A STUDY TO EXPLORE THE LINK BETWEEN GREEN PURCHASING INITIATIVES AND BUSINESS PERFORMANCE

Purba Rao, Asian Institute of Management, Philippines
Mari Kondo, Ritsumeikan Asia Pacific University, Japan

Abstract. The importance of supply chain management in improving the overall corporate environmental management has long been recognized by industry. Since purchasing is at the beginning of the supply chain, one of the most effective ways of addressing environmental problems in supply chain is to focus on the greening of the purchasing function. Intuitively, industry believes that business performance would indeed result from green purchasing. However, to establish a significant link between green purchasing and business performance, a study of 92 organizations in the Philippines was conducted. This paper provides the theoretical concepts, detailed research methodology, application of structural equation modeling and the results obtained from the analysis.

Integrating environmental management into the purchasing function of an organization, called green purchasing, is not unfamiliar in today's world (Hamner, 2006). As more and more consumers are expected to be aware of environmental issues in this decade (Carter and Narsimhan, 1998), organizations would consistently be implementing environmentally conscious purchasing practice, which would endeavor to reduce the generation of pollution and waste at the source and increase the volume of recyclable, reusable, and environment friendly materials in the product content. Of course this would have to be done without sacrificing the quality performance of the end product or service that the organization is producing (Min and Galle, 2001).

Thus organizations are now expected to perform well on business related issues such as cost saving, increased productivity and enhanced market share as well as be responsible for environmental and social performance across the supply chain. These expectations arise from government agencies, non-government organizations, community organizations as well as from employees and management (Seuring et al., 2008). Since purchasing is a starting point in a supply chain, the environmental and social initiatives along with strategizing to perform in its business perspective too, would have to start at this phase, to have far reaching impacts downstream along the supply chain.

The green purchasing concept encompasses many opportunities for purchasing that affect greening of the supply chain for organizations. Awareness of green purchasing gives rise to sourcing raw materials which are environment friendly, which have been produced using environment friendly processes, using recycled materials and reused materials, using less volume of raw materials (dematerialization), using materials which produce minimum waste and no hazardous waste at all, and using only those suppliers who have environmental processes.

Enhancing the above definition on concepts of green purchasing, Bowen et al. (2006) use the term green supply to indicate supply chain activities which not only improves environmental performance of material inputs or of suppliers who provide them but also help to incorporate integrated recycling and waste reduction initiatives, coordination with suppliers to develop new products or processes and systematize data gathering system on the (1) Products, (2) Processes, and (3) Suppliers and vendors in the purchasing/sourcing phase of the supply chain.

It is the objective of this research to observe the greening initiatives in terms of the above three dimensions, as established by existing research (Bowen et al., 2006) in the purchasing phase of the supply chain, call it green purchasing and explore the statistical significance of a possible link, between these dimensions and business performance in an organization.

Over the last 10-15 years, green purchasing initiatives have been explored by various research reports in the academic research context (Seuring et al., 2008). Among them, Carter and Jenning (2002), and Carter and Carter (1998) present the linkages of green supply chain management and other associated factors with environmental performance of the firm. Baylis et al. (1997) examines green purchasing in the context of small and medium enterprises (SMEs) in New South Wales. Holt (2004) examines the green supply chain management activities undertaken by UK organizations with special focus on supplier assessment, supplier coaching, education and mentoring.

While more and more research is getting unfolded in the area of green purchasing, it is also true however that the strategies used to incorporate green purchasing in organizations are varied and fragmented in implementation.

In order to integrate green purchasing initiatives in the organization in an effective manner, Lamming and Hampson (1996) propose broadly five basic types of strategy used for green purchasing: Vendor questionnaire; Environmental Management Systems (EMS) implementation with suppliers; Life Cycle Analysis (LCA) with suppliers; Product stewardness; Collaboration and relationship with suppliers.

In all of these green-purchasing strategies, an important focus is the suppliers without whose involvement and cooperation green purchasing would not be feasible. Thus considering green purchasing strategies along with involvement of suppliers, Hamner (2006) proposes a comprehensive set of green purchasing strategies which have the objective of changing supplier behavior towards sustainable development. While proposing this set of strategies, he also recommends that each strategy be considered with reference to the associated costs and efforts it requires.

Now let us consider in detail the issues involved under green purchasing strategies in varied contexts and settings.

Green Purchasing Strategies

Product content requirement: This strategy is considered as the most common strategy being adopted by organizations. Here the buyer organization specifies that the products being supplied by the suppliers and vendors must have environment friendly attributes. As a result of this requirement the suppliers try to include recyclable and recycled materials in their products, use materials which have been reused, use materials which would provide same product quality but using less volume (dematerialization), and so on.

Product content restriction for suppliers: Under this strategy, the organization specifies that the products purchased should not contain environmentally hazardous attributes. This strategy is also considered a fairly common one wherein the organizations restrict their suppliers not to include any item in their product that may give rise to environmentally hazardous waste or require treatment to mitigate adverse impacts on the environment.

Product content labeling or disclosure: With this strategy, the organization requires the suppliers to provide a complete listing of the environment and safety attributes of the product contents of the items it buys from the suppliers. Sometimes this takes the form of requiring Material Safety Data Sheet (MSDS) or other labels such as 'green labels' available in different countries.

Supplier questionnaire: Here the organization asks the suppliers regarding their environmental aspects, impacts and environmental management programs about how the suppliers are addressing their environmental concerns.

Supplier Environmental Management Systems (EMS): The organization urges and sometimes requires the suppliers to develop their own EMS and even get it certified.

