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MANAGING THE GREEN SUPPLY CHAIN: CONCEPT IMPORTANCE AND INDIAN IT SECTOR CASE STUDY

Upravljanje „zelenim“ lancem snabdevanja - značaj
koncepta i studija slučaja IT sektora u Indiji

Abstract

Supply chain management is still considered to be a relatively new business philosophy which has been the subject of the preoccupation of both scientific and expert public during the last 30 years. Regardless of its novelty, this business philosophy is very dynamically evolving, constantly improving its existent concepts and creating new ones which form part of it. In this manner it only confirms its importance for doing modern business. The introduction of the green supply chain and its adequate management should precisely be regarded in the context of the mentioned dynamic changes. The consideration of the importance of the green supply chain is the subject of detailed analysis in this paper. The very paper is divided into three parts. Within the first part we define the concept of green supply chain and its chosen important aspects, in particular its potential advantages for companies as well as its basic strategic options. The second part of the paper is dedicated to the analysis of the most important strategic activities within the green supply chain management process: green manufacturing and re-manufacturing, reverse logistics and waste management. Finally, within the third part of the paper we consider the challenges of adequate green supply chain management and the use of this concept in business practice of companies in IT sector in India.

Key words: *green supply chain, risk strategy, efficiency strategy, innovation strategy, "closed loop" strategy, green recycling and re-manufacturing, reverse logistics, waste management, IT sector, India*

Sažetak

Upravljanje lancem snabdevanja i dalje se smatra relativno novom poslovnom filozofijom koja je predmet preokupacije naučne i stručne javnosti u poslednjih 30 godina. Bez obzira na to, ova poslovna filozofija veoma dinamično evoluirala, konstantno unapređujući postojeće i kreirajući nove koncepte koji čine njen sastavni deo. To je dokaz više njenog značaja u kontekstu modernog poslovanja. Nastanak koncepta „zelenog“ lanca snabdevanja i njegovo adekvatno upravljanje upravo treba tumačiti u duhu pomenutih dinamičnih promena. Razmatranje važnosti koncepta „zelenog“ lanca snabdevanja predmet je detaljnije analize u ovom radu. Sam rad podeljen je u tri celine. Unutar prve celine, razmatra se pojam koncepta „zelenog“ lanca snabdevanja i odabrani važni aspekti koncepta, sa posebnim fokusom na koristi koje preduzeća mogu imati od njegove primene kao i na strateške varijante koncepta. Druga celina rada posvećena je analizi najvažnijih strateških aktivnosti pri upravljanju „zelenim“ lancem snabdevanja: „zelene“ reciklaže i ponovne proizvodnje, povratne logistike i upravljanja otpadom. Konačno, u okviru treće celine razmatraju se izazovi adekvatnog upravljanja „zelenim“ lancem snabdevanja i primena ovog koncepta u poslovnoj praksi preduzeća IT sektora u Indiji.

Ključne reči: *„zeleni“ lanac snabdevanja, strategija rizika, strategija efikasnosti, strategija inovacija, strategija „zatvorene petlje“, „zelena“ reciklaža i ponovna proizvodnja, povratna logistika, upravljanje otpadom, IT sektor, Indija*

Introduction

The idea of supply chain management first became the focus of interest of a group of consultants during the eighties of the 20th century. Shortly after, it seriously expands and grows into an individual business philosophy. The key elements on which this philosophy is based mostly refer to the concept of *Value Chain*, developed by the American professor *Michael Porter* [22, p. 63]. Professor *Porter* has pointed out that all activities within a company can be divided into primary and support activities, depending on whether they create value or just acquire basis for its creation. The link between mentioned activity groups adding value to products and services of a company is precisely known as the Value Chain [23, p. 5]. Based on such an idea, supply chain management can be defined as “connection between different stages of a business process creating the link between flows of raw materials, production, transport, resource distribution, information and financial flows adding value to finally delivered products and services” [4, p. 32].

The philosophy of supply chain management is dynamically changing and developing fields of influence dictated by the market trends. Taking into account serious ecological problems threatening to permanently change the way people live and work, there have arisen numerous so-called green initiatives which are being incorporated in the majority of modern business philosophies, including supply chain management. As a response to these initiatives the idea of green supply chain developed and is the main subject of analysis in this paper. Further on, special attention is dedicated to explaining the basic concept idea and its important aspects, followed by managing its key activity groups. Finally, we consider the adequate green supply chain management practices of companies in IT sector in India.

The green supply chain: Concept and important aspects

Integrating the basic principles of environmental management into managing the entire supply chain is important for achieving a “greener” supply chain and preserving the

competitive advantage of companies forming it. Also, it is important for boosting business profit and achieving determined market goals [24, p. 901]. The concept of green supply chain is difficult to define in a uniform manner since there are various interpretations of it. For example, *Zhu and Sarkis* claim that green supply chain ranges from “activities starting with green procurement up to integrated supply chains involving suppliers, producers and clients finishing with reverse logistics “closing the loop” [35, p. 475]”. According to an interpretation of another author, the green supply chain can be defined as “an integration of ecological thinking within supply chain management including product design, supplier selection and resource procurement, the production process, delivery of final products as well as managing those products after their life span ends” [27, p. 56].

