 3
 Very important = 4

6.1.4. Final sample size

After mailing the questionnaire, we called the companies requesting them to fill-in the questionnaire and to send it back to us. Finally, 88 responses were obtained, comprised of 29 from the Philippines, 16 from Indonesia, 17 from Thailand, 14 from Malaysia and 12 from Singapore. The respondents were primarily from manufacturing companies engaged in electronics and semi-conductors, automation, metalworking, chemicals, food, textiles and pharmaceuticals. 28 percent of the sample was from small and medium enterprises (SMEs) and 72 percent was from large enterprises. (SME refers to a company having less than 500 employees.)

6.2. The research findings

After obtaining the data from 88 companies, the mean ratings for the specific actions in greening of

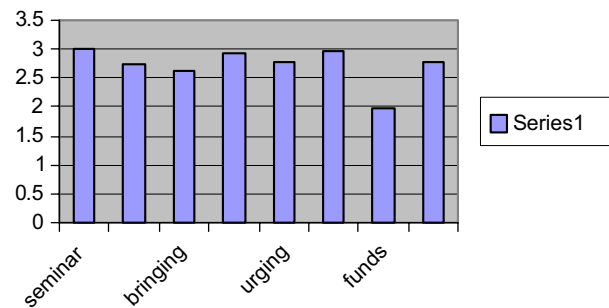


Fig. 1. Mean ratings for driving forces.

suppliers were computed (see Fig. 1). The data are presented in Table 3.

Therefore, among the list of initiatives the companies were most frequently ‘holding awareness seminars for greening suppliers’ (3.01), followed by ‘choice of suppliers by environmental criteria’ (2.96) and ‘informing suppliers about the benefits of cleaner production and technologies’ (2.94). The least implemented action for greening of suppliers was found to be ‘arranging funds to help suppliers to purchase equipments for their environmental programs’ (1.96).

For the driving forces included in the survey, the mean sample ratings of the driving forces presented in Table 3 were obtained. (see Table 4).

It is evident from the analyses that the most important reason companies attributed for the implementation of “greening of suppliers” was to improve their own environmental performance (3.125), followed by the desire to reduce operating costs (3.09), increase market share (2.9375) and to avoid export limitations (2.89). The least important reasons were enhancing workers’ environmental knowledge (2.5) and to improve the relations with their communities (2.5958).

Next the author sought to achieve a segmentation of the companies with reference to different driving forces. For this, a principal component analysis using k-means cluster analysis was performed.

Table 3

Mean ratings on the ‘greening of suppliers,’ initiatives

1. Holding environmental awareness seminars for suppliers	3.019
2. Guiding/helping suppliers to establish their own environmental programs	2.731
3. Bringing suppliers together	2.615
4. Informing suppliers about the benefits of environment friendly technologies	2.942
5. Urging suppliers to take environmental actions	2.788
6. Choice of suppliers by environmental criteria	2.961
7. Arranging funds to help suppliers for their environment programs	1.961
8. Sending company auditors to appraise environmental compliance of suppliers	2.769

Table 4
Driving forces towards greening of suppliers

Driving forces	Mean ratings
ATHORITY (improved relations with authorities)	2.6875
BRAND (enhanced brand image and reputation)	2.7375
CAPITAL (access to capital)	2.6120
COMMUNITY (improved relations with communities)	2.5958
COMPETE (competitiveness)	2.7524
CUSTOMER (customer pressure)	2.3541
ENVIRON (environmental improvement)	3.1251
EXPORT (avoid export limitation)	2.8987
FINANCL (improvement of financial performance)	2.6933
MKTSHARE (increase in market share)	2.9791
PRODUCE (increased productivity and quality)	2.7291
REDUCE (reduced operating cost)	3.0908
SOCIAL (corporate social and environmental responsibility)	2.7535
WORKER (enhancing worker's environmental knowledge)	2.5421

For the principal component analysis, the underlying commonalities amongst the different variables, the 14 driving forces, were considered and groups of correlated variables, called principal components, or factors obtained. The components comprised highly correlated variables with each of them but between the principal components there was no significant correlation. The relevance of the principal components or factors were evaluated by looking at entities called eigen values, the greater the eigen value the more important is the principal component. Also the eigen value for a principal component or factor represented the percentage of variation explained by the factor.