Supplier auditing: Here the organization sends its own personnel or internal auditors to appraise the suppliers' environmental performance, their EMS and even their compliance with the environmental regulation that is appropriate for them.

Product stewardship: This strategy requires a very high level of commitment on the part of the organization that takes the responsibility for managing the environmental impacts of products purchased from the suppliers throughout the product life cycle. Under this strategy the organization is required to work with suppliers during their (buyer organization's) production phase using the design for environment friendly production, in collaboration with the suppliers who often prove to be of great help. The supplier involvement often contributes to making the inbound logistics phase as well as the outbound logistics phase clean and green.

Education, collaboration and mentoring of suppliers: The buyer organization educates its suppliers about the environment friendly technologies, holds awareness seminars for them, brings together suppliers in the same industry to share their know-how, etc. Sometimes the organization also guides its suppliers to establish their own EMS, offers know how and even facilitates the funding for them to adopt environment friendly technologies.

Looking at the many green purchasing initiatives which are pursued by companies all over the world, one observes that green purchasing strategies could perhaps be categorized into three broad constructs (Bowen et al., 2006); (a) green products (b) green process and (c) greening/mentoring suppliers, vendors and business partners -- dealing with people. Thus green purchasing encompasses three critical aspects of operations; *materials, process/methods and people* and initiatives to design and implement ways of greening all three of them. Greening products; greening process and greening/mentoring of suppliers constitute green purchasing among companies.

The concepts of green purchasing, especially greening of suppliers is gaining popularity in the Philippines for several reasons. Firstly, corporations have realized that their customers as well as stakeholders do not make a distinction between the environmental performances of the company and that of its suppliers. Corporations are often held responsible for the environmental liabilities of their suppliers. Secondly, global corporations are now attempting to demonstrate their commitment towards their corporate social responsibility by including suppliers and other business partners in the entire greening process. Thirdly, corporations in the South East Asian region are engaged in supplying to global customers who are increasingly indicating their preference in doing business with corporations who display continuous improvements in the environmental performance of their own activities as well as those of their suppliers.

Corporations like Ford Motor Company, Texas Instruments, and Nestle International, are attempting the "greening of their suppliers" by holding awareness seminars, assessing them for their environmental performance and eventually doing business with those who meet

the standards. Some of these corporations have developed specific environmental criteria such as the amount of recyclable/reusable materials in their products, and have stipulated these in their supplier contracts, while others have detailed checklists for their suppliers to ensure that they are able to provide environmental protection and safety for their employees (Rao, 2003).

Consider the case of Nestle Philippines, which has a coffee manufacturing plant in Mindanao. In accordance with the company policy, Nestle sources the raw material locally from the coffee growers in the region. In its efforts towards being environment friendly, the company obtains coffee beans produced through an environment friendly process and assists the coffee growers in turning green. Nestlé's agronomists visit the local coffee growers and teach them environment friendly farming methods, by discouraging the use of chemical fertilizers and encouraging the use of biological or cultural farming methods and the use of sloping agricultural land technology (SALT) to prevent soil erosion. Farmers are taught the proper methods and levels of pesticide usage. The company has established a local agricultural services department tasked with the implementation of a growers program centred on the transfer of proven and well tested technology to the local farmers (Rao, 2003).

Consider the case of another company, the Amkor Anam Philippines. Amkor Anam had successfully implemented the Environmental Management System under ISO 14001 standard in 1997. As part of EMS another far-reaching environmental effort that originated within the company operations was the greening of the suppliers and the business partners. This effort was started in the form of seminar on ISO 14001 orientation that was a part of the objectives and targets and was included in the environment management programs.

The suppliers and business partners of the company are associated with the company's operations in different capacities and in different phases of the production process. The company has organized many awareness seminars for its business partners and many corporations have sent their representatives to these programs. Initially the business partners sent their people to these seminars out of courtesy and a desire to please their customer. However with time, genuine interest is growing on their part to improve their environmental performance, ensure legal compliance, enhance marketability and even achieve cost savings in their operations (Rao and Holt, 2005).

Apart from manufacturing corporations operating in the Philippines it may also be relevant to look at the environmentally responsible procurement initiatives incorporated in a large multilateral organization in the country that has accepted environmental sustainability as one of its cross-cutting themes in its long-term strategic framework. This initiative of environmentally responsible procurement (ERP) in operations has been given international recognition and has been accepted as part of the organization's environmental policy. The organization has put in significant effort to convince and assist executive agencies, contractors, suppliers and consultants to bring their own policies and procedures in line with the organization's environmental policies. ERP in this organization is a systematic approach to conduct the procurement function in a manner that is least harmful to the environment and even requires that the contract awards be based on environmental criteria.

As part of ERP, the organization would integrate ERP in the environmental assessment process for all loans, which would be the borrower's responsibility; integrate ERP early in the project cycle; include ERP analysis in the terms of reference for environmental assessment consultants and identify ERP recommendations for all projects in general.

Within the next few years many other corporations in this region are expected to undertake green purchasing as part of their commitment to continuously enhance their environmental performance. These corporations are likely to focus not only on their first tier suppliers but also on those who are further up in the supply chain. These efforts have the potential to ensure that the greening process permeates large sections of the industry.

In order to encourage many corporations in this region to start and implement this concept, it is important that the forces that are driving the corporations towards this initiative are understood completely. Such an understanding would help other corporations in realizing why the greening of suppliers is worth the effort and appreciating the benefits of enhanced business performance as well as environmental sustainability and social commitment.

