



Maciej Urbaniak

University of Lodz, Faculty of Management, Department of Logistics, murb@uni.lodz.pl

The Role of Environmental Management Concept in the Supply Chain

Abstract: The purpose of this article is to define the role of environmental management in the implementation of the concept of a Green Sustainable Supply Chain. Widespread interest in the implementation of this concept determines the environmental activities which are undertaken by companies. For this reason, more and more organizations are interested in the introduction of an environmental management system (based on the requirements of the ISO 14000 family of standards). The involvement of companies in the implementation of the concept of sustainable development is also reflected in the propagation of this idea among business partners in the supply chain. Undertaking activities mitigating the negative impact on the environment is considered by many organizations an important criterion in the initial and periodic assessment of suppliers. Many companies, while working on developing a strong and positive brand image among their customers, use environmental labels when promoting their products. In recent years, more and more companies implement the material flow cost accounting concept which takes into consideration the relationships in the supply chain.

Keywords: relationship with suppliers, environmental management system, supply chain management

JEL: L14, N 50, R 40

1. Introduction

In recent years more and more international companies, which produce finished products – OEMs (Original Equipment Manufacturers), pay attention to their suppliers' implementation of the concept of sustainable development, and especially their environmental management systems (Igarashi, De Boer, Fet, 2013). This is evident particularly in the case of companies that are signatories of the Global Compact initiative, one of whose principles is to promote environmental responsibility (Ağan, Kuzey, Acar, Açıkgöz, 2016). Economic entities' focus on environmental management systems is aimed at taking actions (both organizational and investment) related to improving not only their environmental impact, but also that of their partners in the supply chain (Caniëls, Gehrsitz, Semeijn, 2013). These companies specify to their suppliers the requirements for a reduction of the negative environmental impact of their processes, and products are often based on the guidelines contained in the ISO 14000 series (Arimura, Darnall, Ganguli, Katayama, 2016). The following documents constitute a comprehensive set of standards for the most common business practice used:

- 1) ISO 14001, containing the basic requirements that must be met for the implementation of the environmental management system (as well as any confirmation of it);
- 2) the ISO 14040 series, which are the principles and guidelines for the evaluation model of a product's life cycle;
- 3) the ISO 14020 series, which provide guidance on getting the right environmental labels for the right products and submitting environmental statements;
- 4) ISO 14062, which is a technical report, providing practical guidance on the design of the products and considering environmental aspects (the Eco design approach and relationships with partners in the supply chain);
- 5) ISO 14064, the standard that contains a set of guidelines and tools needed to develop programs aimed at reducing greenhouse gas emissions;
- 6) ISO 14051, which is the guidance for the accounting of costs of material flow in the supply chain.

Japanese companies, which consider the environmental protection requirements placed upon their suppliers crucial, have developed detailed guidelines for suppliers. These companies include Toshiba, Sharp, Mazda (Green Procurement Guidelines), Canon, Kyocera (Green Procurement Standards), Fujitsu (Green Procurement Directions), Sony (Green Purchasing Standards), and NEC (Green Procurement Policies). These standards are imposed on suppliers as clauses included in contracts. The clauses they relate to include:

- 1) the legal requirements of environmental legislation,
- 2) eco-declaration,
- 3) environmental management system questionnaires,

- 4) environmental management system according to the requirements of ISO 14001,
- 5) procedures which describe the practice guidelines for good environmental practices.

2. Requirements for suppliers in terms of the implementation of an environmental management system

It is increasingly apparent that companies who want to cooperate with other international companies, have to adapt to the stringent requirements relating to environmental management (Leppelt, Foerstl, Reuter, Hartmann, 2013). An implementation of an environmental management system is for many enterprises one of the main criteria (like ensuring product quality, timeliness and flexibility of supply as well as the ability to reduce costs) for initial and periodic evaluation of suppliers (Kumar, Jain, Kumar, 2014). Emphasis on the implementation of the requirements relating to environmental management is linked to compliance with legal provisions, especially in the Directives and Regulations of the European Union, such as:

- 1) RoHS (Restriction of Hazardous Substances) Directive EU 2003/95/EC,
- 2) WEEE (Waste Electrical and Electronic Equipment) Directive 2001/96/EC,
- 3) EuP (Eco-design for Energy using Products) Directive 2009/125/EC,
- 4) Battery and Accumulator Directive 2006/66/EC,
- 5) Packaging Directives 94/62/EC, 2004/12/EC, COM Decision 97/129/EC,
- 6) REACH (Registration Evaluation Authorization and Restriction of Chemicals) Regulation 1907/2006/EC.