Based on the revolution connected to the philosophy of quality management from the eighties of the 20th century, followed by the revolution caused by supply chain management philosophy during the nineties of the 20th century, the span of interest and interpretation of the green supply chain expanded onto corporate environmental management and ecologically-led production strategy [35, p. 477]. Regardless of the complexity and non-unified interpretation, the concept of green supply chain is becoming more and more the subject of interest both in academic and practical circles dealing with operation and supply chain management. It is interesting to notice that while conducting a literature review of the global presence of this concept in certain countries and industries, we can state that the interest for the implementation and limits of this concept is still dominantly connected to the most developed countries (Japan, USA, Germany, United Kingdom) [13, pp. 933-936] while there are only hints of concept use and serious related studies in developing countries such as Serbia.

Based on the analysis up to now, we can conclude that the concept of green supply chain is rapidly evolving and becoming more complex. Therefore it is evident that we cannot analyze all the ideas of the concept within this paper. That is why, continuing, we only deal with those aspects crucial for the concept interpretation and our further analysis.

From traditional to green supply chain

Green initiatives and raising the ecological awareness among companies represent a new challenge for their future organization and the way of functioning. In order for the new trends to best fit company business it is necessary to introduce certain modifications in the coordination of their activities. The introduction of such modifications is certainly not an easy task. Therefore, it is a real challenge to create a milieu in which the industrial development and environmental protection can coexist in symbiosis [33, pp. 2-4]. The necessary modifications are explained by differences occurred during the transition from traditional to green supply chain.

The traditional supply chain can be defined as “the process of production integration within which raw materials and resources are used for the production of final products and then delivered to customers via the wholesale/retail distribution channels” [17, p. 47]. The design, shaping and analysis of the traditional supply chain focus exclusively on the optimization of procurement and distribution processes regardless of the environmental repercussions [7, pp. 50-51]. Key issues addressed while managing the traditional supply chain are given in Table 1. The traditional supply chain is shown in Figure 1.

Table 1: Key issues while managing the traditional supply chain

Managing the traditional supply chain: Key issues
The determination of the most efficient production/distribution agenda
The optimization of the needed supply quantities of raw materials/materials/semi-products/final products
The optimization of the number of supply chain participants
The determination of optimal locations of distribution centers
The determination of the most adequate assignments for production
Managing supplier/buyer relations
Product differentiation and specialization

Source: [7, p. 54]

The first step needed for the adoption of the so-called “green” initiative is to redefine the basic structure of the entire supply chain from the aspect of ecological awareness. The mentioned redesign refers to introducing the practice of scarce resources limited usage and minimizing the quantities of waste. In order to reach the contemporary interpretation of the green supply chain concept it was necessary for the ecological management, as an important part of the concept, to go through five phases (see Table 2).

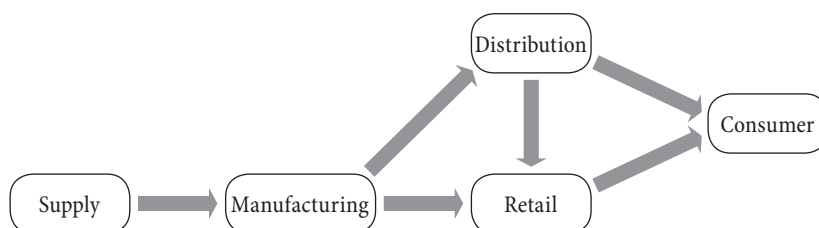
Table 2: Development phases of the ecological management

Phase	Phase characteristics
1. Problem solving	The traditional approach which sees the ecological legal regulations as additional business costs
2. Coordinated management	First attempts of coordinated and integrated management of ecological legal regulations
3. Promise management	A visionary and long term planning which uses risk management to balance future ecological obligations and costs
4. Eco-efficiency management	Pollution prevention instead of pollution control; The reduction of the quantity of generated waste and resource reduction
5. Total integration	Developed ecological component; Global concern for the production process and product life cycle

Source: [7, p. 58]

