Journal of Engineering and Applied Sciences 11 (2): 267-273, 2016
ISSN: 1816-949X

Developing a Green Strategic Management Model with Regarding Health, Safety and Environmental Management System (HSE-MS)

[1]Amin Padash, [2]Gh. Nabi Bidhendi, [2]Hassan Hoveidi and [2]Mojtaba Ardestani
[1]Department of Environmental Planning, Alborz Campus,
[2]Department of Environmental Planning, Faculty of Environment,
University of Tehran, Tehran, Iran

Abstract: The aim of this research is developing a model for green management based on health, safety and environmental management system. The model is developed in this study can be used for industries as guidelines for implementing green management issue by considering health, safety and environmental management system. The pars special economic/energy zone organization on behalf of Iran's Petroleum Ministry and National Iranian Oil Company (NIOC) manages and develops the South and North oil and gas fields in the region. Based on process approach the model consists of the following steps and components: first factors involved in green issues are determined. Based on them a framework is considered. Then with using MCDM algorithms such as TOPSIS the priority of basic variables are determined. Fuzzy-AHP Method is used first for evaluation of GSM strategies and weights are defined which are qualitatively meaningful. Basic factors involved in green issues and their weights can be the main finding. Model and relation between factors are the other finding of this research. The case is considered Petrochemical Company for promoting the system of ecological industry thinking.

Key words: Green strategic management, health safety and environmental management system, MCDM technique, Fuzzy-AHP Method, TOPSIS

INTRODUCTION

These days the environment affairs in industrial sectors have been grow, this industry needs to develop some green related key strategies. In this regard, the HSE department is developed in new structure of petrochemical company. This research is part of a comprehensive research that is based on green technology and green management.

The range of environmental products in the global market was relatively modest in the past years but it is now a rapidly expanding sector. For the future as sustainable development concepts are being adopted, there will be a substantial broadening of opportunities towards redesign of industrial processes and products, environmental restoration and new economic activities such as eco-tourism which depend upon environmental quality.

Green Strategic Management (GSM) adds 'green' component to the conventional procedures by including practices like green operations, green design, green manufacturing, reverse logistics and waste management (Srivastava, 2007).

GSM has been gaining much attention of academia and industry over the last few years. The companies cannot afford to ignore environmental issues in today's competitive business environment. Increasing government regulations and stronger public mandates for environmental accountability have brought the green issues high on the strategic planning agenda of manufacturing firms (Walton *et al*., 1998).

GSM practices have become a very important part of company's policy and are increasingly turning into a major strategic thrust in business organizations. GSM is a relatively new concept for the majority of Indian manufacturing firms.

Strategic planning in GSM context means the identification of relevant goals and specification of long term plans for managing those goals (Mudgal *et al*., 2010).

It charts out the future course of action for GSM implementation. The biggest challenge in GSM practices for companies is to select suitable strategies in accordance with the stipulated regulations and customers' requirements (Hsu and Hu, 2008). A Health, Safety and Environmental Management System (HSE-MS) monitors health, safety and environmental performance,

Corresponding Author: Amin Padash, Department of Environmental Planning, Alborz Campus, University of Tehran, Tehran, Iran

similar to the way a financial management system monitor's expenditure and income and enables regular checks of a company's financial performance. An HSE integrates health and safety requirements with environmental management into a company's daily operations, long term planning and other quality management systems.

Environmental policy refers to the commitment of an organization to the laws, regulations and other policy mechanisms concerning environmental issues and sustainability. These issues generally include air and water pollution, solid waste management, biodiversity, ecosystem management, maintenance of biodiversity, the protection of natural resources, wildlife and endangered species. Policies concerning energy or regulation of toxic substances including pesticides and many types of industrial waste are part of the topic of environmental policy.

The environmental sector has been described as quite disorganized with many small firms; companies with new technologies but limited sense of markets or access to capital; investors interested but uncertain of the opportunities and governments struggling to determine how to stimulate or facilitate the growth of the sector. This characterization, however, ignores some of the large actors in the business, e.g., in the waste disposal, the supplier relationships between smaller firms and major industries and the well-organized efforts of some countries like Japan and Germany to build a highly competitive, worldwide business in environmental technology.

At the international level, policy making is far more complicated due to the sovereign status of each participating policy maker and the immense diversity of cultural influences represented. The process, however is conceptually similar to what takes place within deliberative bodies at all levels of government, at least within democratic societies.

