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# Green IT logistics in a Greek retailer: Grand successes and minor failures

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## Abstract

Environmental sustainability is one of the issues that organizations need to face today. Nevertheless, Green IT practices have their disadvantages, especially financial ones, which make the green logistic topic controversial to organizations. Achieving zero emissions while receiving financial benefits is idealistic thus companies need to adapt specific green strategies according to their particular needs. This study analyzes a specific company in terms of its green logistics strategy in order to discover any shortcomings and to depict how issues from literature review can influence the operation of the organization. This company is a super market chain dominant in the market of northern Greece. Focusing on the e-logistics of the firm, issues such as warehouse management system, inventory control, transportation, distribution and reverse logistics are examined in combination with the environmental consciousness. Our results could be useful to companies looking to exploit Green IT logistics.

**Keywords**: Green Logistics, environment, retailing

## 1. Introduction

Logistics used to depict the transport, storage and handling of products as they move from raw materials source to their point of consumption. Over the past few years, in a background where public and government concern for the environment increases, firms are "forced" to reduce their environmental impacts of their logistics processes and turn them to green (McKinnon, et al., 2011). In response to this pressure, a new approach to logistics emerged in the early 1990s, which focused not only on the standard logistical objectives for efficient, effective, and fast handling and movement of goods, but also took into account measures for protecting the earth's environment: the "green logistics" approach (Aronsson & Brodin, 2006). Freight transport is responsible for 8% of CO2 emissions worldwide. Warehousing and package of products account for 2-3% (Ribeiro & Kobayashi, 2007). The pressure for the firms to transform their logistics operation to environmental friendlier is becoming very intense. Making Logistics 'green' will involve more than reducing carbon emissions. It consists also the endeavors to cut other environmental costs of logistics and reconcile the economic, environmental and social objectives in logistics (Brundtland Commission, 1987) (Fiksel, 2010). By Green Logistics the companies not only pose an environmental friendly image to the public view, but also support and improve their general performance. Painting logistics "green" is not easy. The cost-saving strategies related with logistic operators are often in contrast with the environment, since they usually maximize the environmental costs. Moreover, logistics do not usually pay back the full costs of using the infrastructures. As a result, logistical operators use the most polluting and least energy efficient transportation modes to increase the velocity of distribution (Rodrigue, et al., 2001). Green design and operations, reverse logistics, waste management and green manufacturing in the firms are included in the Green Supply Chain Management, focusing on a better relation with the environment. The main aim of green logistics is to reduce the environmental harmful procedures in supply chain such as the diminishing of material resources, overflowing waste and other kinds of environmental pollution. Existing research on the adoption and application of Green logistics today is limited thus this paper aims to examine the green logistics and e-logistics strategy of a Greek super market chain. The objectives are the in-depth examination of the practices followed by the specific company and the determination of the trade-offs between the Green IT investment and actual benefits for the organization.

## 2. Green logistics

Green logistics is a concept that is gaining popularity all over the world. More organizations are trying to make their logistics green in order to present a more environmentally friendly face (Rao & Holt, 2005). 1989 marked the advent of Green Supply Chain Management, based on an idea of reused products and recycling (Fortes, 2009). Green Logistics emprise the connection of ecological operation in the supply chain, including the product design, choice and shipment of raw materials, the products elaboration, its delivery to the customer and the product's life cycle after the usage (Srivastava, 2007). The main purpose of Green Logistics is to minimize the environmental harmful effect of a product or a service covering the phases of extraction of raw materials and sourcing, manufacturing, distribution and product recovery (McKinnon, et al., 2011). According to Boks and Stevels (2007) the meaning of the word Green divided to three different perspectives: *the Green Science*, *Green Government* and *Green Customer*. The first of them refers to these procedures by which the effect of a product or a service in the environment is measured and the product's life cycle is analyzed. Green Government mostly worries about emissions of each process in the supply chain, as well as with the availability of the energy sources, population and geographical location. Responsible for this is the European Commission with guidelines and legislations (Sarkis, 2003). Finally, the third of the above perspectives is trying to interpret the customer's perspective towards the environment, if it is friendly or not (Boks & Stevels, 2007).