The implementation of these EU directives is often required of suppliers from outside the European Union and especially of large multinationals producing high-tech products (mainly from the United States and Japan), such as Dell, HP, IBM, Motorola, Fujitsu, NEC, Panasonic, Sony or Toshiba.

An important element of the assessment of the suppliers' implementation of the environmental management system is to identify the environmental aspects and to introduce actions included in the objectives and environmental programs which include specific tasks and measures of the suppliers' assessment (Ferrón-Vilchez, 2016).

Frequently, expectations of suppliers relate to aspects such as:

- 1) consumption of materials, energy factors, and packaging materials (per unit/mass produced product);

- 2) water consumption and sewage disposal;
- 3) toxic substances (including heavy metals such as lead, mercury, chromium and cadmium);
- 4) emission of gases (in particular carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, benzene, biphenyl, noise, electromagnetic waves).

Increasingly, suppliers are also obliged to:

- 1) recycle waste products, worn parts, and consumables;
- 2) use renewable energy sources;
- 3) introduce electronic communications, both external (between customers and suppliers in the supply chain) and internal (circulation of documents and records, as well as training materials);
- 4) increase awareness of employees, especially in terms of their preparedness and response to emergencies (such as emissions, fire or explosion) and accidents at work;
- 5) introduce the concept of integrated pollution prevention and control through the implementation of programs such as Responsible Care, Cleaner Production, and the declaration of Best Available Technology (BAT) and Economically Viable Application of Best Available Technology (EVABAT);
- 6) use environmental reporting.

The effectiveness of the implementation of these requirements by suppliers is assessed by data analysis, contained in self-evaluation cards and reports from initial and periodic evaluation of suppliers as well as verified during the audits.

Providers who have a problem with reducing carbon dioxide are often obliged to implement the guidelines contained in ISO 14064 (Hsu, Kuo, Chen, Hu, 2013). This document contains a set of tools needed to develop programs aimed at reducing the greenhouse gases. The effectiveness of the implementation of these requirements is assessed by periodic analysis of data contained in the reports in the form of achievements cards for suppliers (supplier environmental performance reports cards/supplier environmental performance feedback reports cards), which are a kind of supplier self-assessment. The accuracy and reliability of the data contained in these reports is verified through audits of suppliers (Li, Chow, Choi, Chan, 2016). Analysis of the reports and audits allows for the effective evaluation of the activities carried out by suppliers, related to the implementation of environmental programs and the achievement of the goals focused on reducing the negative impact on the environment. During the audits, the following are assessed: documentation (documents and records) for the products, the implementation process, whether the company has the resources necessary to meet the imposed requirements (such as staff qualifications, state of the infrastructure and the working environment to ensure the safety of processes and products), as well as employee behavior observed during process activities, staff's awareness of the organizational goals and the applicable standards of conduct (in particular

those relating to the identification and monitoring of the environmental aspects, preparedness and emergency response, communication with stakeholders, waste treatment, monitoring measuring equipment and prompting control of operational processes [e.g. design, purchasing, production, maintenance, services]). For a supplier, the audit result indicates the extent to which the requirements and customer expectations in terms of reducing onerous impact on the environment have been fulfilled and what areas need improvement and continuous improvement (Govindan, Rajendran, Sarkis, Murugesan, 2015).

3. Requirements for suppliers in terms of implementing life-cycle assessment and ecodesign

More and more multinational companies require their suppliers to reduce the negative impact of products and processes on the environment through the implementation of the concept of Life-Cycle Assessment (LCA, based on ISO 14040 series of standards) and Eco design approach (Brones, de Carvalho, de Senzi Zancul, 2014). This concept focuses on analyzing and reducing the negative impact of each product on the environment in all phases of their life cycle (design, manufacturing, distribution, installation, use, maintenance, disposal/destruction and dematerialization), or reuse of materials (recycling). These activities aim at:

- 1) improved material efficiency (by minimizing consumption of materials, use of materials with low impact on the environment, use of renewable raw materials and/or use of materials recovered);
- 2) improved energy efficiency (by reducing energy consumption, use of energy sources with low impact on the environment, use of energy from renewable resources);
- 3) designing (products and processes) for cleaner production and safe use of products (through the use of cleaner manufacturing techniques and avoiding the use of hazardous materials);
- 4) designing for durability (considering in this respect the length of the operation and the improvements of maintainability of a product, resulting from the emergence of new technologies);
- 5) designing for reuse of products, recovery and recycling.

The Eco design approach is based on Environmental Effect Analysis (EEA) and takes into account: the identification of legal requirements, design planning, conceptual design, the construction and evaluation of a prototype, production, and packaging).