Whether adopting local environmental standards for the disposal of motor oil or developing international safety standards for oil tankers, the fundamental steps of policy making apply, albeit seldom in a linear fashion. The purpose of this chapter is to examine these steps, show how they affect policy contents and indicate where they lead with respect to international environmental agreements. Requirements for health and safety and of environmental topics in the world are proof for anyone. If the system does not have Health, Safety and Environmental Management System (HSE-MS) in place now it may be required to implement one soon. An HSE-MS can assist a company in the following ways:

- Minimize environmental liabilities
- Maximize the efficient use of resources
- Minimize the hazard risk in company
- Maximize the safety in procedure and structure of company
- Reduce waste
- Demonstrate a good corporate image
- Build awareness of environmental concern among employees
- Gain a better understanding of the environmental impacts of business activities
- Increase profit, improving environmental performance, through more efficient operations

An HSE-MS can be a powerful tool for organizations to both improve their environmental, health and safety performance and enhance their business efficiency. An HSE is not prescriptive, rather it requires organizations to take an active role in examining their practices and then determining how their impacts should best be managed. This approach encourages creative and relevant solutions from the organization itself.

Likewise, organizations can use HSE-MS to ensure that their performance is within regulatory requirements and to keep ahead of more stringent regulations which might be introduced in the future (Fig. 1). Following are more examples of components that should be considered when developing an HSE.

HSE policy: This is a statement of what an organization intends to achieve from an HSE. It ensures all health, safety and environmental activities are consistent with the organization's objectives.

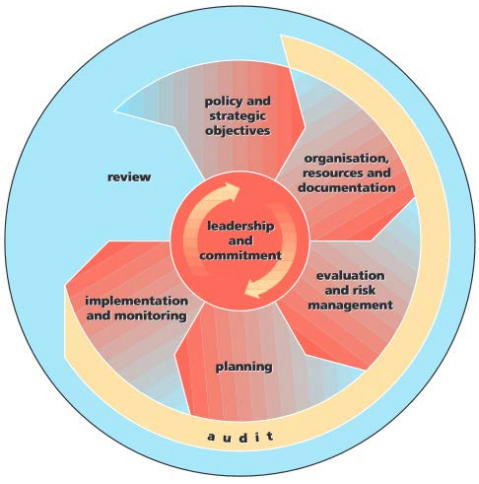

Fig. 1: The model of Health, Safety and Environmental Management System (HSE-MS)

Risk assessment and management: Risk assessment and management is a continuous process and very important for all HSE activities. The regular determination and assessment of hazardous factors in HSE activities are executed to be simultaneous with suitable solutions for controlling and preventing all potential risks.

Operational and emergency procedures: All procedures should be reviewed to ensure they are compatible with the organization's environmental objectives and targets. Any changes should be included with the documentation.

HSE management plan: This details the methods and procedures which an organization will use to meet its objectives and targets.

Responsibilities and reporting structure: Responsibilities need to be allocated to staff and management to ensure the HSE is implemented effectively.

Review audits and monitoring compliance: Review audits should be undertaken regularly to ensure the HSE is achieving its objectives and to refine operational procedures to meet this goal. In order to ensure regulatory and other requirements are being met it is often necessary to undertake regular environmental monitoring.

Continual improvement: An important component is continual improvement. An HSE comes into its best use when used to review progress towards the targets and objectives set by a company to protect the environment. The procedures set in place to meet these objectives should be constantly examined to see if they can be improved or if more effective systems can be introduced.

MATERIALS AND METHODS

Case study: The Pars Special Economic/energy Zone Organization on behalf of Iran's Petroleum Ministry and National Iranian Oil Company (NIOC) manages and develops the South and North oil and gas fields in the region. The zone consists of three regions; Pars 1 (South Pars) with an area of 14.000 ha, Pars 2 (Pars Kangan) with an area of 16.000 ha and Pars 3 (North Pars) with an area of 16.000 ha.

The organization was established in 1999 to support the development of South Pars Gas Field, the world's largest gas field, through establishing, approving, planning, implementing, utilizing and maintaining of public infrastructures like roads, rail ways, ports, airports, power plants and drinking water facilities.

The availability of proper infrastructures in the up, middle and down streams of oil and gas industry, Pars Complex Port, the International Persian Gulf Airport, water and power facilities, communication, roads and available natural tourist attractions have made the region an ideal place for local and foreign investors.