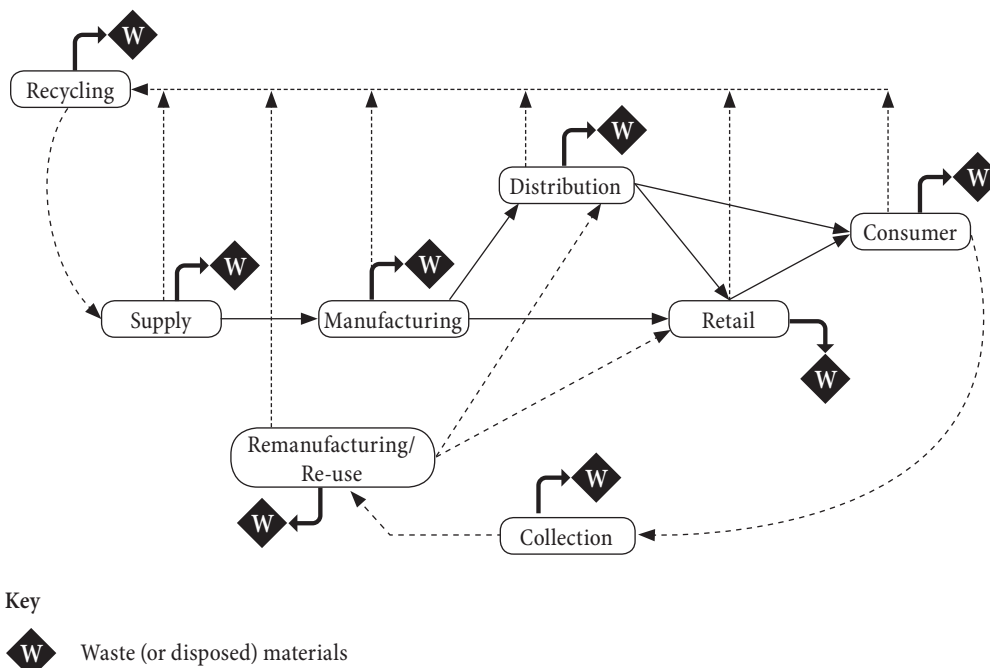
From the analysis up to now we can conclude that green supply chain practically represents an improvement of the so-called traditional chain. Namely, it encompasses all traditional supply chain elements, with the addition of two-side product movement from producer to customer thus forming the so-called “closed loop” which also includes some new activities such as green recycling and re-manufacturing, reverse logistics and waste management. These activities are the subject of analysis in the next part of the paper. Continuing, we show a graphic representation of the green supply chain (see Figure 2).

Figure 1: Traditional supply chain



Source: [1, p. 3]

Figure 2: The green supply chain



Source: [1, p. 7]

As it is shown in Figure 2, full lines represent the traditional supply chain, whilst the dotted lines stand for the green supply chain. *W* stands for *waste* which is a product of the entire process and all entities and must be taken care of by the supply chain participants. Also, the figure shows new groups of activities. Having explained the transformation from traditional to green supply chain continuing we consider the key advantages of the introduction of this concept.

The advantages of green supply chain introduction
 Under the influence of the mentioned green initiatives, more and more people and companies have become aware of the growing ecological problems such as global warming, the usage of damaging substances which are toxic for health and environment as well as problems caused by irrational spending of limited natural resources. The governments of the majority of developed countries have carried out numerous campaigns for promotion and raising of public awareness regarding these issues. Some companies have accepted right away the “green” principles such as using environmentally non-harmful raw materials, then reducing energy consumption, using recycled packing paper etc. These principles have been extended to all business areas as well as the supply chain [9, p. 43].

However, when similar topics are analyzed, it is a common demand of the companies to know what the advantages of a certain business concept are when they decide to introduce it. Therefore, the question is: Which is the exact advantage of using the green supply chain concept for company’s business besides the ecological benefits for the society as a whole? Fulfilling the ecological demands is considered the main criterion of preserving the competitive advantage in modern business, as well as the criterion of business process sustainability and profitability achievement [19, p. 1440]. The most often stated reasons for using the concept of green supply chain that have proven in business practice are given in Table 3.

Table 3: The rationale for using the concept of green supply chain

The main reasons for using the concept of green supply chain
Target marketing
Resource sustainability
Lower costs/greater efficiency
Product differentiation and achieving the competitive advantage on that basis
Lower competition pressure
Adopting regulations and lowering risks
Return on investment
Employee moral
Ethical reasons

Source: [5, p. 24]

It is important to mention that the advantages achieved by using the green supply chain concept do not necessarily need to have only the economic aspect, but can be equally justified for the company in a social and ecological way. *Stevels* points out that the advantages of using green supply chain concept can be threefold: material, non-material and emotional [28, pp. 97-98]. *Material* benefits have to do with lower production costs, costs of suppliers and end-users, lower resource usage as well as a lower degree of burdening the environment and society. *Non-material* benefits allow lesser supplier rejection, production process facilitation and better social acceptance. Finally, *emotional* benefits create a positive image of producers and suppliers, making a better impression with clients and sending a positive image that the entire economy is developing well [28, pp. 99].