### 2.1 Why Green Logistics

Unarguable, the reasons which force organisations to make on investment of Green logistics are different in each country, sector and organization (Scot & Fischer, 1993). Furthermore, governmental allowances can help the increase of more green supply chains, although the firms need to strategically decide to become friendlier with the environment because this is the "right thing to do" (Wang, et al., 2011). The three basic benefits of green logistics are the competitive advantage, because the customers prefer the more ecological firms, motivating aspects, from the workers and employees to help the environment and obviously financial benefits, through reduction of the use of resources (Rao & Holt, 2005). Good will towards the environment is not the only reason why companies choose to transform their logistics systems. Profitability, cost reduction, waste reduction, advertising and other financial and marketing issues have driven the implementation of Green Logistics (McKinnon, et al., 2011). Also, one of the most significant reasons of Green Logistics existence is the environmental laws the governments instituted (Paulraj, 2008). For example the Environmental Protection Agency (EPA) protects the human health of each potential danger the environment can pose. In addition, laws and rules such as the Restriction of Hazardous Substances refer not only to the manufactures, but also to the suppliers, retailers even to the customers (Trunick, 2006). Another important motive of Green Logistics is the intense competition between the firms. Every organization aims to impress the customer about their ecological profile and stand out of the competition. Green Supply chain is one of the best ways of marketing and advertisement regardless if the competitors use it or not (Clark, 1999).

### 2.3 IT and Green logistics

Information Systems (IS) can provide great help in Green Logistics management. By the efficient use of information technology, the appropriate function of the network will occur, aiming towards faster and more effective green supply chain management. Cutting edge technologies in logistics cannot only improve the business performance, but can reduce the ecological impacts as well. For instance, information sharing techniques create an efficient and green supply chain (Heying & Sanzero, 2009). Techniques like information sharing can facilitate the environmental performance of a firm through a better cooperation between the partners or the sectors of the firm, in order to recycle and reuse the products (Bernon, et al., 2011). Internal cross-departmental integration can also contribute to greener logistics. For instance the better anticipation of customers' demand can reduce the returns of unsold products which harm the environment (James, et al., 2004). IT practices such electronic data interchange (EDI) can improve environmental consciousness. For instance, by using EDI organizations diminish the paper consumption, e.g. prints of invoices. However, it is important to note that these techniques could cause an increase in energy consumption, which could harm the environment (Sarkis, et al., 2004).

IS can provide management tools for the supply chain of a firm and its logistics transport them (Hoek, 2004). Moreover, Warehouse Management System software can also facilitate to overcome the problems related with returns. These systems can produce a competitive advantage, allure new suppliers and manage the returns process (Parvenov, 2005). Although, studies have shown that there is not the perfect information system that can anticipate the amount of returns and provide the best solution to become more ecological (Mortensen & Lemoine, 2005). In conclusion, there are a number of issues related to Green IT but in this study we emphasise in the use of IT to support green logistics.

### 2.4 Rationale for implementing a green logistics strategy

Green Logistics not only improve the ecological performance of companies, but also can raise sales, improve market share and promote new opportunities for the green organisations which sequentially bring financial profits (Rao & Holt, 2005). Moreover, Green Logistics can enforce the economic performance and provide competitive advantage because, through them raw materials and energy are saved. Apart from cost reduction through the green performance, there is also a reduction of the risk for any potential fines from the government for not following the green laws (Klassen & McLaughlin, 1996). Nevertheless, there are still a number of sceptics on this subject, claiming that Green Logistics can harm the financial performance of the firm. As a result in many cases the meaning of Green Logistics either is overseen or avoided (Klassen & McLaughlin, 1996). The cost of the Green equipment, the lack of commitment from senior managers, the lack of green standards can influence the implementation of Green Logistics in a specific industry sector (Min & Galle, 1997). The change into greener logistics sounds easy and profitable but in reality is a complicated strategy which can involve a lot of risks. (Rodrigue, et al., 2001). Cost could be the major impediment as ecological functions can cost more than the less green ones. Also, in terms of time-delivery, the more ecological modes seem to be the less reliable. As far as the warehouses' function is concerned, the reduction of the inventory provokes more emissions because the products are moving all the time trying not to be stored in one warehouse (Rodrigue, et al., 2001). Furthermore, the high cost of environmental programs, lack of buyers, supplier awareness or national regulations are issues which need to be dealt with by firms in order to improve their environmental performance (Rao & Holt, 2005).