Lying on the coast of the Persian Gulf, the zone has access to the rich hydrocarbon resources in the region providing suitable conditions for foreign investment. It is the hub of development activities underway at South Pars gas field. With its reserves estimated at 14 trillion cubic meters of gas and 18 billion barrels of condensates, the field is the world's largest gas field. It represents 6.8% of the global gas reserves. Given the field's capacity, 28 development phases and 3 giant LNG projects have so far been planned to be built in Assaluyeh and Kangan in an area of 30,000 ha. Currently, the first ten phases are on stream. On average, $1.5 bn has been invested for each phase. The implementation work of phases 11-24 have been started and are underway. Several word-scale petrochemical plants are being constructed in Assaluyeh zone as part of the country's 3rd, 4th and 5th development plants (Fig. 2).

Access to international waters and mainland and Central Asian markets, the South Pars (Assaluyeh) with enjoying 6.8% of worldwide reserved gas became pivotal energy hub for the country. In the first stage, 24 phases of gas refineries and 17 worldwide petrochemical complexes as well as many downstream industrial plants implemented.

In order to analyze green petrochemical policy-making in Iran's petrochemical company we have used both quantitative research methods. At the targeting viewpoint this research is the developmental-applicable research but from implementation view is descriptive in which in the exploratory way we tried to determine certain factors.

At the beginning of the research, the affected variables are recognized and conceptual model is designed. The structure of model is based on simple PDCA cycle (Fig. 3). Then the factors are prioritized with MCDM methods.

MCDM (Multiple Criteria Decision-Making) technique, determining the priorities of the factors. Based on process approach the model consists of the following steps and components: first factors involved in green issues are determined. Based on them a framework is considered. Then with using MCDM (Multiple Criteria Decision-Making) algorithms (TOPSIS) the priority of basic variables are determined (Jahanshahloo *et al*., 2009).

Fuzzy-AHP Method is used first for evaluation of GSM factors and weights are defined which are qualitatively meaningful. Thereafter, using fuzzy TOPSIS method, the criteria application is quantitatively evaluated for order allocation among the selected strategies. The

