# Electronic Commerce and the Environmental Issues

**Dr. S.R. Pagare**

Faculty of Commerce,

K.J.Somaiya College of Arts, Commerce and Science, Kopargaon, Maharashtra.

(Affiliated to Savitribai Phule Pune University, Pune)

**Abstract:**

Electronic commerce is expected to influence a wide range of supply chain systems and thus lead to unidentified environmental impacts. Current paper discussing the impacts have the problem common in that they arrive either at conflicting or un-generalisable results. This paper is an attempt to address the issue of methodology and proposes an assessment model for the resolution of environmental problem. Some important implications for supply chain management are also presented. This paper tries to show that the subject of" Greening Supply Chains" is in need of a new focus and direction in research which involves building a new set of constructs for decision making.

**Keywords:**

Electronic commerce, environmental assessment, greening supply chain, internet, information technology, just in time.

## Introduction:

There are new terms emerging and spreading by this millennium: Information technology, Globalization, Internet, Electronic commerce (E-commerce), ICT, Teleworking, Dematerialization, Teleconferencing, and more. These terms are in one pool: *the era of Digital Economy*. People, industry, government – the different levels of society – are using and talking about these terms. The concern is that there are beliefs that the new communication methods of information technology and Internet will build up a considerable momentum towards the sustainable development. There are, though, some voices in society that disbelief in this and rather stand againstit.

As one of those hot issues of information technology, E-commerce (or called sometimes E-business) has increasing trends as an extra trading channel of transactions among the industries (B2B), and between the consumers and the total business sector (B2C) (Abouzeedan et al., 2003). Such transactions are expected to influence a wide range of man-made systems of the industrial infrastructure including systems of manufacturing/production, transportation, packaging, warehousing, yet to unknown extent and form. For example, one central hope in E-commerce is that supply chains of miscellaneous merchandise will be shortcut. This is by performing faster delivery of products with less number of nodes in the middle, in the meaning that such nodes, i.e. large and small retailers and wholesalers, and even distribution centers, vanish in the long run. This may ultimately lead to direct deliveries from the manufacturing company to the consumers (Caudill et al., 2000; Davis, C., 2000; Li, 2001; and Hurst,2001).

The total literature on E-commerce and environment indicates that there are both negative and positive environmental implications, with a high difficulty to weigh them over each other (Joint Symposium on E-commerce and Environment, 2000). Proponents of E-commerce expect there will be considerable environmental benefits such as decrease of paper consumption,

decrease of fuel consumption, reduction of size of stores/offices/warehouses, decrease of transportation flow, etc. On the other hand, opponents are pessimistic about some significant negative environmental effects such as increase of human orders and amount of shopping, increase of electronic waste equipment, more use of faster-mode transportation (often use of airfreights) to farther destinations, etc (Leahy, 2001). Some opponents were even pointing to hidden un- expectable effects such as consumption of erbium minerals, which are necessary in building the cable structures of the wide band Internet communication.

“Modern E-commerce will influence not only the delivery of goods, but also stores, warehouse space and perhaps also the way people use their time and how they travel. How this influence will develop must be understood to ensure that proper initiatives are taken both by companies and official agencies to develop distribution and transportation

systems and a strategy for sustainable development in areas affected by the increasing use of the Internet. It will therefore be of utmost importance to identify and study which areas will undergo a change due to E-commerce and the use of Internet, and in what way the changes will create new systems for transportation or changes in the old ones. E-commerce must be considered in a global perspective, as suppliers and consumers may function differently on different continents. This means that it is important to ensure that the understanding of differences and experiences from several countries be utilized as much as possible." (Jonson et al.,2000).

What do all that mean from an environmental point of view? Many questions need answers. Are the trends of transportation going to change dramatically? What about the type of transportation? Will the railway system get enhanced and become competitive to the heavy truck system? Or is it the airfreight system going to increase and play a significant role in delivering orders? Is the industry going to increase or decrease the amount and variety of products? Dematerialisation: would E-commerce contribute "positively" in this side? What about energy consumption? Miscellaneous questions have been raised.

No doubt that several disciplines are intervening in this regard. The trading system in the society, the economic system, the systems in supply chains, the human behaviour, and the technological development in general are all pulling the ropes. This makes the future scenarios very difficult to be predicted if notimpossible.

The important terminologies in electronic commerce and environmental issues and implications especially greening supply chain are as follows:

**Supply chain**: "A set of three or more companies directly linked by one or more of the upstream and downstream flows of products, services, finances and information from a source to a customer" (Mentzer et al., 2001).