The green supply chain strategies

Having considered the basic idea and importance of the concept, we now analyze the strategic options that can be used while managing the green supply chain. Efficient green supply chain management assumes the usage of traditional focus (costs/quality/service level) including ecological performances. Since every supply chain is formed of particular entities, activities, cultures and goals it is difficult to find a mutual strategy basis for all those elements. However, research carried out in this field, shows that practical situations most often differentiate four strategies typical for managing the green supply chain [33, pp. 7-8]:

- The risk strategy
- The efficiency strategy
- The innovation strategy
- The “closed loop” strategy

The risk strategy. This strategic option is most acceptable when there is an inter-organizational resource investment activity going on. Companies adopt this green supply chain strategy explaining that it is in accordance with the demands of stakeholders. The minimizing risk strategy is ideal for companies which put aside minimum funds for ecological issues or have just recently begun thinking of introducing the program of green supply chain. Also, one of the advantages of this strategy is the

minimum management engagement and involvement of only basic clauses in contract agreements having to do with ISO 14001 standards [15, p. 1102]. Summing up, we can conclude that the use of this strategy offers companies clearly established ecological performance and benefits, as well as performance management by maximum capacities with global system recognition [18, p. 333].

The efficiency strategy. This strategic option is more complex and demanding compared to the risk strategy. The ecological performance and benefits are obtained through efficient fulfillment of operative goals and not through regulation obedience. The essence of this strategy is the possibility of achieving double benefits for the supply chain: both economic and ecological. This simultaneously demands a closer cooperation between suppliers and buyers. This strategy offers cost advantages in the sense of their reduction, but also fits easily into the existent organizational goals. However, this strategic option does not allow more technologically intense activities of managing the green supply chain, such as product design, raw material substitution or innovation. Therefore, the product resembles to the ones which are cheaper, due to poor material selection. This strategic option bears a constant risk since it only focuses on achieving the efficiency within the supply chain. Concluding, we say that this strategy is considered technologically weaker, but far more responsible when it comes to surroundings than the risk strategy [8, pp.170-173].

The innovation strategy. This green supply chain strategy sees ecological performance as specific demands which cannot be achieved by simple procurement policy or certificate possession [3, p. 176]. The green supply chain is regarded as a whole line of specialized processes, technologies and performance measures which alter the level of needed knowledge and participant cooperation. This strategic option demands a high level of innovation and integration of ecological performance within the supply chain in order to create ecological products [15, p. 1102]. In order for this strategy to be developed serious financial efforts are needed to contribute to faster innovative solution integration (such as ecological design, ecological product characteristics, repair/recycling) into the company environmental strategy [3, p. 178]. Only in this manner

can a strong, ecologically aware production, distribution and usage system be developed.

The “closed loop” strategy. This strategic option is the newest among green supply chain strategies and represents a very complex form of cooperation between participants. It is often considered to be the same thing as *reverse logistics*, which is only one of the specific activities of green supply chain and a term of less complexity, as shall be elaborated further on. The implementation of the “closed loop” strategy should enable material retention and its renewal through the process of repair or recycling [16, p.1150]. This strategy connects the ecological performance throughout the entire supply chain. Unfortunately, there are very few examples of its practical usage mainly due to bad and incomplete control over the channel of reverse logistics as well as due to bad infrastructure. However, those companies which have succeeded in implementing this strategy have a high level of control over the entire process of organizing the reverse logistics. In order to be implemented successfully, the “closed loop” strategy demands a high level of coordination and integration among partners as well as complex knowledge, which means years and years of effort and hard work [15, p. 1105].

Managing specific activities of the green supply chain

While explaining the new concept of green supply chain we have pointed out that it assumes the reconfiguration and

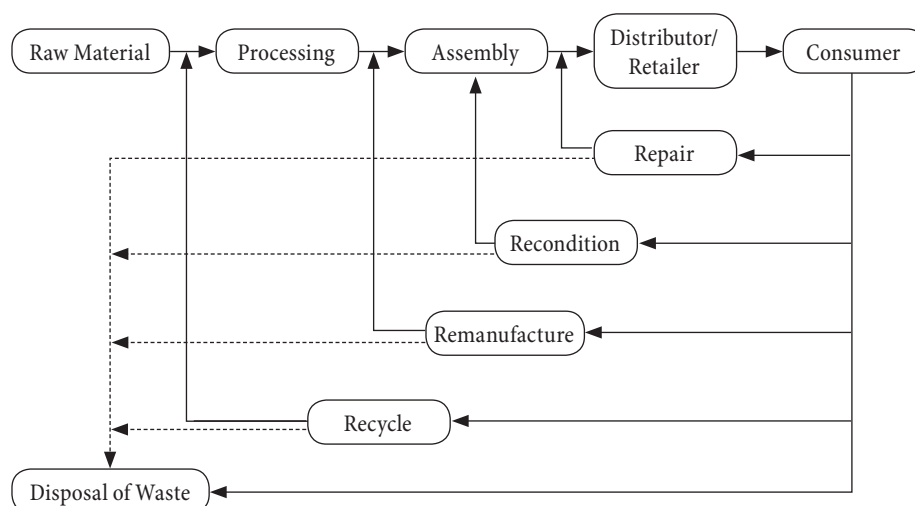
addition of activities compared to the traditional supply chain. Also, we have pointed out that three new activity groups can be differentiated within this new concept. Those activities are: recycling and remanufacturing, reverse logistics, and waste management. Although these activity groups can be given a different term, depending on the author, according to their contents they are most often named in the manner we use in this paper. Continuing, we explain the essence of all three activity groups.