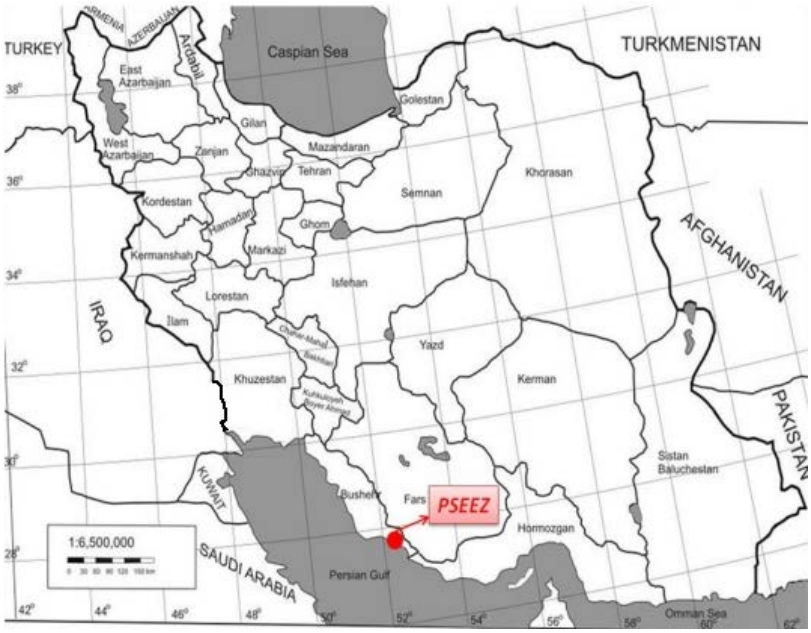

Fig. 2: Pars Special Economic/Energy Zone

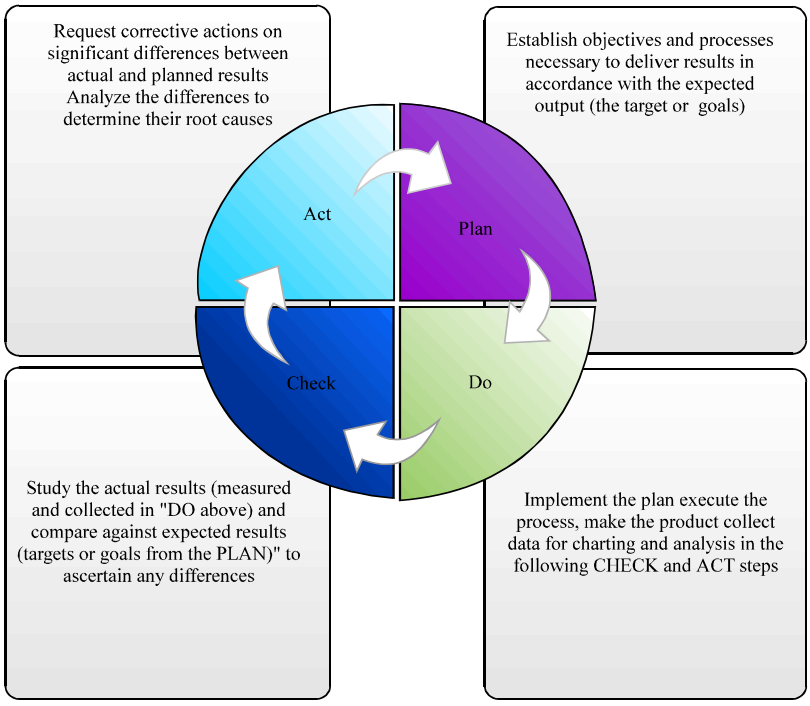

Fig. 3: PDCA Cycle (Rother, 2010)

researchers believe that the proposed model and results of this research can aid industries managers to implement green subjects according to Health, Safety and Environmental Management System in a more efficient and effective manner.

RESULTS AND DISCUSSION

Respondents (approximate 64) are experts and managers (petrochemical company decision maker in Iran) who have high experiences in wide variety of certain fields

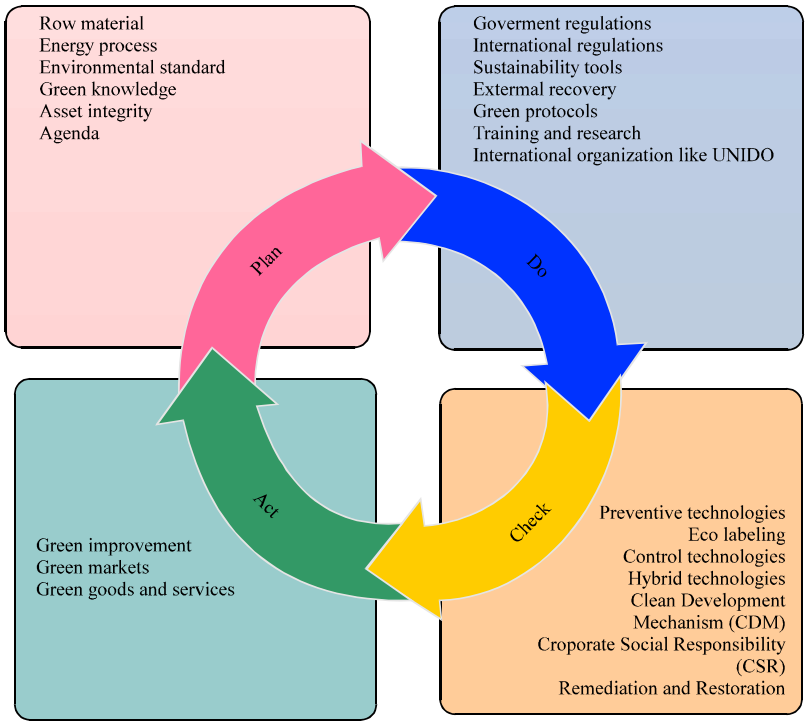

Fig. 4: Conceptual model

such as health, safety and environmental section. In qualitative analysis (interviews and open questions of questionnaire) that is based on resulted confirmed variables. Accordingly in participate of academicals and industrial experts, validity of questionnaires are dominated.

In green conceptual modeling we use process oriented approach in explaining green dimension consist of technologies with approach of clean that involved in petrochemical company. The dimension and factors are described as follows. This model is consisted of four elements.

Inputs: These inputs are consisting of:

- Raw material
- Energy consumption: over utilization of equipment and machinery (facilities), fuel wastage
- Green knowledge and related information
- Environmental standards
- Equipment and tools
- Agenda
- Management

Processing and operations: Preventive technologies, monitoring technologies, control and remediation, hybrid, clean technologies, corporate social responsibility; eco labeling.