**Supply chain management**: is a concept "whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers" (Monczka, Trent, and

Handfield, 1998). (There are several definitions among the authorities in this discipline; however, I preferred to select the least complicated that a foreign audience to this discipline can grasp easier)

***Logistics***: According to the Council of Logistics Management (CLM, 2002), "logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customer's requirements". A logistical system, therefore, includes mainly four main processes: transportation, warehousing, inventory management, and order processing (Pfohl, 1990; and Lambert, 1998).

***Packaging***: One concise definition is the following: "Packaging is a coordinated system of preparing goods for safe, efficient and effective handling, transport, distribution, storage, retailing, consumption and recovery, reuse or disposal combined with maximizing consumer value, sales and hence profit" (Saghir, 2001).

***Business-to-business (B2B)*:** This represents the business-only transactions, simply within the span from supplier to manufacturers to wholesalers to retailers/intermediaries. This is considered a part of the total supply chain.

***Business-to-consumer (B2C)*:** This represents the transactions between the businesses and the consumers who use and consume the products to the end of life of these products. In fact this term is sometimes used to indicate the transaction between the retailers and consumers only, or sometimes to cover the whole transactions between any business type, for example wholesaler or manufacturers with theconsumers.

***Environment*:** There are several definitions for the term "environment". One international definition is the one presented within the frame of the ISO 14004 International Standards: "*Surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelations. NOTE–Surroundings in this context extend from within an organisation to the global system*" (Cascio et al, 1996). In

the Longman Environmental Dictionary for the environmental glossary, there is another definition as: "*The sum total of external influences acting on an organism*" (Lawrence, 1998). In the same dictionary, the definition of the term "environmental impact" might clarify that more: "The changes in the total environment, both in terms of the ecology and the social impact, caused by human activities" (Lawrence, 1998), whereas the term "environmental science" is: "the study of how humans and other species interact with their non-living and living environments". In general, the word "environment" here refers to the body of knowledge of environmental science, which consists mainly of three disciplines: environmental engineering, environmental management, and the science of ecology. A main concern in this arena is the study of the interactions of human beings with the living and non-living natural resources. These sciences attempt to understand how to utilize the man-made systems of the civil infrastructure including systems for production, logistics, transportation, packaging, and other systems, in environmentally responsible manner.

***Industrial ecology***: The primary objective of this concept "is to interpret and adapt understanding of natural ecological systems and to apply the most beneficial of these concepts to the acquisition of human made systems such that they become efficient, effective and sustainable" (Sage, 1997).

***Design for Environment***: "The activities undertaken when a product's design is to reflect environmental considerations in the entire life cycle of the product in order to increase product competitiveness, add to the market value, decrease the cost of ownership, or meet existent and future environmental regulatory demands" (Karlsson,2001).

***Life Cycle Assessment***: It is the most commonly environmental assessment method in the field of environmental management normally conducted on a specific product vis-à-vis another competitive product in the market. This tool assesses the environmental implications of the product across its whole life cycle from cradle to grave.

Discussing the topic of environmental consequences of electronic commerce (E-commerce) will concern several research areas, including the area of the subject of "Greening supply chains". In this topic, three perspectives are involved: E-

commerce, Logistics/Supply chain management (SCM), and Environmental science. For the environmental science side, E-commerce is just a business concept and cannot be evaluated as is. But, it is possible to evaluate it by assessing the influence it has on the processes of supply chains. In brief, an environmental assessor will be interested in looking at the changes arising in supply chains when using E-commerce.

E-commerce is expected to influence a wide range of man-made systems of the industrial infrastructure, including systems of manufacturing/production, transportation, packaging, warehousing, etc. Moreover, E-commerce is at the very departure to be an effective trading channel. That is why this chance should be invested in environmental investigations before the environmental abatement measures become difficult to implement in the future. The impact is as yet of unknown extent and will arise in uncertainways.

In addition, the topic of environmental assessment (in general) is of importance to the development of the logistics/SCM discipline. In general, the subject of "Logistics/SCM and Environment" should have two lines of discussion: the assessment, and the measure implementation. The assessment discussion develops through the availability of two themes: "*assessing the impact of logistics on the environment*" and "*assessing the impact of the environment on logistics*". These results have led to the question as to whether it can even be considered an established subject. These two themes of assessment are complementary and feed into each other continuously; missing one of them weakens the development of this knowledge. This is one reason why research in greening supply chains is somewhat stagnating.

The literature to date on the environmental implications of E-commerce indicates a limited knowledge. The total literature is primarily in the form of pilot studies, anecdotal arguments, and a limited number of life cycle assessments, with the problem common in that the results are either conflicting or un-generalizable.

**Objective:**

The basic objective of this paper is to shed light on this problem in relation to the assessment methods used, and within this frame, we propose a novel assessment model that builds on and expands the current, commonly used method. As a consequence, an important objective has been to show that the topic of "E-commerce

and the Environment" contributes immediately to the knowledge of "Logistics/SCM and the Environment", as one implication of the proposed model. Ultimately, the aim has been to focus attention on the fact that, in order to further develop this model, requires that a new set of constructs for decision-making in "Logistics/SCM and Environment" be developed.