The principal components were also required to be labelled considering the different variables contained within each of them and also looking at their relative criticality or loading within each component.

Once the principal components are identified and labelled, a segmentation of the population of companies represented by the sample is carried out. This process is termed cluster analysis procedure in which the k-means cluster analysis was performed in this case [8].

7. Sustainability motivators and economic motivators: segmenting the South East Asian companies based upon the driving forces

The driving forces that appeared to motivate the companies to go for greening of their suppliers are

presented in Table 2. Based on these data, a segmentation of the companies was performed to identify groups of companies having similar behaviour patterns and having similar ratings on the driving forces. The methodology followed for this was to determine the inter-correlations among the driving forces, group the items which were correlated into factors, called the principal components, and then to use the components to segment the companies.

7.1. Principal component analysis and the k-means cluster analysis

In order to explore the underlying dimensions or commonalities in the data relating to driving forces the Principal Component Analysis was administered on the results of the survey pertaining to driving forces. The objective was to extract common factors or components, if any, that have effects shared in common with more than one of the observed variables, which form the items in the questionnaire. Using eigen values greater than one, only two components or factors emerged from the analysis as presented below.

Factor number	Eigen value	% Variance explained	Cumulative variance
Factor 1	10.1485	72.489	72.489
Factor 2	1.133	8.095	80.584

The 14 driving forces referred to above were the same as used in Table 2, like customer pressure, reduced operating costs etc. (see Table 2).

The results obtained conclusively indicated that there were two factors, which explained 80.58% of the total variation. Considering factor loadings more than 0.7, the two predominant factors, which emerged, encompassed the following forces.

Factor 1	Environmental improvement Improved relations with communities Corporate social and environmental responsibility Enhancing/capturing worker's environmental knowledge Productivity and quality Enhanced brand image
Factor 2	Access to capital Avoid potential export limitation Increase in market share Improvement of financial performance Reduced operating costs

Consideration of the underlying construction of the driving forces included in the two factors, led to

the following labels: the labelling was done by looking at the concepts behind each variable under each factor. For instance, under Factor 2 the variables included were access to capital, increase in market share, improvement of financial performance etc. All these variables signified a concept which could be termed economic motivators. Similarly, the variables under Factor 1 were environmental improvement, enhancing/capturing workers' environmental knowledge etc leading it to be labelled as Sustainability Motivators.

Factor 1: sustainability motivators;

Factor 2: economic motivators.

These factors were then used to perform the segmentation process. This was done with the help of k-means cluster analysis [8].

The three clusters identified are listed in Table 5.

8. Conclusions from the cluster analyses

The largest cluster or segment that contained 60% of the companies (cluster 2) was proceeding with the “greening of suppliers” initiatives motivated primarily by economic factors (factor 1).

The next largest cluster or segment containing 25% of the companies was motivated by sustainability factors.

The third cluster or segment, containing 15% of the companies was not motivated by either of the two factors. (see Table 6).

From Fig. 2, it can be concluded that a large segment of companies (60%) in the South East Asian region consider greening of suppliers important for economic considerations, in view of the significant increase in export possibilities, improved financial performance, better access to capital and reduction in operating costs. It must be noted that about one fourth of the companies are proceeding with these initiatives for sustainability reasons such as improvements in environmental performance and the fulfilment of corporate social and environmental responsibility.