Outputs: Green goods and services, green markets, security and healthy. Green labeling, Establishment of Environmental Management System (EMS), Life Cycle Assessment Evaluation (LCAE).

Other affected variables: Among those factors others such as green culture, use of green techniques and tools, external and internal recovery, sustainability tools; green protocols international organizations like UNIDO.

In this model systematic framework of factors involved in green management issues is explained (Fig. 4). Each category in turn includes several factors which are listed as:

Input

Raw material:

- Develop necessary standards in raw materials purchasing (Melnyk *et al*., 2003; Trowbridge, 2001)
- Raw materials purchasing analysis (Melnyk *et al*., 2003)
- Adjust the necessary rules and procedures in order to reduce of raw materials consumption

Energy:

- Electrical power consumption in manufacturing sectors to reduce the wastes (Trowbridge, 2001)

- Optimized utilization of electrical power using advanced technologies (Melnyk *et al*., 2003)
- Reduce and prevention of wastes using of fossil fuels analytical survey
- Green knowledge

Tool, equipment and machines:

- Observing necessary standards in tools, equipment and machines, purchase (Trowbridge, 2001; Zhu *et al*., 2007; Geyer and Jackson, 2004)
- Finesses of official instruments to employees
- Develop necessary standards in machines, equipments and instruments purchasing (Faruk *et al*., 2001; Melnyk *et al*., 2003)
- Informing employees toward correct using of official machines (Trowbridge, 2001; Ferretti *et al*., 2007)

Agenda

Processing:

- Technology (preventive technologies, monitoring technologies, control and remediation, hybrid, clean technologies, corporate social responsibility; eco labeling) (Chen *et al*., 2011; Ahluwalia, 2012; Sheldon, 2005; Leadbeater, 2010)
- An integrated cluster of bio-industries, using a variety of different technologies to produce chemicals, biofuels, food ingredients and power from biomass raw materials
- Environmental innovation in processing such as industrial ecology procedure

Output (green goods, information and knowledge, green markets, security and healthy) influential factors:

- Environment based personnel training (Rao and Holt, 2005); encouraging personnel to do environment oriented research; setting environmental standard systems. Analytical review of waste recovery outside the company improving the company's culture (Trowbridge, 2001; Rajabzadeh *et al*., 2008); checking environmental standard systems (Melnyk *et al*., 2003; Trowbridge, 2001); paying attention to the customer
- Green labeling, Life Cycle Assessment Evaluation (LCAE)

Based on TOPSIS technique to prioritize green management factors, the technique needs some criteria and their weights of green productivity criteria. The analysis has been done on inputs and also the other factors that we called them as influential factors.

Table 1: The final weights of green management (input)

Green criteria cnput	Material	Energy	Green knowledge	Standards
Weight	0.15	0.1	0.1	0.15
Green criteria	Equipment	Machinery	Agenda	Management
Weight	0.125	0.125	0.15	0.15

Table 2: The final weights of green management (influential factor)

Green criteria inflectional factors	Culture	International organization	Government regulation	Sustainability tools
Weight	0.053	0.146	0.172	0.138
Green criteria	External recovery	International rules	Green protocols	Training and research
Weight	0.248	0.133	0.154	0.268

All weights are rounded and the following Table 1 and 2 show the results of the TOPSIS algorithm. The results of using TOPSIS Method for prioritize indexes according to input-process-output approach have been done.

CONCLUSION

This conceptual model describes the dimensions and factors involved in green management. The focus of this model is on clean technologies and green management that could be used in different industries. Some basic dimension in clean technology in chemistry are as follows:

- The design of processes to maximize the amount of raw material that ends up in the product
- The use of safe, environment-benign substances, ncluding solvents, whenever possible
- The design of energy efficient processes
- The best form of waste disposal: not to create it in the first place

SUGGESTIONS

Some basic dimension green management based on human resources are as follows (Haden *et al*., 2009; Miller and Buys, 2008; Nouri *et al*., 2005):

- Use green businesses and buildings to enhance productivity and health of staff and reduce absenteeism
- Use a green workplace, corporate culture and reward systems to motivate or encourage green activities
- Employ experts in environmental development to implement environmentally friendly management systems and policies
- Increase employee productivity by creating a healthier working environment

- Design business strategies to address environmental issues that satisfy stakeholder expectations on social issues, environmental performance and daily environmental risks
- Make employees aware of pollution reduction using education and training

This proposed model can help the policymakers to identify the factors involved in green conceptual model based on petrochemical industry. In this respect and according to results of methods, managers must review their conceptions about the priorities. The differences on weights are not significant but we can consider them.