Recycling and remanufacturing

This activity group is very important for adequate green supply chain management. *Recycling*, which is mostly motivated by economic and legislative reasons, can be defined as exploiting the contents of used and/or non-functional products. Out of total recycling costs, more than 90% account for logistics activities [29, p. 22]. The term *remanufacturing* stands for production with integrated recycling. This green supply chain activity has found most use within the automobile industry as well as tire and electronics industries [14, p. 2069]. Although these two activities dominantly determine this group, recently a so-called *4R strategic model* has been developed. Besides *recycling* and *remanufacturing* it also includes *product recovery* and *repair*, thus its name [1, p. 337]. The way *4R* strategic model influences the supply chain activities is shown in Figure 3.

Based on the information from Figure 3 we can conclude that there is no isolated treatment of strategic

Figure 3: 4R model influence on supply chain activities



Source: [1, p. 337]

activity groups of the green supply chain. Namely, we can see that waste management, which shall be elaborated in detail further on, follows every phase of the supply chain influenced by the 4R model.

Reverse logistics

Defining logistics as “a process of planning, implementation and control of flows of raw materials, semi-products and finished products as well as the flows of information from the moment of their creation till the moment of their spending with the aim of pleasing customer needs” [25, p. 22], we have practically obtained the definition of reverse logistics as well, since it involves all the foregoing activities. The only difference is that reverse logistics involves those activities, but in a reverse order, as shown in Figure 4.

As can be confirmed from Figure 4, there is a clear interconnection between all activity groups of the green supply chain. The awareness of importance and skill of managing reverse logistics constantly keeps growing, thus there is great practical interest for its implementation. Since reverse logistics is a critical activity in some industries, it is particularly present within them. A good example can be found in the automobile industry where the market for trading with repaired automobile parts is estimated at USD 36 billion. In USA alone there are about 15,000 companies dealing with car repairs and demounting. That means that around 50% of all original engines are remounted and reused, which saves up a couple of million gallons of crude oil and other oil derivatives [26, pp. 30-32]. Although we have not pointed that out explicitly

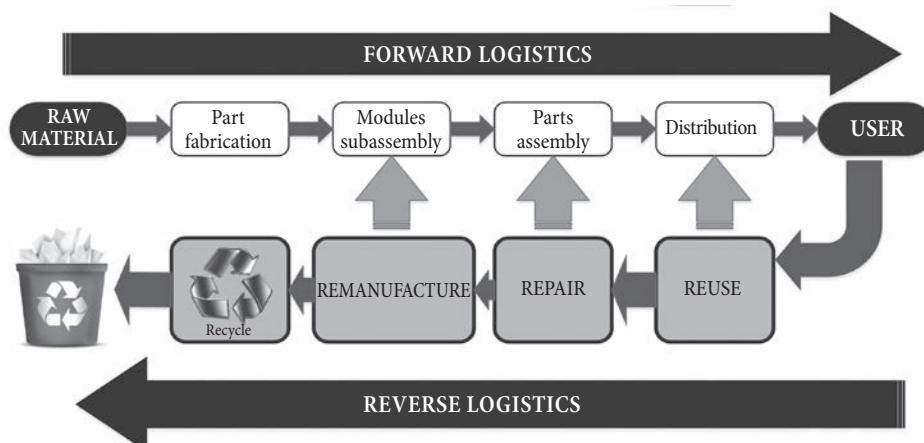
up to now, we can see from the example that the return of product package/its remount is considered one of the most important activities within this group.

The reasons why reverse logistics is considered a strategically important activity can be divided into two groups: a) competition pressure and b) supply chain clearance. Under competition pressure we assume the liberalization of product return policy, in order to retain customer satisfaction. This policy is differently treated in different parts of the world. For example, it is most liberal in the USA. Supply chain clearance means that clients can get rid of their supplies and free up the space for new products, decreasing the spent funds and offering maximum protection [25, pp. 25-26].

Waste management

This activity group within the green supply chain can be defined as “prevention, surveillance, reuse and permanent disposal of solid waste” [6, p. 219]. Talking about solid waste, we say it can be divided into three groups: a) communal waste, b) agricultural waste, and c) special waste (dangerous materials, chemicals and sewage dump). While defining the green supply chain we have seen that waste is created within every activity of every entity, so the question is not of its existence, but of its quantity. However, one of the modern tools created within waste management is the SR/P2 model which is based on pollution prevention in the source (within the products or production process) rather than on its elimination upon creation. Basically, this model tends to eliminate waste or at least to reduce

Figure 4: Regular flow of logistics activities and reverse logistics



Source: [25, p. 23]

it to the lowest possible level [11, p. 41]. It is clear that up to now conditions in company business have not yet been created in order for the waste to be completely eliminated as a category. That is why adequate waste management is of great importance.