BRIEF REVIEW OF LITERATURE

Green purchasing initiatives with its greening of suppliers have become an area of interest and research in the last 10-15 years (Seuring et al., 2008). In recent years corporate environmental responsibility has gone beyond the accomplishment of the environmental performance in the company operations. From a piecemeal fragmented approach towards a reactive solution of environmental problems in the earlier stages, the thrust now is to integrate environmental management into the key company strategy of the firms. Thus from the end-of-pipe short term solutions which corporations used to resort to, the move now is to integrate product stewardship processes where corporations monitor and mentor the environmental impacts of their products right from the conceptual phase to the use and disposal by the consumer. For organizations which go about these initiatives in a systematic manner there are many benefits which accrue such as enhanced environmental performance, marketing advantage, competitive advantage and even economic performance.

Just as the corporate environmental thinking has grown and expanded over the years, so has the research and its documentation. For instance green purchasing has been explored closely by Min and Galle (1997) who note that consumers are gradually beginning to favour green products. In order to satisfy green consumers, a company has to integrate its environmental goals with its purchasing strategies and thereby go for a proper supplier selection. In a survey conducted in their research they concluded that the high cost of environmental programs appears to be the predominant obstacle to green purchasing in the US firms. In a succeeding research conducted by them (2001), they also consider the effects of the firm size on green purchasing as well as the major driving forces behind green purchasing implementation. Their findings bring out the growing interest of organizations towards green purchasing but still do not investigate fully the integration of green purchasing with strategy formulation or the association of green purchasing with business and/or economic performance of organizations.

In the following paragraphs we outline the different aspects of research in the area of green purchasing as reported by many authors writing on this topic and also try to explore if there is an association between such green purchasing activity and business performance in general.

Among the current research a significant mention could be made of Ellram et al. (2008) who explore how environment-friendly manufacturing practices like design of product, process and greening the actors across the supply chain lead to reduced time to market, lower costs and improved customer acceptance, which constitute the business performance aspects in an organization.

Tsoulfas and Pappis (2008) consider a complete internal supply chain ranging from product design and manufacture to transportation and logistics and examine how environmental performance indicators may be introduced on them. Similarly, ecological indicator system for the supply chain of a company has also been considered. In addition, these indicators for environmental performance have also been interfaced with related added value of economic activities.

Bala et al. (2008) focused on a public administration supply chain and explained how spreading green purchasing throughout the administration and supply chain affected various aspects of business performance such as quality and performance of products and services.

Geffen and Rothenberg (2002) consider the prospects of achieving environmental performance enhancement through unique partnerships with suppliers in an automotive paint process situation. They mention that prior to the 1980s, the automakers' relationship with suppliers used to be characterized by arms-length type of dealings and has since transformed into a close supplier-manufacturer relationship as witnessed in Japan's auto industry. In this industry, supplier involvement is turning out to be important for the innovations required in designing new products and processes. In their research, conducted to explore supplier involvements in developing product and process innovations, 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 require reducing the emissions 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 thus makes it easier for the firm to adopt new technology and develop environmental innovation.

Dyer, Cho and Chu (1998), while referring to different models of supplier management with reference to business and economic performance, discuss the applicability of the arms-length model and the partnership model in the US, Japan and Korea. While Japanese style partnership models 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 the inefficient suppliers.

In their case based research on integrating suppliers into environmental management process, Walton, Handfield and Melnyk (1998) have observed two evolving trends in the business today. The first trend pertains to the way environmental issues are becoming an intrinsic part of the strategic planning agendas because of stricter regulations and stronger requirement for environmental accountability. The second trend refers to the corporations integrating their supply chain to bring down their operating costs and improve their customer service thereby enhancing business performance. After combining these two trends, it is evident that the corporations must now involve suppliers and purchasers to make them contribute towards improving the environmental 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 the green suppliers' production process, evaluate the suppliers using environmental criteria, and work towards greening of the entire inbound logistics process. They have also realized 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 corporations have traditionally tried not to take environment issues too seriously and in many cases adopted the practice of continuing to pollute and then settling for a small fine for it. When regulations got stricter following major environmental mishaps and public outcry, these corporations adopted the practice of controlling pollution after it was 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 helped immensely in reducing cost. In the next step they started to appreciate the tremendous marketing advantage and competitive edge these measures provided to their organizations, and started adopting proactive approaches to environmental performance in the form of Environmental Management Systems (EMS) and green 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 established that some of the corporations were indeed working with suppliers to reduce emissions, monitor the waste streams from suppliers, help them to set up their environmental programs and even extend technical support 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, and reverse logistics program.

There is also existing research which investigates how the environmental performance of a firm requires coordinated effort between supply chain partners and how corporations work together to bring about environmental change (Hart and Ahuja, 1996; Rao and Holt, 2005). They note that environmental adaptation can occur on account of supplier and buyer firms declaring their intentions to align their activities and enhance environmental performance by the efficient use of resources. The adaptations can occur in response to changing business conditions, changing environmental legislation or banning of environmentally damaging substances.

Sroufe (2006) presents a framework to help academic researchers and practitioners understand the strategic environmental sourcing. He recommends a model for supplier selection and argues that the environmental initiatives such as environmental sourcing would improve the corporations' competitive standing and reduce various risks. The model would work under a supplier assessment metrics, which looks at a list of environmental performance indicators that forms the database for the suppliers' environmental performance and can be used for their assessment.