LCA is a complex process involving the analysis of the profitability of investment projects with simultaneous emphasis on reducing a product's negative impact

on the environment. This concept takes into account measures to determine the quantities of used materials, energy and waste generated at each process (starting with raw material extraction, through manufacturing, distribution, use and reuse/recycling, to final disposal) (Benetto, Jury, Igos, Carton, Hild, Vergne, Di Martino, 2015). A particular stage in the design and development of a new product with the use of the Eco design approach is screening. This analysis takes into account:

- 1) legal requirements (including the restriction of use of hazardous substances and waste management) and the functionality of the product (specifications) and safety for the environment and for users;
- 2) technological capability and business infrastructure;
- 3) suppliers' capability of providing the appropriate (new) solutions, technical quality and solutions relating to the fulfillment of requirements for improving the environmental aspects (Fargnoli, De Minicis, Tronci, 2014).

The effective application of Eco design and the concept of LCA help companies meet the requirements relating to environmental supplier statements (environmental product declarations) and the application for the use of eco-labeling for products.

4. Requirements for suppliers in terms of implementing material flow cost accounting

Many companies are adopting a system for collecting information on measures to reduce the negative impact on the environment by analyzing the incurred expenditures (costs) and the benefits achieved as a result of the activities of the organization. For these reasons, it may be noted that in recent years, many enterprises implemented an environmental accounting system (environmental management bookkeeping), using in this respect, inter alia, international guidelines such as Environmental Management Accounting Procedures and Principles by the United Nations Division for Sustainable Development. Environmental accounting is taken into consideration for business units (branches, departments, processes) and particular products (Rieckhof, Bergmann, Guenther, 2015). Environmental accounting is not limited to individual business units, but increasingly it includes in its scope the relationships between partners in the supply chain. Enterprises implementing environmental cost accounting usually introduce the concept of MFCA – Material Flow Cost Accounting (Guenther, Jasch, Schmidt, Wagner, Ilg, 2015). Environmental accounting began to be used more widely in the 1990s in Germany. In 2007, Japanese managers suggested a definition of global guidelines on the implementation of the concept of Material Flow Cost Accounting (MFCA) in the form of an international standard of management within the group of standards

for environmental management, in particular the ISO 14040 series, concerning the assessment of the life cycle of the product, and ISO 14064, specifying guidelines in terms of the quantifying and reporting of emissions and the removal of greenhouse gases. Guidelines for the implementation of this concept have been included in the ISO 14051 standard (Environmental Management – Material Flow Cost Accounting – General Guidelines), which was published in 2011 (Nakajima, Kimura, Wagner, 2015). This standard establishes guidelines for the identification and quantification of individual components of the product (weight, quantity) and the measurement of costs in the analysis of maps of flow values. The collected information helps to identify types of waste (losses in the form of waste, energy loss, and implementation of measures that are not effective) occurring in the flow of materials (raw materials, parts, components), and opportunities for the reduction of the negative impact on the environment (by reducing the amount of waste, emissions, etc.) in the operational processes related to the implementation of the product (design, purchase, production, packaging, storage, delivery, use and withdrawal from use). It can also help to identify potential savings, optimize the quantitative flow of materials, and exploit the potential of infrastructure (Burritt, Schaltegger, 2014). By identifying waste, one can limit the purchase of necessary materials (by optimizing the norms of consumption), the level of waste resulting from non-compliance of the product, and the level of energy losses, emissions, and waste water. Currently, the concept of MFCA is increasingly being implemented in the supply chain of the automotive industry, the chemical and rubber, metal, textile, food, and timber industries, as well as office equipment and medical devices.

5. Supplier development programs

Many international companies assist local suppliers with meeting their stringent requirements by offering help in the form of consultations and training in the implementation of product innovations and improving operational processes (Dou, Zhu, Sarkis, 2014). These activities focus on deliveries of aid in terms of:

- 1) ensuring the technical quality of products,
- 2) improving the efficiency and effectiveness of processes,
- 3) improving working conditions and improving staff qualifications,
- 4) reducing the level of threats in the supply chain to ensure the continuity of processes carried out by the partners.