The above literature review has revised a number of under-examined areas which will be the focus on this study. All these area are depicted in figure 1. The selections of these themes have been based on the literature in relation to the specific context of the case study, which is a Greek retailer. Retailers are responsible for the collection, storage, distribution and disposal of products. They have the role of the receiver of customers recycling. For the aforementioned reasons they commonly act as pioneers in reducing waste and preserving the quality of product life and natural resources (Triantafyllou & Cherrett, 2010). The company under consideration is a retailer who having all these concerns in mind has embarked in a green logistics operation as described in the next sections. Our purpose is the study the company's efforts as a way to determine the trade-off between being green and investments needed.

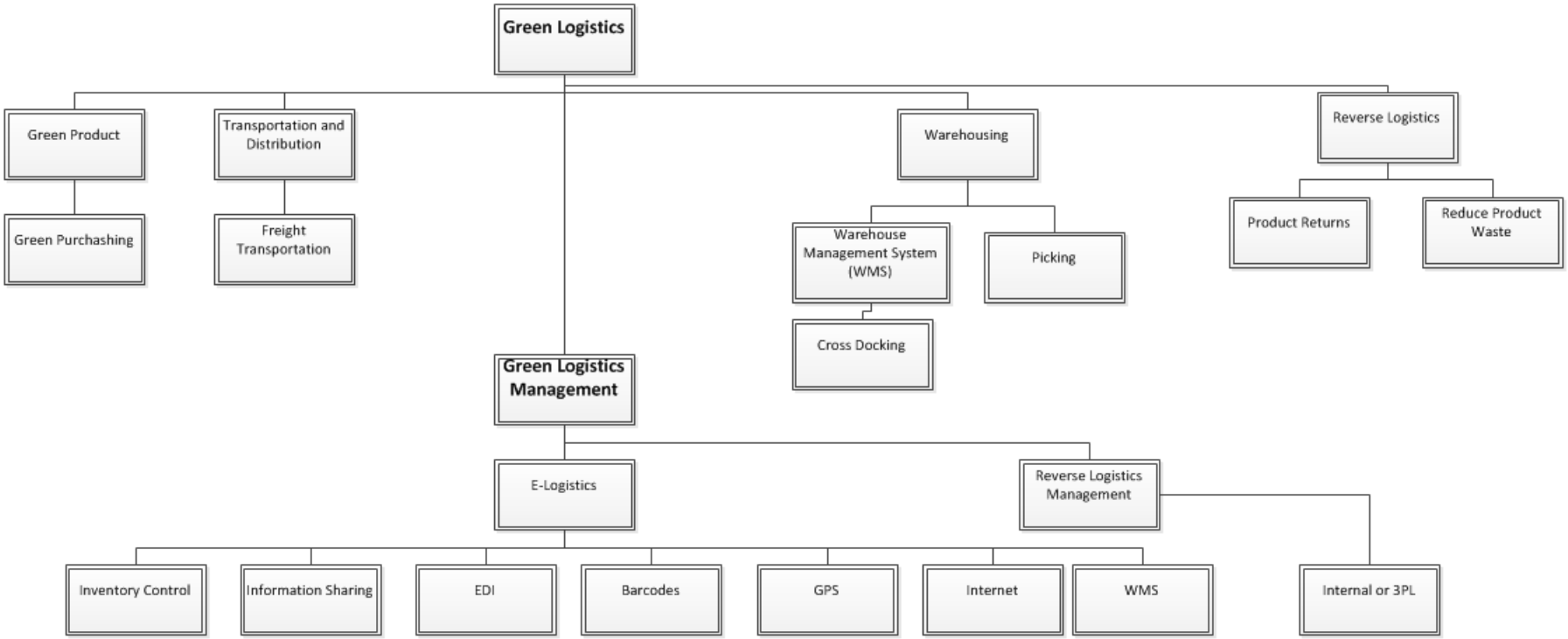


**Figure 1.Key issues to be examined**

## 3. Research Methodology

This study was designed as a qualitative single case study. Case study research is an approach of researches in real life, especially in management topics. When a holistic study is needed this kind of research is one of the best which can be used. By asking comprehensive questions, the organization's culture is investigated, and the findings refer mostly to the specific firm (Boyatzis, 1998). As it is referred this paper focuses only on one firm, a super market chain, by providing information and a clear picture to the reader about the specific company and its green logistics. Masoutis is a supermarket chain in Greece. Its headquarters are located in Thessaloniki. The company was established in 1976 by Diamantis Masoutis - who still owns the company. Masoutis is by far the biggest regional grocery retail chain in Greece. As of 2012, the company has a total of 234 retail stores. All of them are located in Northern Greece. The main warehouse is located in Thessaloniki at the area called Kavalari. The warehouse, 57.400 $m^2$, was a 75 million investment aiming to cover the logistic needs for each super market. All the stores are provided the products either from the main warehouse of the company or directly from the supplier, according to their specific contracts. The warehouse is operated by 400 warehouse employees. Masoutis has its own trucks to distribute the products but also cooperates with three 3PL companies. There are 80 different exits in the warehouse, providing the opportunity to load 80 different trucks at the same time. In addition, they adopted a new technology, which is based on automations and RFIDs. Moreover, there is a specific place for the destroyed, or unable for reuse products where their landfill occurs. The ecologic standards are followed during the warehouse's construction and operation. The company does not manufacture any product but it cooperates with partners in order to produce its own label products which are recyclable and almost all of them reusable. As far as the data collection is concerned, interviews and documents were occurred to collect the data. Semi-unstructured interviews were the main body of the data collection in the case study, asking flexible questions applicable to any change maybe was needed (Saunders, et al., 2003). The anonymous interviews were based on records alongside note taking techniques (Bernon, et al., 2011). Documentation such as blueprints of any innovation or change in the firm, personal notes of the employees, personnel records, stakeholders' reports etc. were also used. The interviewees belong in 4 different groups representing diverse views within the organization. The 4 main groups for the interviews were:

- Top management executives (3 people)
- Procurement managers (4 people)
- Supply chain assistants (10 people)
- Warehouse employees (10 people)

The sample for interviewees was selected randomly in order to have a holistic and impartial point of view (Saunders, et al., 2003).

Moreover, observation was another means used to gather the data. Observation is way of data collection by watching behaviors, events, or noting physical characteristics in their natural setting (Lofland, 1994). The observations took place within 3 weeks in May 2012. Qualitative data analysis (Silverman, 2006) has been used to analyze the collected data. Thematic analysis (Boyatzis, 1998) was the specific technique used to analyze the key issues depicted in figure 1. Additionally, describe-compare-relate was the main way of data analysis. Comparisons and exemplar analysis were used to filter and correlate categories or themes from the literature review in light of the case study (Bazeley, 2009).

## 4. Findings

According to top management executive 1 from the company, over the years have embodied and reinforced Green Logistics in their culture, and ecological consciousness in their strategy. They are also committed to follow loyally the regulations towards the environment proved by their effort to obtain any required certification related to the environment. According to the same manager, they have decided to become even more ecological in their logistic procedures, because they believe this brings better functionality as well as financial benefits. They aspire to become one of the greenest retailers in Greece by rating Green Logistics among their top three supply chain priorities. In line with this strategy, senior managers have already mapped their supply chain in three main sectors receipt, inventory and distribution and separately they are trying to make all of them more ecological. In the next sections we examine the company's actions in relation to Green logistics themes presented in figure 1.

### 4.1 Green Product

As the company is not a manufacturer their effort in using green products is focused on using ecologically responsible suppliers. Due to company's dominant position in the market they can even force their existing suppliers to become ecological in order to increase their orders. For instance, top management executive 1 declared: "*As much as our suppliers care about the environment, we care about them*". The company has initiated the development of a scorecard in order to collect data according to the environmental performance of some products. By that they have developed the eco-labeling technique. They use eco-labeling on some products, informing the costumers which products are the most ecological and how many emissions were exposed during their production. Procurement manager 2 declared, "*It was tough to convince our suppliers to use ecol-labels on their products, because they feel unsure about people's reaction. Eventually almost everybody comforted in this situation by giving to them better offers from our sid*e". In addition, the company has made sure that their own label products, which are manufactured by outsourcing plants, are ecological and recyclable as well as economical. Their strategy in this area was to provide cheap but green products to customers. The interviewees reported that even the consumables that the company uses in a daily basis, are environment-friendly, despite the facts that sometimes they are more expensive.