**Methodology:**

This paper is based on an extensive survey across several disciplines, such as logistics/SCM, environmental science, manufacturing, production, and operations management. This survey sought several topics in interdisciplinary environmental knowledge. The aim has been supporting a work on concept development for the sake of proposing an assessment model to resolve the problem of conflicting results/un-generalizability. The second purpose of this survey task was to serve as the source of evidence (input) to carry out of this assessment,

Regarding the application/empirical side of the model, the results of the survey, which is supposed to be the source of evidence into the model, have led to some limitations; the evidence needed is very limited. (This limitation, as a by-product of the work, has led to discover a significant gap in some types of environmental knowledge for SCM; further discussion is presented later.) However, based on the available evidence, we present two tentative examples of how a change from one strategy of supply chains to another can be looked at from an environmental point of view. The two examplesare:

a. Adopting the Just-In-Time strategy,and
b. Changing from one type of postponement strategy toanother.

The Delphi method, for instance, could have been utilised as an alternative to the survey; however, some limitations in our project did not permit such an experiment. More discussion on the model, type of evidence, and the two examples will be provided.

**Evaluating E-commerce:**

This section presents a supporting background before proposing the novel model and then the two examples. The section concludes with a discussion on the empirical side

of the model and directions for future considerations.

E-commerce is defined as "any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact".

Generally, when studying E-commerce, several demarcations have to be specified such as: the merchandise type, geographical borders, supply chains spectrum either B2C or B2B or both, the market share as a competing trading channel, etc. Several factors, such as cost, human factors, access to Internet, etc., will differently determine this market share according to the type of merchandise/product. One more demarcation is the impact form, which comes basically in three forms: primary (infrastructure effect), secondary (application effect) and tertiary (rebound effects). This classification does not indicate any type of ranking or preference; it is only a sort of categorization. At the end, as can be realised that the total demarcations will form several combinations of studying levels – "magnificationlevels".

**Environmental Assessment Methods:**

Among several methods, the most commonly used for assessing the impacts on the environment is, generally, the Life Cycle Assessment (LCA). It is an internationally standardised method and is mentioned within the frame of ISO14000 International Environmental Standards. Similarly, there is a clear dominancy in the literature on "Logistics/SCM and the Environment" to utilize LCA. Behind this might be several reasons. An important one is that LCA has a similar principle of SCM in having a holistic view over the chain of processes/stages that the products pass through: from raw material extraction to manufacturing, distribution, and use until disposal.

**E-commerce & the Environment:**

Consequently, there is a clear tendency to use LCA as the favoured method by which to discuss the environmental effects of E-commerce. In spite of the fact that LCA is normally conducted for a specific product across a supply chain; however, it was used here to evaluate a technology, namely, E-commerce.

**Demarcations:**

One demarcation for our research work is that its concern is only for E-commerce

and not for IT (information technology) or Internet. Readers often meet several different terms for instance IT, ICT (Information and communication technology), Internet, EDI (Electronic data interchange), and E-commerce. E-commerce is one activity among several services (emailing, chatting, presenting oneself, researching, etc.) provided by the Internet, which is one type of IT. We are concerned with evaluating E-commerce only, not evaluating Internet with all its activities.

A second demarcation is the focus on the secondary effects, i.e. those effects of the use/application of E-commerce infrastructure . Whereas the primary effects are concerned, to a limited extent, with the waste of electronic equipment at the end of their life, the secondary effects are of a higher complexity and interacting events. The tertiary rebound effects are important, but they are more likely to represent humanbehaviour.

## A Proposed Model of Assessment:

The purpose of the forthcoming discussion is to build the reasoning for the problem behind using LCA. This results in a novel model of assessment that expands the capacity of LCA, not in its regular form, but in a cross-disciplinary supply chain management language framework. The model will be based on two pillars as presentednext.