With regard to the mentoring of suppliers with the objective of greening the purchasing, Hines and John (2001) examine the implementation of "greening of suppliers" with respect to the tools that are used. They provide an overview of the drivers of environmental supply chain management; the implementation aspects of the EMS under the ISO 14001 standards, the cost reduction through efficient and effective use of the supply chain, the issues regarding avoidance of environmental risk, the reduction in the cost of purchasing through the use of less virgin and more recycled materials, and the avoidance of environmental liability. The research of Hines and John provides an understanding of the mentoring process and analyzes the stages of supplier environmental involvement through the supply chain. Starting with the no-involvement phase of the supplier, the company involves the supplier through environmental questionnaires, site assessments, mentoring programs and partnering programs. Since one of the drivers of green supply chain management, as explored by them, is overall cost reduction, their research has associated green supply chain management with business performance.

Questionnaires have been a part of the supplier assessment by corporations over a long period but the supplier/vendor assessment questionnaire usually dealt with the quality, price and delivery aspects of the supplier. It is only recently that the questionnaire included items relating to the environmental performance of the supplier. Site assessments are carried out by company auditors or by a third party and are being done by quite a few corporations for the purpose of greening the suppliers. The mentoring and partnering tools used in greening the suppliers pertain to the development of a close relationship between the customer and the supplier, providing guidance in implementing EMS, and working together to improve efficiency, environmental product design product design etc.

Sarkis (2005) considers the greening aspect of the entire supply chain comprising inbound logistics, internal/production, outbound logistics and reverse logistics by giving a detailed description of research undertaken in each phase. He also provides anecdotal examples in each phase of the supply chain as well as the emerging issues that encompass the supply chain such as the role of government, industry differences, and evolving organizational forms.

Bowen et al. (2006) 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 twenty-four business units were interviewed and in the second, questionnaires were sent out to key respondents in the operating units of the same business units. Based on this data the authors cluster the operating units into four archetypal groups of green adopters and examine the distinctive features of each group. They 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.

Theoretical Framework

As mentioned in the related literature there has been an increasing attention towards combining environmental performance of the green purchasing and green supply chain. In certain cases, the literature has also indicated that the greening initiatives at the purchasing phase would also lead towards the achievement of business performance of the firm (Tsoulfas and Pappis, 2008; Hamner, 2006; Bowen, 2006; Hart and Ahuja, 1996; Corderio and Sarkis, 1997). Since purchasing is at the beginning of the supply chain (Min and Galle, 1997) some of these initiatives like the green supply chain management emphasized a special need for green purchasing as described above. At the same time, there remains a need for developing implementable models and frameworks to plan how environmental initiatives can be integrated into the purchasing function (Sroufe, 2006).

Originally the green purchasing concept encouraged the corporations to work with the suppliers to go for material substitution, which would reduce the generation of hazardous as well as non-hazardous waste to increase the volume of recyclable and reusable materials in the finished product, material, water and energy conservation, on the part of both suppliers and buyers. The objectives of such efforts primarily used to be avoiding the risk of non-compliance with environmental regulations and enhancement of environmental performance in general. However, recently this approach is emerging as a strategic direction, which is expected to integrate corporate decisions involving product, price, and market with the environmental objectives of the company. This synergy would again develop into an integral part of competitive advantage of the company and its business performance.

The competitive advantage which is expected to originate from green purchasing, would arise because green purchasing, effectively integrated in organizational activities , would enable firms to design products and processes which are environmentally more sound, minimise waste thereby enhancing efficiency, lowering operating cost and reducing risk of non-compliance with environmental regulation.

Since there is not much empirical evidence yet that green purchasing leads to environmental performance, as well as business performance of the firm, the current research explored if this is indeed a reality at least in the Philippine context. The environmental initiatives in the purchasing phase have been considered under the three categories of product, process and suppliers/vendors and the research explores their links with the business performance aspect of the firm.

The Research Question
Figure 1: Conceptual model for Green Purchasing
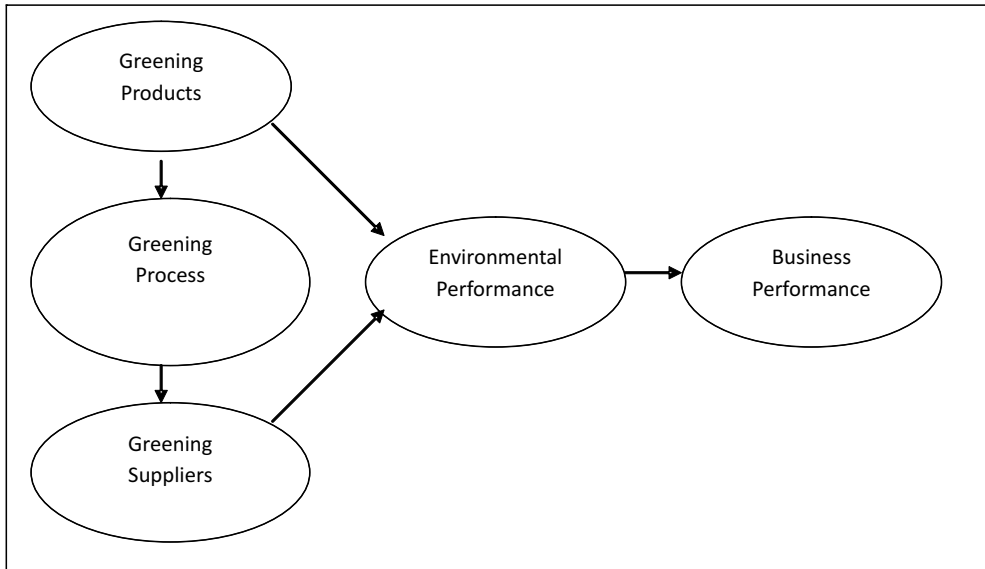
In this research, in order to explore and validate this model, the green purchasing function, which could be viewed upon as encompassing many different initiatives, has been looked upon as comprising three broad constructs: (a) green products; (b) green process; and (c) greening/mentoring suppliers and business partners. The three categories would thus deal with materials, methods and people involved in the purchasing phase of the supply chain. The environmental performance here comprises achievement of reduction of different categories of waste, improvement of compliance and commitment to preserve environment. The business performance constitutes enhancement of productivity, achievement of cost saving and even financial performance.