The strategic importance of this activity group occurs due to the augmentation of quantities of solid waste in the last thirty years. For example, in the USA only, there is an annual production of 12 billion tons of industrial waste, from which only 208 million represents communal waste. It is a frightening fact that out of that quantity only 27% is recycled and turned into fertilizers, 16% is incinerated and 57% stocked in landfills [34, p. 92]. Based on stated data, we can conclude that the importance of waste management is indisputable and that it must be taken care of with much greater attention in the period to come.

Successful management of the green supply chain and its implications for Serbia: Indian IT industry case study

The previous theoretical review clearly indicates the growing importance of the green supply chain concept and its implementation. It is also clear that this business concept, as others, will not have an equal influence on all global economies, their sectors and companies. However, based on relevant global case studies as well as modest information from Serbian national economy, we can conclude that there are some industries which cannot do without the implementation of the green supply chain concept. Driven by that logic, following we analyze in detail the IT sector in India and their experience with the implementation of the green supply chain concept.

Reasons for choosing Indian IT industry as a case study example

The questions with which we begin the analysis are: “Why India?” and “What are the implications of this case study for Serbia?” There are several reasons for this choice. First of all, the selection of particular industry was made since the IT sector has a lot of potential for “greening” its supply chain activities. Second, the country selection was

made since the IT sector has been developing within it very intensively in the past few years, despite the global economic crisis. Third, the information obtained from the analysis of this case study can be very indicative for Serbia since, according to some sources, it is expected to become a center for greenfield investments in IT sector, financed by some renown global companies [2]. Therefore, the chosen business case should depict the importance of the green supply chain concept on an industry example which can and must use it in order to survive. Further on, this case study analysis can be very indicative for Serbia, since our country could, with certain alterations, be faced with the “Indian scenario”, which means that IT industry could develop rapidly and simultaneously start with the green supply chain concept initiatives in order not to be troubled with “dirty” technologies in the future.

The IT industry is one of the fastest growing global production industries, but due to short product life cycles and technology “ageing”, also an industry with high rate of electronic waste. Thanks to the rapid connection between information and communication technology sectors, in the last decade India has become one of the leading countries in this field. The Indian market of technologically intensive products and services confirms steady growth with the passing of the years. The value of this market in 2012 was estimated at about EUR 14.9 billion, and just a year later, in 2013, the estimation was at about EUR 28.7 billion [21]. The Indian IT sector can be divided into the following subsectors: 1) hardware products subsector, 2) software products subsector and IT services, 3) business process outsourcing subsector (based on information technology). The greatest contribution is given by the first subsector, than third and finally second [21]. Serbia has a quite adequate level of software production and export, but the crucial production and export growth in Serbian IT sector could be achieved by opening up hardware production, which is best demonstrated within the Indian case study. The announced investment in Serbia, i.e. the construction of production capacities of the company Mubadala (for start, later accompanied by their suppliers) is precisely connected with hardware production and exports.

Incentives for and limits of using the green supply chain concept in India

Although India is second on the list of the so-called Clean Development Mechanism countries (CDM), the presence of polluted gases market made it more difficult for the clean technologies to be accepted and for the sustainable business practices to be wider spread. A certain advance has been made starting from 2012, when the period of uncertainty on the market of polluted gases appeared, which signaled the start of stronger restraint of gas emissions in India. In accordance with the growing global competition and therefore the concern for the environment, companies were asked not only to improve the quality of their products and to strive for innovative production with competitive prices, but also to develop such a supply chain that would be sustainable in a longer time period.

Unexpected for many, but still based on facts, the Indian economy has achieved significant success in the last twenty years in the sense of production growth, better resource usage, and thus better conditions for the environment. An average GDP growth rate of 7.5% in the last decade enabled India to highly position itself among global economies. Simultaneously with the advancement of the economy, grew the gas emission – from 1.2 billion

tons of CO₂ in 1994 to 1.7 billion tons in 2007, which positioned India in the fifth place on the list of countries emitting polluted gases with the “greenhouse” effect. The gas emission per capita is 1.7 tons per inhabitant which is much lower than the global average of 4.3 tons per inhabitant [10, pp. 237-239]. The report issued in 2009 by the Indian Government states that in the following 20 years the gas emission per inhabitant shall be in the range from 2.77 to 5.00 tons per inhabitant indicating the “greening” of the supply chain and the determination to keep this problem under control [20, pp. 77-82]. Researching the implementation of the green supply chain management concept in Indian companies, we pay special attention to solid waste management, performance improvement and incentives as well as the obstacles to sustainable supply chain management. An interest is also shown in internal environmental management, green procurement, customer cooperation oriented towards ecological achievements, ecological product design as well as return on investment. While determining the status of India a special focus is also put on waste material reduction, waste recycling within companies etc.