### The First Pillar:

The first pillar is the holistic assumption that is found in the Systems Approach school . If an impact, in some form and amount, occurs at a point somewhere in a system, this impact might be compensated for at another point somewhere else in a similar or different form or amount (for the convenience of the paper, we would call this assumption “impact compensation”). Several arguments in the literature reflect this view, as follows:

For example, “a switch to the use of a material that is more readily recycled may seem like an environmental improvement on the face of it. However, such a change may introduce different production processes upstream in the supply chain, perhaps, for example, releasing larger amounts of ozone-depleting gases than was previously the case. Such contingent effects need to be taken into account” . Another example is

when switching to a strategy like Just-In-Time (JIT). This may seem like an environmental improvement, as it contributes to reducing the size of warehousing, but "JIT usually requires the supply of materials in smaller lot sizes with more frequent deliveries. This may cause greater transportation and packaging-related environmental problems" . Some further arguments can be found also in the production/manufacturing field. Some critics point out "that reducing one factor of production may increase another. Efforts to increase the efficiency of throughputs may lead to a greater production of waste. Reducing inventory, for example, may lead to a greater production of waste. The small batch size production inherent in lean production entails more frequent changeovers, and these changeovers might require cleaning of production equipment and disposal of unused process material" . Also in the logistics field, it looks that "the nature of logistics management is cross functional and integrative and since so many logistical activities impact on environment," and therefore "to minimise total environmental impact, it must be evaluated from the total system perspective".

**The Second Pillar:**

The second pillar is based on the idea that E-commerce should not be regarded as a pool of products, but as one of three components in man-made systems: the process that produced the output, the technology used to execute the process, and the decisions/strategies that control the forms, conditions and location of the process. As these systems are un-natural and need to be assessed and monitored, consequently the assessment should be performed around three central axes:

1. The Process/Productaxis,
2. The Decisions/Strategies axis,and
3. The Technologyaxis.

Matching these axes as a basic conceptual structure to a supply chain, and drawing horizontal lines to represent four main physical processes . Production/Manufacturing, Packaging, Transportation, and Warehousing (a non-physical process can be, for example, inventory management or order processing), we accordingly parallelise the previous three axes of assessment as follows:

1. Process/Product [verticalassessment],

2. Decisions/Strategies [horizontal assessment],and
3. Technology [full-scale assessment = vertical + horizontalassessments].

There are many strategies, such as Just-In-Time, postponement (of different forms), decentralisation, centralisation, differentiation, standardisation, customisation, etc. So, the conduct of the horizontal assessment is to judge/evaluate the change in strategies by E-commerce from an environmental perspective.

*Example 1 – Adopting Just-In-Time Strategy*

This example is about evaluating the adoption of Just-In-Time strategy. Several driving forces, including E-commerce, can be behind accelerating this change.

In total, from an environmental point of view, JIT appears more optimistic than pessimistic. Although there are critics which contend that reducing levels of inventory may adversely lead to a greater production of waste and more frequent changeovers, the first stream emphasises that when adopting quality standards there is good evidence that reducing levels of inventory leads to lower emissions of chemicals. On the other hand, despite the available empirical and anecdotal evidence on the environmental disadvantages, some scholars believe that the use of combined transport options is a window of opportunity to alleviate the negative impacts. In addition, there is good evidence of some benefits from JIT: supporting pollution prevention/source reduction plans, and reducing set-up times in manufacturing.

**Conclusion:**

One possible plan for conducting this evaluation is presented in Figure 6 (appendix). The idea is to simulate a SWOT analysis, but will be referred to as: “environmental SWOT analysis;” nevertheless, there might be other possible plans/procedures. Worth mentioning here is that asimilar tool has been used for the topics of “corporate business and environment”, recommended for improving corporate environmental policy . But, the difference is in substituting the usual words “Strengths” and “Weaknesses” by “Advantages” and“Disadvantages”, in order to avoid misleading judgments.

A scale or a ranking system can be developed according to the conditions of a country/region. Unfortunately, this work is beyond the scope of this paper and has been left forfuture research.Another critique is that it is not easy to generalize and state that a specific type ofpostponement will dominate the market. In addition, it is difficult to predict the type of shift E-commerce will lead to specifically.

Adopting these ideas and developing the proposed model of this paper in the future agendas of logisticians will be an interesting gateway to the renewal of environmental issues of logistics/SCM. One more benefit why logisticians should take an effective role in this type of assessment ("*assessing the impact of logistics on the environment*") is that today many papers on environmental science regard logistics as merely a "transport activity". A logistician with environmental assessment interests can bring a better understanding to this field than an environmental scientist with insufficient background in the logistics/SCMdiscipline.

**References:**


**1** Abukhader, Sajed and Jönson, Gunilla (2003) 'Logistics and the environment: Is it an established subject?' (Forthcoming in *International Journal of Logistics: Research andApplications*).

**2** Abukhader, Sajed and Jönson, Gunilla (2003) 'The environmental implications of electronic commerce – A critical literature review', *Management of Environmental Quality – An International Journal – a special issue, Vol. 14, No.4*.

**3** European Commission (1998) *An Introduction to Electronic Commerce*, accessible at:

**4** CLM (Council of Logistics Management) (2002)

**5** Li, Yujing (2000) 'Greening of local E-commerce, how to realise the environmental potential of online grocery trade – A case study in the City of Lund', *MSc thesis, LUMES program*, Lund University,Sweden.