Table 5
Clusters with the corresponding numbers of companies in the sample

Cluster	Number of cases in each cluster
1	13
2	53
3	22
Total number of companies	88

Table 6
Factor mean scores in each cluster

Factor mean scores	Cluster number		
	1	2	3
Factor score 1	−1.87799	0.069674	0.927116
Factor score 2	−1.09782	0.669677	−0.97799

9. Discussion of findings

In an attempt to understand the implications of the two motivating factors, the sustainability factor and the economic factor, one may retrace one's steps to the beginning of corporate environmental consciousness in the region.

Since the industry collectively acknowledged its environmental responsibility in the Earth Summit at Rio de Janeiro in 1992, there have been several endeavours to prevent pollution at the source. Governments, NGOs and international organizations have held many conventions and seminars to promote environmental consciousness and lead companies towards development that is sustainable in nature.

South East Asia has always encountered a dire shortage of goods and services, in the face of rising demand fuelled by the burgeoning population, rapid urbanization and industrialization. The region has witnessed a massive thrust towards economic growth and creation of wealth. While manufacturing can be credited for the creation of new goods, services and jobs, it must be faulted for creating grave environmental burdens in terms of industrial pollution. The recognition of possible environmental hazards has given rise to passionate activism highlighting the environmental damage caused by these industries.

On the one hand, companies are required to enhance the standard of living by creating goods, services and jobs. On the other hand they were now expected to perform their tasks in a way that guarantees preservation of the environment. In light of these conflicting expectations, it was necessary to identify the factors that would motivate companies to

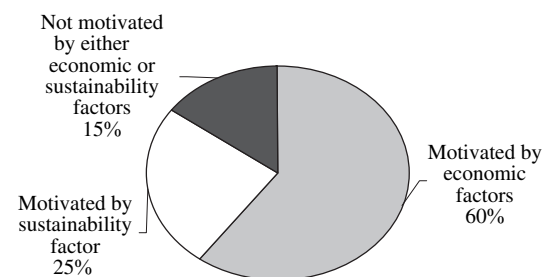


Fig. 2. Segmentation of companies in South East Asia to greening the suppliers.

undertake prudent environmental initiatives. This researcher has attempted to describe the factors and the nature of these factors.

The results of the data analysis show that 60% of the population of companies implement ‘greening of suppliers,’ initiatives because of economic considerations. This implies that they observe a correlation or connection between this environmental initiatives and their economic performance. This observation validates the conclusions of another empirical study [9] where a structural equation model brought out a statistically significant link between Supply Chain Environmental Management (SCEM), comprising holding of awareness seminars for suppliers, choice of suppliers by environmental criteria, guiding suppliers to establish their own EMS etc., and economic performance, via environmental performance and competitiveness.

This validation may help governmental organizations, NGOs and academic institutions in different countries of South East Asia to organize seminars, workshops and other advocacy programs to advocate greening of supplier’s initiative, with greater conviction, for the industrial sector in this region. For instance in the Philippines a social organization called the Philippine Business for Social Progress (PBSP), regularly organizes seminars and training programs on greening of the supply chain with focus on inbound logistics. During such training programs in addition to enhancement of environmental performance associated with greening of suppliers, if the resulting economic performance is also high-lighted, the appeal to greening of suppliers would be much more widespread. Also the results, as brought out by this research, can be presented to the industry that 60% of the companies already go for greening of suppliers because of economic reasons. Further, as brought out by the previous research [9], there exists a significant link between greening of suppliers, to environmental performance, competitiveness and economic performance. Thus, if the companies decide to go for this initiative, not only would their environmental performance improve, thereby reducing the risk of non-compliance, penalty and even closure, but it could also lead to improved economic performance. Thus, benefits that accrue on account of “greening of suppliers” both environmental and economic, should be advertised widely in order to encourage more companies to join in this endeavour.