The general state of Indian companies when it comes to managing the environmental issues is on an enviable

Table 4: The comparison of green supply chain performance in India, Japan and China (2010)

“Green” supply chain performance	Min. grade	Max. grade	Average India	Stan. dev.	Average Japan	Average China
1. Gas emission reduction	3	5	4.30	0.78	5.00	3.72
2. Waste water reduction	3	5	4.20	0.72	4.66	3.70
3. Solid waste reduction	2	5	4.10	0.94	4.78	3.57
4. Less use of toxic materials	3	5	4.20	0.75	4.67	3.72
5. Lower frequency of ecological catastrophes	3	5	4.30	0.64	4.89	3.82
6. Improvement of the company ecological position	3	5	4.20	0.75	4.89	4.08
Ecological performance – average			4.22		4.82	3.77
7. Procurement material cost reduction	2	5	3.77	1.12	5.00	3.34
8. Energy consumption cost reduction	2	5	3.69	0.82	4.89	3.28
9. Waste treatment cost reduction	2	5	3.30	1.10	4.78	2.99
10. Waste disposal cost reduction	3	5	3.60	0.66	4.78	2.99
11. Ecological catastrophe penalty reduction	2	5	3.40	0.80	5.00	3.46
Financial performance – average			3.55		4.89	3.21
12. Growth of goods quantity delivered on time	3	5	4.30	0.64	3.38	3.65
13. Lower stock levels	2	5	4.00	1.00	4.62	3.39
14. Lower waste levels	2	5	4.00	1.00	5.00	3.48
15. Product quality promotion	3	5	4.00	0.63	3.00	3.93
16. Product line improvement	3	5	3.90	0.54	4.78	3.81
17. Capacity usage improvement	3	5	3.90	0.83	4.78	3.78
Operative performance – average			4.02		4.11	3.67

Source: [32, pp. 125-134]

level, of course bearing in mind the characteristics of this country. Compared to economies of similar power and degree of development, the Indian companies have adopted the ecological management to a much larger degree, especially compared to China, which is similar in many aspects. As compared with China, India has introduced to a greater extent the elements of the green supply chain management, mostly concerning the return on investment, and least concerning green procurement. According to some research, the implementation of the green supply chain management in Indian companies brought about significant improvement of ecological and operative performance, and somewhat of financial performance as well, according to surveys carried out in three countries. [32, pp. 125-134] The evaluation range was from grade 1 till grade 5. Table 4 shows average grades obtained from the company sample of all three countries, minimum and maximum grade of individual attributes as well as the standard deviation of the grades of companies in India.

Besides the stated measurable indicators, an important incentive for the introduction and acceptance of the green supply chain management is given by the Indian government and the norms it imposes, as well as the corporate social responsibility of companies which affects their image. In that way companies are stimulated to work most actively on produced waste reduction and its recycling.

Indian companies should pay more attention to cooperation with suppliers of the second degree. These companies have shown themselves, but also to other companies in the supply chain, the significant results in ways of waste disposal and recycling. Summing up the total performance of the green supply chain management in India it is clear that financial results are not as yet high as expected. Compared to results of other relevant Asian countries, we can see that only Japan has better results. Indian companies have a lot of potential for improving raw materials and energy consumption, as well as waste treatment and disposal. Taking all into account, based on the latest available data from the end of 2012, India has shown significant improvement and results in the operative management of the green supply chain concept [20, pp. 77-82].

Examples of green supply chain management concept implementation in Indian IT sector

Indian Institute for energy and resources in New Delhi states that the participation of the IT sector in the total production of electronic waste accounts for 30% of its total amount. One of the reasons for this percentage is the shorter usage span of the computers – from 5 years during the nineties of the 20th century to 2 year a decade later. Precisely, in India this usage span is around 3 years [31]. The stated information indicates that enormous quantities of electronic waste are generated every year. The fact that adds seriousness to this problem in India is that more than 4 million used computers annually contribute to quantity of electronic waste. The following two examples show in detail how companies in India deal with ecological problems and issues related to the green supply management.

HCL Infosystems LTD is one of the leading Indian companies in the field of hardware production, integrated systems and IT services. Along with HCL Technologies, dealing with IT and consulting services, it forms HCL enterprise group. This company is the greatest vertically integrated producer of computers in India, owning four companies for computer production, all stationed in India. Computers are delivered to locations across India with the support of wide network of their partners, professional logistic companies. Every production location is coupled with the unit for tracking customer satisfaction, in charge of collection and resolving issues spotted on the field. The company has the widest distribution and retail network in India, encompassing 27 warehouses, more than 700 locations for packing and about 90 thousand retail objects in more than 11 thousand cities in India [12].

Green supply chain in production. From the very beginning, the focus of this Indian company has been sustainable development through ecologically acceptable IT products and services. Bearing in mind many projects the company has participated in, HCL is considered to be one of the companies in India with most usage of green supply chain management. Acting in that manner, the company has initiated the so-called “eco-secure” program which allows all the high ecological standards and procedures in the company’s production and distribution process to

be fulfilled. As a result of the given program, the company has started producing “green” monitors, equipped with special technology, enabling energy costs reduction up to 30%. Besides this product, the company has developed RoHS compatible computers, servers and laptops, which do not contain any damaging substances. Thanks to these actions, HCL is considered to be the leader among the producers of “green” integrated circles technology.