ACKNOWLEDGEMENTS

This research was partially supported by National Petrochemical Company. We thank our colleagues from Department of Health, Safety and Environment (HSE) who provided insight and expertise that greatly assisted the research although, they may not agree with all of the interpretations/conclusions of this study. We would also like to show our gratitude to Mr. Ghodrat Allah Nasiri, the Head of HSE Department and also Mr. Alireza Nariman Nejad in safety section for assistance with green criteria factors and TOPSIS and AHP methodology and Mr. Shahram Ahmadi for comments that greatly improved the manuscript.

REFERENCES

Ahluwalia, V.K., 2012. Green Chemistry: Environmentally Benign Reactions. CRC Press, USA, Pages: 210.

Chen, D., S.K. Sharma and A. Mudhoo, 2011. Handbook on Applications of Ultrasound: Sonochemistry for Sustainability. CRS Press, USA, Pages: 739.

Faruk, A.C., R.C. Lamming, P.D. Cousins and F.E. Bowen, 2001. Analyzing, mapping and managing environmental impacts along supply chains. J. Ind. Ecol., 5: 13-36.

Ferretti, I., S. Zanoni, L. Zavanella and A. Diana, 2007. Greening the aluminium supply chain. Int. J. Produ. Econ., 108: 236-245.

Geyer, R. and T. Jackson, 2004. Supply loops and their constraints: the industrial ecology of recycling and reuse. California Manage. Rev., 46: 55-73.

Haden, P.S.S., J.D. Oyler and J.H. Humphreys, 2009. Historical, practical and theoretical perspectives on green management: An exploratory analysis. Manage. Decis., 47: 1041-1055.

Hsu, C.W. and A.H. Hu, 2008. Green supply chain management in the electronic industry. Int. J. Environ. Sci. Technol., 5: 205-216.

Jahanshahloo, G.R., F.H. Lotfi and A.R. Davoodi, 2009. Extension of TOPSIS for decision-making problems with interval data: Interval efficiency. Math. Compu. Model., 49: 1137-1142.

Leadbeater, N.E., 2010. Microwave Heating as a Tool for Sustainable Chemistry. CRC Press, USA, Pages: 290.

Melnyk, S.A., Sroufe, R.P. and R. Calantone, 2003. Assessing the impact of environmental management systems on corporate and environmental performance. J. Oper. Manage., 21: 329-351.

Miller, E. and L. Buys, 2008. Retrofitting commercial office buildings for sustainability: Tenants' perspectives. J. Property Investment Finance, 26: 552-561.

Mudgal, R.K., R. Shankar, P. Talib and T. Raj, 2010. Modelling the barriers of green supply chain practices: An Indian perspective. Int. J. Logist. Sys. Manage., 7: 81-107.

Nouri, J., M., Abbaspour, E. Roayaei and H. Nikoomaram 2005. Comparison of environmental performance HSEQ management system, regarding the international and Iranian oil and gas general contractors. Am. J. Appl. Sci., 2: 447-451.

Rajabzadeh, A., A.A.A. Rostamy and A. Hosseini, 2008. Designing a generic model for outsourcing process in public sector: Evidence of Iran. Manage. Decision, 46: 521-538.

Rao, P. and D. Holt, 2005. Do green supply chains lead to competitiveness and economic performance?. Int. J. Operations and Produ. Manage., 25: 898-916.

Sheldon, R.A., 2005. Green solvents for sustainable organic synthesis: State of the art. Green Chem., 7: 267-278.

Srivastava, S.K., 2007. Green supply chain management: A state of the art literature review. Int. J. Manage. Rev., 9: 53-80.

Trowbridge, P., 2001. A case study of green supply-chain management at advanced micro devices. Greener Manage. Int., 35: 121-135.

Walton, S.V., R.B. Handfield and S. A. Melnyk, 1998. The green supply chain: Integrating suppliers into environmental management processes. Int. J. Purchasing and Materials Manage., 34: 2-11.

Zhu, Q., J. Sarkis and K.H. Lai, 2007. Green supply chain management: Pressures, practices and performance within the Chinese automobile industry. J. Cleaner Produ., 15: 1041-1052.