But at the same time, it must be noted that there is a considerable segment (25%) of the industry that is proceeding with “greening of suppliers” initiatives, not only for economic benefits but also for reasons of sustainability. These are the companies, which have achieved substantial success in the industry in terms of business performance, sales, market share, cost saving etc. However, having achieved business success now

they want to contribute towards the cause of sustainability in bringing other organizations like suppliers and business partners also in the path of greening of industry and lead them all to leave behind a livable planet for one and all; a planet for generations to thrive on for the future. In the words of Juan B. Santos, Chief Executive of Nestle Philippines, the Nestle Company is ‘greening their suppliers’ to “look beyond the walls of the factory ... to reach out and share our blessings with many people outside these walls.” [10].

Appendix 1. Questionnaire for greening of suppliers

Company name _____
 Industry _____
 Main manufacturing activity _____
 Number of employees _____

Please indicate how important each of the motivators for incorporating greening of suppliers in your company

Motivators/driving forces	not imp	somewhat imp	imp	very imp
Customer pressure				
Avoid potential export limitations				
Environmental improvement				
Reduced operating cost				
Increased productivity and quality				
Enhancing workers’ environmental knowledge				
Improved relations with authorities				
Improved relations with communities				
Brand image and reputation				
Competitiveness				
Corporate social and environmental responsibility				
Access to capital				
Improvement of financial performance				
Increase in market share				

What are the actions which the company undertakes in greening the suppliers? Please rate on a four-point scale:

strongly disagree,
 disagree,
 agree,
 strongly agree.

Environmental actions	strongly disagree	disagree	agree	strongly agree
1. Holding environmental awareness seminars for suppliers				
2. Guiding/helping suppliers to establish their own environmental programs				
3. Bringing suppliers together				
4. Informing suppliers about the benefits of environment friendly technologies				
5. Urging suppliers to take environmental actions				
6. Choice of suppliers by environmental criteria				
7. Arranging funds to help suppliers for their environment programs				
8. Sending company auditors to appraise environmental compliance of suppliers				

References

- [1] Min H, Galle WP. Green purchasing strategies: trends and implications. *Int J Purch Mater Manage* 1997;33(3):10–7.
- [2] Sarkis Joseph. How green is the supply chain? *Pract Res*. Worcester MA: Graduate School of Management, Clark University; 1999.
- [3] Bacallan JJ. Greening the supply chain. *Bus Environ* 2000;6(5): 11–2.
- [4] Antonio Lisa C. Corp Strategy Syst Taiwan *Bus Environ* 2000; 6(5):13–5.
- [5] Sector based public policy in the Asia-Pacific region, US-AEP; 1999.
- [6] Cox J, Sarkis J, Wells W. Exploring organizational recycling market development: the Texas Mexico border. In: Charter M, Polonsky MJ, editors. *In greener marketing: a global perspective on greener marketing practice*. Sheffield, England: Greenleaf Publishing; 1999. p. 381–94.
- [7] Hines Frances, Johns Richard. Environmental supply chain management: evaluating the use of environmental mentoring through supply chain, presented in greening of industry network conference, Bangkok; 2001.
- [8] Boyd Jr HW, Westfall R, Stasch SF. *Marketing research: text and cases*. Richard D. Erwin Inc; 1994.
- [9] Rao Purba. Greening the supply chain: a new initiative in South East Asia. *Int J Oper Prod Manage (IJOPM)* 2002; 22(6).
- [10] Rao Purba. Nestle Philippines—greening the business partners. Case written under AIM publication; 2002.
- [11] Bowen FE, Cousins PD, Lamming RC, Faruk AC. Horses for courses: explaining the gap between the theory and practice of green supply. Paper forthcoming in *Greening of the Supply Chain*, Greenleaf Publisher UK; 2004.
- [12] Geffen GA, Rothenberg S. Suppliers and environmental innovation. *Int J Oper Prod Manage* 2000;20(2):166–86.
- [13] Dyer JH, Cho DS, Chu W. Strategic supplier segmentation: the next best practice in supply chain management. *Calif Manage Rev* 1998;40(2):57–75.