RESEARCH METHOD

Exploratory Research

In the exploratory part of research, we wanted to explore the different kinds of green purchasing that the Philippine corporations were trying to implement. Using the aforementioned categorization, green purchasing was looked upon as being constituted by green sourcing, dealing with materials, green inbound methods, dealing with procedures for and greening/mentoring suppliers and business partners.

To be more specific, the three constructs were taken as comprising:

Green products:
· Sourcing environment friendly raw materials.
· Substitution of environmentally questionable raw material by environment friendly raw materials.
· Reducing the purchased volume of items that are difficult to dispose of or those that are harmful to the ecosystem.
· Reducing the use of hazardous virgin materials by purchasing a higher percentage of recycled or reusable portions.

Green process:
· Selection of suppliers by environmental criteria.
· Requiring suppliers to provide environmental impacts of the product content.
· Specifying that the products that are supplied must have green attributes.
· Specifying that the products must not contain environmentally hazardous attributes.
· Requiring suppliers to provide information about their environmental aspects.

Greening/mentoring suppliers:
· Holding awareness seminars for suppliers.
· Urging suppliers to take environment friendly actions.
· Guiding suppliers to establish their own EMS.
· Bringing together suppliers in the same industry to share their know-how and problems.
· Sending in-house company auditors to appraise suppliers' environmental performance.
· Urging suppliers to take back packaging.

For each of the different items included under the three categories of green purchasing it would be important to know the extent to which the Philippine corporations are implementing them. Using a survey questionnaire as the research instrument where each of these items was measured on a four-point scale, a measure of implementation of each of these was ascertained. Using the same ratings, an average measure for each of the three categories was also obtained.

Confirmatory Analysis/Structural Equation Modeling

The second part of the research methodology comprised the use of Structural Equation Modeling (SEM) to validate the model proposed in the section called 'theoretical framework', investigating if green purchasing would lead to the enhancement of the environmental performance and business performance. In other words the objective was to find out if there were significant linkages between latent constructs such as the ones mentioned above.

Structural Equation Modeling is an analytical method that provides parameter estimates of the direct and indirect links between observed and unobserved variables. This method is similar to regression in that there is a quantification of relationship between dependent and independent variables. One of the unique features of SEM is its ability to provide parameter estimates for relationships among unobserved variables or latent constructs (Sroufe et al., 1999) which are measured using indicator or manifest variables.   These variables again are obtained from respondents in response to questions in the questionnaire. The convergence of the model is evaluated by Chi Square, associated degrees of freedom and the significance level (p-value), which should be greater than .05 for acceptance of the model

The proposed model, which would be validated, has five latent constructs each being measured by the indicator variables as given below:

Table 1: The five latent constructs and the associated manifest variables

Latent Construct	Manifest / Indicator Variables
Green Product	Sourcing environment friendly raw materials Substitution of environmentally questionable raw material by environment friendly raw materials Reducing the purchased volume of items that are difficult to dispose of or are harmful to the ecosystem Reducing the use of hazardous virgin materials by purchasing a higher percentage of recycled or reusable materials
Green-process	Selection of suppliers by using environmental criteria Requiring suppliers to provide environmental impacts of the products content Specifying that the products must not contain environmentally undesirable attributes Requiring suppliers to provide information about their environmental aspects etc.
Greening / Mentoring Suppliers	Holding awareness seminars for suppliers Urging suppliers to take environmental actions Guiding suppliers to establish their own EMS Bringing together suppliers in the same industry to share their know-how and problems; sending in-house company auditors to appraise suppliers' environmental performance. Urging suppliers to take back packaging
Environmental Performance	Reduction of solid/liquid waste Reduction of air emissions Improvement of environment compliance Preserve environment Improved waste disposal
Business Performance	Cost saving , productivity New market opportunities Product quality improvements Increased efficiency in production Enhancement of corporate image Increase in sales

Data and Sample

To conduct the empirical research to carry out the exploratory and confirmatory analysis, we decided to carry out an extensive survey with a questionnaire requiring some demographics referring to the number of employees, if the corporations belonged to the Multinational Corporation (MNC) category or if they had Environmental Management System (EMS). Then the questionnaire asked the company respondent to rate different items under green sourcing, greening suppliers/mentoring suppliers, environmental requirements from suppliers, environmental performance, and business performance.

These items were rated on a four-point scale: 'Neither agree nor disagree ', 'somewhat agree', 'agree' and 'strongly agree'. The usual rating of 'strongly disagree' was not included because Philippine corporations usually do not like to check 'strongly disagree' because they do not like to 'disappoint' the group organizing the survey. Also the lowest point in the scale was 'neither agree nor disagree,' otherwise, if we had put 'disagree,' respondents would not have marked it. The questionnaire was maintained short and easy so that the corporations would not have difficulty answering the items.

Sampling frame: When the research was started the sampling frame was to be the top one thousand corporations in the Philippines. In fact a random sample of four hundred was created and the questionnaire was mailed to these four hundred corporations. It was to be answered by chief operating officer or the production/operations/environment manager. However, this effort did not generate the response needed in the research and very few corporations, 12 corporations, actually sent back the questionnaire after completing the answers. The study needed a minimum sample size of about 100, so that the margin of error would be not more than 10 %.