“Greening” the procurement. The company selects its suppliers based on the following criteria – high level of service quality, acceptable costs, a defined level of eco-regulations and demands fulfillment. In order to keep the suppliers constantly on the alert, they are evaluated in equal time periods, by a special form of supplier evaluation. HCL has a unique procedure within its supply chain which assures that suppliers will not be using prohibited materials or will be using them but in allowed quantities. Additional initiative in this field is the formation of the list of substances which are not officially prohibited, but are dangerous for the environment and health, thus their usage is controlled.

Waste management. The company practices a unique policy of recycling electronic waste, supporting its buyers to recycle old products in an ecologically-friendly way. HCL is also engaged in the reduction of illegal copying of ICT products and thus it started a campaign to prevent these activities in India. All HCL initiatives, including green manufacturing, electronic waste disposal and recycling and piracy banning, have helped “green” its supply chain and achieve ecologically acceptable business realization.

TATA Consultancy Services (TCS) is one of the leading companies in India when it comes to IT services, consulting activities and creation of unique business solutions. TCS is the part of the TATA group, the biggest conglomerate in India. It hires 240 thousand exceptionally trained consultants in 145 offices in over 40 countries which service 1,035 active clients. [30] “Greening” the supply chain is an important concept in this company’s business strategy. All its activities are directed at the promotion of ecological initiatives within the supply chain, in order to maximize the influence on the environment.

“Greening” the information technology. TATA has undertaken numerous initiatives in order to reduce energy

consumption of its data centers and computer stations. These initiatives include the so called “cloud” server, managing systems for server temperature regulation, procurement of equipment labeled “energy star”, controlling computers on distant locations etc. The company has initiated a pilot project of virtual computers, with the aim to achieve additional energy savings. As for product consumption, TATA allows its employees to access the newest software or servers on-line, without its physical distribution on CDs [30].

“Greening” the procurement. While acquiring raw materials, TATA is focused on cooperation with suppliers who influence less the environment and use purer technologies in their processes. This is achieved through two paths of action: 1) spending less and 2) using recycled inputs.

Managing electronic waste. TATA diminishes its influence on the environment by using materials which are not harmful for it. This practice is achieved by affecting several fields [30]:

- Lowering the quantity of waste in its origin.
- Focusing on material usage with the possibility of reuse.
- Recycling. Every employee has at his disposal different kinds of containers for waste disposal and is obliged to put away the waste in accordance with its kind, i.e. in the adequate container.
- Buying products which contain recycled parts. This is an obligation for all processes of the company, for example, buying used and recycled paper.

Conclusion

The globalization and technical innovation have brought about new forms of modern business management, thus making the supply chain management the imperative of growth and success. Introducing sustainable and ecologically acceptable components is considered to be the improvement of the basic SCM concept, and is called the green supply chain concept. The implementation of the green supply chain management concept assumes the maximum usage of company resources and reduction of residual waste. This concept also leads to improving company image as well as operative performance and compatibility

between companies, society and environment, by achieving sustainable development. Despite high implementation costs, this concept brings long-lasting economic and social benefits. A few years ago, companies dealing with the IT sector in India got familiar with the green supply chain management concept. The state of Indian economy, in some aspects, was very similar to the present state in Serbia: bad infrastructure, low level of GDP, a great number of low income customers etc.

Serious industry development and especially IT sector which started a few years ago in certain parts of Indian industry brought about the implementation of the green supply chain management concept. That was the right timing for India as a developing country with relatively “flexible” law obedience to enforce the adequate legislative solutions, introduce the relevant stakeholders to these solutions and start to implement them without exception. If it were not for these solutions, today India would be facing much more serious ecological issues. Thanks to the right laws headed by big IT companies as development drivers, India has achieved the fastest global success in solving ecological issues and improving the conditions of the environment.

The entire concept of green supply chain management is still new in Serbia. There are some partial actions on the level of individual companies, but not the entire supply chain. Of course, these actions mostly refer to companies from the IT sector, especially in the domain of commerce, but also within some brands from the automobile industry. Introducing certain laws, the state has tried to stimulate “green” company behavior, but these efforts had little results. The reason lies in the absence of serious state policy and lack of sanctions for breaking the rules concerning the environment-friendly laws. Therefore, apart from the theoretical review of the subject, we have paid special attention to the Indian case study, its IT industry development and company behavior in some segment of the green supply chain management concept. The Indian case study can be very indicative for Serbia, especially if announced investment plans in the IT sector in Serbia come true in the following few years. If our economy and government do not pay serious attention to the concept of the green supply chain, not just individually but as a

whole, Serbia could become a “fertile” soil for pollution, waste accumulation and environment endangerment.

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