Some supplier development programs aim at improving the environmental impact of products. Green supplier development programs are based on setting goals and formulating supplier task programs, which are associated with the use of less environmentally harmful materials, and the implementation of more environmentally friendly technological solutions (Li, Chow, Choi, Chan, 2016). OEMs support

their suppliers by providing expertise knowledge, delivered through training and specialist advice. Enterprises engage providers in joint projects related to designing new product solutions that use the Eco design approach. The effective implementation of these programs allows the partners to improve the quality of products (lower level of non-compliance, introduce product innovations, increase reliability and security), shorten cycle processes and reduce their costs (especially in relation to operational processes such as design, customer service before and after the sale, production/services, transportation and infrastructure maintenance), as well as improve mutual communication (Yan, Dooley, 2014). The successful implementation of these programs allows both suppliers and customers to improve the quality of products (lower the level of non-compliance, introduce product innovations, increase reliability and security), shorten cycle processes and reduce their costs (in particular with regard to operational processes such as design, customer service before and after the sale, production/services, transportation and maintenance of infrastructure) and improve mutual communication (Bai, Sarkis, 2011). Actions aimed at developing suppliers undoubtedly contribute to a reduction in transaction costs related to the exploration of new supply capacity, conducting audits and other forms of assessment, and the verification and qualification of the sources of purchase (Nagati, Rebolledo, 2013). To ensure the effectiveness of supplier development, a training program is necessary to produce an atmosphere of cooperation based on mutual commitment, trust and open information exchange, especially in the area of performance quality (level of compliance with the requirements for the provision and improvement of products and processes) and cost (access to financial data relating to joint ventures). Effectively implemented, the development programs of suppliers undoubtedly contribute to building the intellectual capital of the partners (Krause, Handfield, Tyler, 2007). Some international companies require regular reports on the progress in improving the environmental management system when monitoring suppliers. They also monitor them regularly by means of Environmental Performance Feedback Reports Cards which contain data on reducing energy, materials, emissions, and waste. The above-described behaviour may be presented as a cycle of constant improvement. Companies implementing management systems which conform to organisational standards much more often complete sheets and employ periodical evaluation indicators as well as audit their business partners when shaping their relations with suppliers, compared to companies which do not implement systems of this type. They also require that bidders implement an environmental management system. Recently suppliers' ability to adhere to the concept of the Global Compact. Many OEMs define particular codes of conduct for their partner suppliers. Regarding environmental protection requirements, Japanese companies provide detailed guidelines for their suppliers. While signing contracts with suppliers, many international companies also make them sign statements according to which they are obliged to adopt principles in-

cluded in clauses of so-called Statements on Business Practices, which are connected with binding laws and ethical standards, avoiding corruption practices and fighting against attempts to bribe domestic and foreign institutions' employees, avoiding employee discrimination, protection of international human rights, and responsibility for the environment. It is worth noticing that these requirements are not imposed by one party only (by means of forcing suppliers to meet them). More and more companies want to shape their image as reliable partners (customers) and, therefore, they draw up purchasing codes of ethics or good practice guidelines.

6. Conclusions

The implementation of the concept of sustainability/sustainable development will continue to be one of the main factors to determine the competitive advantages of companies operating within supply chains (Nishitani, 2010). A concern for the environment will play a special role in the implementation of this concept. The relevant regulations and operational programs adopted by the European Union will increasingly stimulate the interest of business entities regarding the implementation and certification of environmental management systems. The implementation of tools of environmental management based on the ISO 14000 standards requires that companies determine increasingly ambitious goals, define more effective policies, allocate resources and use them effectively, and define the assessment criteria of environmental activities. This contributes to more efficient management of resources and improves the environmental impact on the supply chain.

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Rola koncepcji zarządzania środowiskowego w łańcuchu dostaw

Streszczenie: Celem artykułu jest określenie roli zarządzania środowiskowego w realizacji koncepcji Green Sustainable Supply Chain. Powszechne zainteresowanie jej wdrażaniem powoduje, iż przedsiębiorstwa podejmują działania proekologiczne. Z tego też względu coraz więcej organizacji jest zainteresowanych wprowadzaniem systemowego zarządzania środowiskiem (opartego na wymaganiach standardów ISO serii 14000). Zaangażowanie firm w realizację koncepcji trwałego rozwoju przekłada się także na propagowanie tej idei wobec partnerów gospodarczych w łańcuchu dostaw. Podejmowanie działań związanych z ograniczaniem negatywnego oddziaływania na środowisko jest często brane pod uwagę przez wiele organizacji jako istotne kryterium oceny wstępnej i okresowej dostawców. Można dostrzec, iż wiele przedsiębiorstw stara się kształtować swój pozytywny wizerunek w opinii klientów, stosując etykiety środowiskowe w promocji swoich produktów. W ostatnim okresie podmioty gospodarcze coraz częściej podejmują się prowadzenia rachunkowości kosztów przepływu materiałów z uwzględnieniem powiązań w łańcuchu dostaw.

Słowa kluczowe: budowanie relacji z dostawcami, systemowe zarządzanie środowiskowe, zarządzanie łańcuchem dostaw

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