As a result of the sampling frame of top 1000 corporations not working out, we changed the sampling frame. As part of this process the questionnaire was mailed to all companies who were enlisted with the Management Association of the Philippines which totaled about 500 in number.

The Sample; Addressing sample bias: The sample obtained comprised two separate samples, one from the sampling frame of top 1000 corporations, which were 12 in number, and the other having responses from 92 corporations. However, since the two samples were from two different populations which contained a substantial number belonging to both populations, we could not combine the two samples because it would give rise to sample bias. Thus we worked with the sample of size ninety-two corporations (margin of error of about 10 %) from the second population comprising companies in the Management Association of the Philippines. The survey was conducted in the first half of 2006.

Using the items under green product, green process, and greening/mentoring suppliers, which were rated on the four-point scale we got the following mean figures [Neither agree nor disagree =1; somewhat agree = 2; Agree = 3; Strongly agree = 4].

**Exploratory Analysis: Green Purchasing Actions**

Green products	mean	t-ratio
Sourcing environment friendly materials	2.7027	4.29
Substitution of environmentally questionable raw materials by environment friendly raw materials.	2.6757	4.22
Reducing the purchased volume of items that are difficult to dispose of or are harmful to the ecosystem.	2.7567	4.55
Reducing the use of hazardous virgin materials by purchasing a higher percentage of recycled or reused content.	2.4594	2.55
Green process	**mean**	**t-ratio**
Selection of suppliers by environmental criteria	2.0	0
Requiring suppliers to provide environmental impacts of the product content	2.27	1.57
Specifying products supplied must have green attributes	2.108	0.66
Specifying products must not contain environmentally undesirable attributes	2.4324	2.46
Requiring suppliers to provide information about their environmental aspects	2.2973	1.98
Greening suppliers/mentoring suppliers	**mean**	**t-ratio**
Holding awareness seminars for suppliers	2.1351	0.669
Urging suppliers to take environmental actions	2.297	1.54
Guiding suppliers to establish their own EMS	2.0810	0.47
Bringing together suppliers in the same industry to share their know-how and problems	2.0810	0.4237
Sending in-house auditors to appraise suppliers' environmental performance	1.8378	-.9263
Urging suppliers to take back packaging	2.1891	1.02

Thus, one may observe that the highest rating has been obtained for 'Reducing the purchased volume of items that are difficult to dispose of or are harmful to the ecosystem' (2.75) and 'sourcing environment friendly raw materials' (2.70), both of which belong to the green sourcing category. The item next having the highest rating is 'Substitution of environmentally questionable raw materials by environment friendly raw materials' (2.68), which also belongs to green product category. Taking the average of the mean ratings of items in the three categories, we see that 'green product' has the average rating of 2.6488. The average rating of greening suppliers/mentoring suppliers is 2.1035 and that of environmental requirements from suppliers is 2.22. All items in *green product* are significant. All items in *greening suppliers/mentoring suppliers* are not significant and only one item is significant in *green process category.*

Thus, one may conclude that in the Philippines the corporations are significantly implementing the green sourcing part of the green purchasing but the other two categories are not being significantly implemented yet.

The figures with the mean ratings are given graphically below:

**Figure 2: Sample responses on green purchasing initiatives**
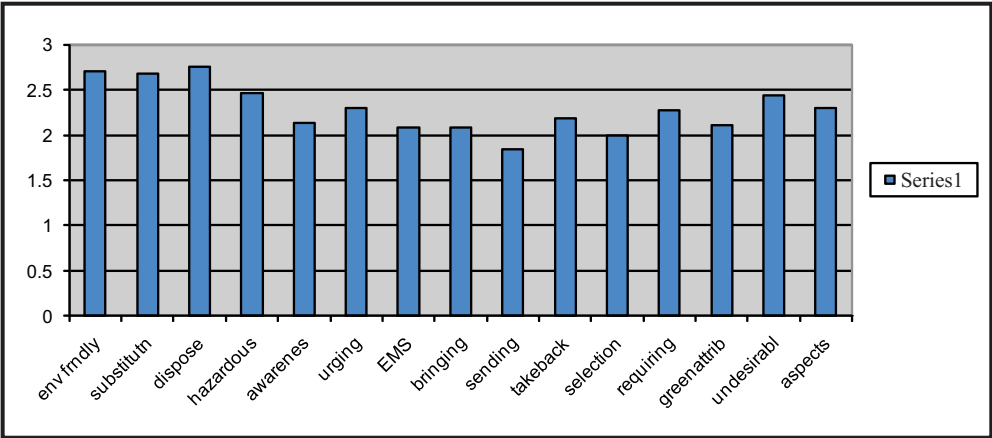
Regarding the sample ratings on environmental performance and business performance, the survey yielded the following mean ratings and the associated t-values.
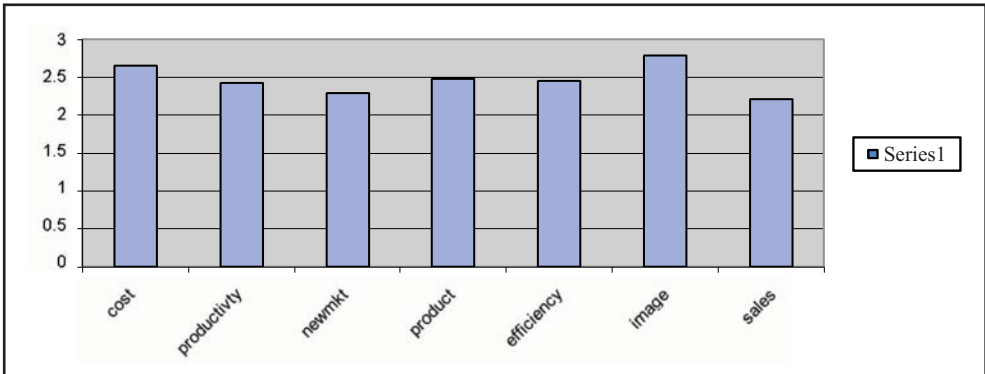
Environmental Performancemean ratingt-value

Reduction of solid /liquid waste	2.59	3.31
Reduction in air emissions	2.67	3.56
Improvement in environmental compliance	2.73	4.14
Preserve environment	2.76	4.32
Social commitment	2.68	3.99
Improved waste disposal	2.62	3.74

Figure 3: Sample responses on Environmental performance
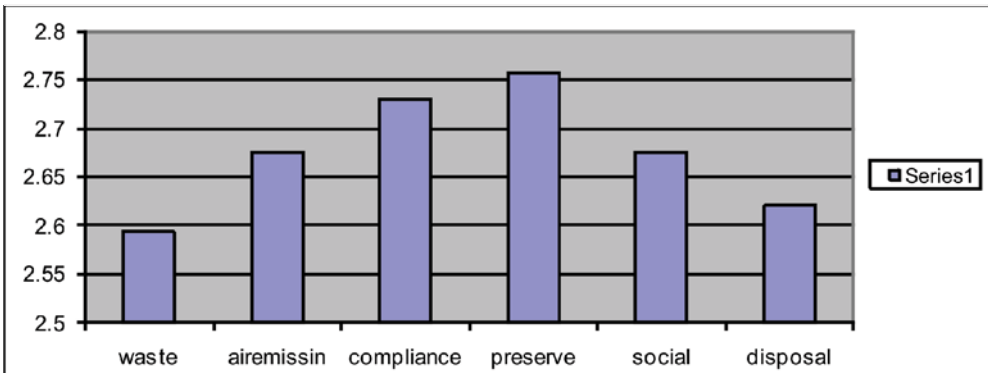
Business Performance `	mean	t-ratio
Cost saving	2.65	3.55
Productivity	2.43	2.52
New market opportunities	2.30	1.72
Product quality improvement	2.49	2.7
Increased efficiency in production	2.46	2.5
Enhancement of corporate image	2.78	4.03
Increase in sales	2.22	1.21

Figure 4: Sample responses on Business performance

From the above mean ratings and the associated t-values, we observe that although the environmental performance benefits and business performance benefits have emerged as significant in this research, in the green purchasing aspect only the green sourcing has been significant (all 4 items are significant in the sense that $t > 1.65$ for each at 5% level of significance). Greening suppliers/mentoring suppliers and green inbound methods comprise items that are not significant. All items under greening suppliers/mentoring suppliers are not yet significant. Under green inbound methods only the last two items (specifying products must not contain environmentally undesirable attributes and requiring suppliers to provide information about their environmental aspects etc) are significant at 5% level of significance.

Reliability Analysis to Test Internal Consistency

Before using the data obtained from the survey for the purpose of structural analysis, we need to be sure that the true underlying level of implementation of the different modules of the standard is accurately reflected in the questionnaire score. This refers to reliability, which is defined as the extent to which the measurements are free from random error variance. According to the classical measurements theory, the relationships between the observed score (X), true score (T) + error (E) is given by;

$$X = T + E$$

The study's measurement instrument, the survey questionnaire will probably be calibrated if there is a high degree of agreement between observed scores (X) and the true score (T). Also the items under one concept or one topic must be such that they all measure the same idea. For instance all items under the construct called green sourcing must essentially correlate with one another for the questionnaire to have internal consistency. This could be systematically measured by a statistic called Cronbach Alpha, which must exceed 0.8 for the module to demonstrate reliability.

After carrying out reliability analysis for the consolidated data the Cronbach Alpha for certain modules yielded non- acceptable reliability. In order to arrive at a survey instrument with acceptable reliability within each module, those items whose co-efficient of multiple determinations with the rest of the items were lowest were removed. The final result of the Cronbach Alpha enumerate as follows:

Latent Construct	Cronbach alpha
Green products	0.91
Greening /mentoring suppliers	0.82
Green process	0.86
Environmental performance	0.84
Business performance	0.79

Confirmatory Analysis /Structural Equation Modeling (SEM) Framework

SEM estimates a series of separate but interdependent multiple regression equations simultaneously. For this, the researcher draws upon theory and the research objectives to distinguish and identify the different independent variables that predict different dependent variables. The proposed relationships are then translated into a series of structural equations for each dependent variable. The structural model expresses these relationships among independent and dependent variables, even when a dependent variable becomes an independent variable in other relationships or when several independent variables are not independent among one another. In SEM there is a unique feature of being able to include variables that are not measured directly and are thus called unobserved or latent constructs (Joreskog & Sorbom, 1993).

The observed variables, which we measured in the field survey, are known as indicator variables or manifest variables and are used to measure the latent constructs. The list of latent constructs used in this analysis and the associated indicator or manifest variables are given in Table 1.

In this analysis the model proposed in the theoretical framework section was considered and evaluated. The model was run using AMOS Graphics for Windows Version 3.6 (Arbuckle, 1997) estimating the regression weight of each link (arrow) and the associated significance. This significance was evaluated with the statistic called "critical ratio" associated with the regression weight concerned.

The convergence of the model is given by the Chi square value, the degrees of freedom and the associated probability level, the p-value. The model is considered acceptable at 5% level of significance if the p-value > .05. Otherwise the null hypothesis Ho (i.e., the proposed model is true) would be rejected. In addition to p-value, chi square/degrees of freedom < 2. GFI, AGFI are additional indicators to evaluate the validity of the model.

The latent constructs which were used in the model and the associated indicator variables were the same as given in the conceptual framework section. Several sets of analyses were conducted with the input being the descriptive statistics of the indicator variables and the correlation matrix for all of them.

Several sets of structural equation models were also run to test variations of the model with alternate paths deleted to assess the importance of model aspects.

RESULTS AND DISCUSSION

Latent constructs	*Regression weight*	*Critical ratio*
Green products Mentoring suppliers	0.617	4.258
Green productsGreen process	0.215	4.232
Mentoring/suppliersGreen process	0.332	6.302
Green process Environmental performance	1.143	5.311
Green process Business performance	0.531	3.4
Environmental performanceBusiness Performance	0.598	6.789

Chi-square = 928.710
Degrees of freedom = 304

Figure 5: Structural Model for Green Purchasing
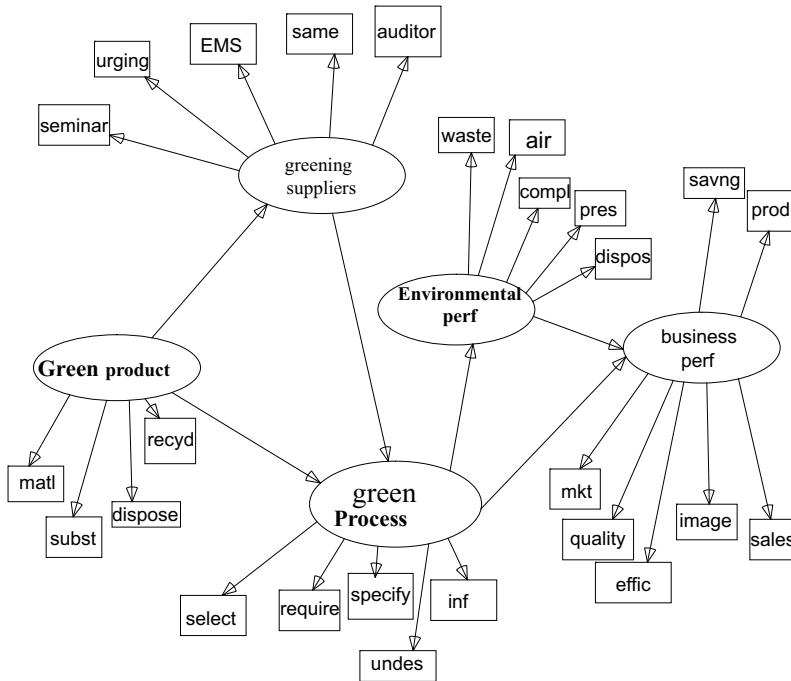
Discussion of results

From the data analysis presented, one may observe that in the context of the Philippines, corporations are significantly carrying out greening the products they are dealing with, encompassing sourcing of environment friendly materials, substitution of environmentally questionable raw materials by environment friendly raw materials, reducing volume purchase of items that are difficult to dispose of or are harmful to the ecosystem and reducing the use of hazardous virgin materials by purchasing a higher percentage of recycled or reused content. All of these items under green product initiative have been found statistically significant.

For greening suppliers/mentoring suppliers all of the six items emerge as nonsignificant. Though there are few cases of large, state of the art global corporations like Nestle and Amkor Anam who are carrying out this greening/mentoring initiative, the survey revealed that on the average, the Philippine corporations are not yet carrying out this initiative.

In the category termed as the *green process*, selection of suppliers by environment criteria, requiring suppliers to provide environmental impacts of the product content and specifying that products supplied must have green attributes, are not significant. However the product content restriction, that is specifying products must not contain environmentally undesirable attributes and requiring suppliers to provide information about their environmental aspects, are statistically significant.

Thus in the Philippines, the companies are at a nascent stage of using environmentally friendly products, which include raw materials which are green and also designing products which have environmentally friendly components.

These products even have components which support conservation and address minimizing waste. This is indeed a very important and satisfactory finding because once the products which are dealt with in an organization are green, the environmental performance is almost guaranteed.

The greening of suppliers has not started in a regular manner yet, with the exception of a few large companies conducting such an initiative.

This is again very understandable because it is still the initial phase of greening industry in the Philippines and companies first have to achieve a stable environment friendly position themselves before extending the mentoring concept to the other stakeholders.

The fact that the green purchasing process has not started yet in a significant way is perhaps on account of companies still looking at tangible products and input materials to green their purchasing process rather than to start also greening their processes.

In fact the structural equation model results show that green product significantly leads to greening/mentoring suppliers and then to green process, critical ratios of 4.258, 4.232 and 6.302 all three significant (>1.96).

Green products Mentoring suppliers	0.617	4.258
Green productsGreen process	0.215	4.232
Mentoring/suppliersGreen process	0.332	6.302

All the same, as per the results of structural equation modeling above, the greening initiatives related to products and input materials would directly lead to green process and greening/mentoring suppliers. Greening/ mentoring suppliers again would ultimately lead to green process and thereafter to environmental performance and business performance.

Hence considering the conceptual framework, we find significant links between green products, greening suppliers, and green process. Then again there are significant links between green process and environmental performance and business performance.

This finding is indeed very encouraging because, in the Philippines, though one does not find all different tenets of the green purchasing initiative to have taken a firm root in company practices, but one can say with conviction that once companies do practice green purchasing, it would actually lead to environmental performance and then even business performance.

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