### 4.2 Transportation and Distribution

This company uses mostly road freight. The distribution in three islands occurs by ferries. They mainly distribute the products by their own trucks and they are cooperating with three 3PL (third party logistics) company, which fulfill the environmental needs by the terms of gas emissions, noise, congestion etc. Moreover, under negotiations with the suppliers, they deliver their products by themselves at the stores. In addition, there are occasions where the supplier is allocated to a place near to a store, so the company's truck visit them at the end of its route and load the products which are needed in the central warehouse. By that, less transportation is occurredIn addition, one of the main aims of the firm is to diminish the return products. In order to succeed that they don't accept returns from the stores by reasons, such as warehouse stock, wrong anticipation or other unimportant reasons. By doing that, they reduced the routes and the fuels consumption (Ubeda, et al., 2011). As a result, they have transformed the firm to a greener one. Procurement manager 1 stated: "*unreasonable returns is like the worm which parasites in the apple, and we want our warehouse to be a healthy apple*". The distribution routes are determined by the place of the store, the freight of each truck, the capacity of each truck, the congestion and the less fuel consumption, in order to reduce the costs and increase their green performance as a company. After 3 interviews with the distribution managers we concluded that the busiest period of delivery is between 8 to 12 am. Because of the regular checking and servicing of each trunk, it is rare for a truck to break down and cause environmental harms. The use of Information Communication Technology (ICT) in the form of on line stores has also contributed to the company's green strategy. The online buying is operating in some areas according to the workload and the demand they have in the specific area. By that they urge the customers not to use their cars so as to decrease the CO2 emissions. By delivering the products at the customer's door they can save money and fuel consumption. They found that by operating online shopping they can lower the carbon and the environmental footprint (Edwards, et al., 2009). Many retailers declared that there are environmental benefits of online grocery distribution. One of the long-term goals of the firm is to evaluate the CO2 emissions of online and ordinary shopping through an analysis of customers' shopping habits, alongside with an analysis of the related freight movements countrywide.

### 4.3 Green Warehousing

Recently, the firm moved to a larger and more innovative and eco-friendly warehouse. They are also trying to perform less storage for the products and increase the cross-docking procedure. After negotiation with the supplier, they know when to deliver the products in the warehouse, at the right time when the other trucks are going to be loaded. As a result, the received products are distributed on the spot. By that, the emissions caused by the storage products are almost reduced to zero.

As far as the function inside the warehouse is concerned, the greenest functionality is the one with the least movements of both equipment and working staff. The company made enormous efforts to lower these movements by using Enterprise Resource Planning (ERP) systems. The picking occurs through the RFID technology by which each product has a barcode and by scanning it you can give some orders to the system such like delete, load, sent, move to a new place etc. At the moment, they are considering two new technologies of picking in a warehouse, the Voice technology and the Pick to Light. Furthermore, they set the warehouse in order to diminish the movements from the other side as well, at

the store where the products are delivered. The structure of the warehouse and the racks inside it actually force the warehouse employee to pile up the products in a trolley for a specific store at the opposite order of the store's racks. Therefore, when the employee at the store receives the products it is easy to unpack them and place them at the racks avoiding any backwards or extra movement.

### 4.4 Reverse Logistics

Regarding the reverse logistics, the company defying cost, adopted green reverse logistics practices which provides the opportunity for their customers to dispose his/her garbage in recycling bin next to every store of the firm. The decision of following a green policy in reverse logistic was taken not only for the financial gains but also to improve the living standard of their customers. As it is already mentioned the firm trying to reduce the fuel consumption they cancel the returns from the stores to the main warehouse. They accept them only if there is a customer's request, the product can be used again, it needs to be allocated somewhere else, repair, refurbishing, remanufacturing and cannibalization. Setting recycling bins next to each store make the above decision of products' returns cancellation even more feasible. The company's trucks when they finish their routes in order not to cover distances without load, they collect the returns from the stores to the warehouse. In addition the firm deals with the suppliers who distribute some products by themselves at the stores, to collect any return of their product the store has and reuse them somewhere else. All of the return products in the warehouse proceed to reuse, recycle or landfill.

### 4.5 Green Logistic Management

**E-logistics**: A number of IS and technologies are used by the company to apply their Green Logistics Management. The top management executive 2 denoted, "*We are trying to set some benchmarks in order to measure our green performance in order to make it greener as the time goes by*". Below, the IS that the company uses will be described and the way that IS improve the ecological image of the firm will be analyzed. The most reliable way to capture the e-logistics implications on the environment is to investigate them from the perspective of the movement of materials and information through the supply chain (Sarkis, et al., 2004).

**EDI**: The company uses EDI to cooperate with suppliers in payments and to provide them statistical data for their products (sales, demand, stock etc.). By that, they save a lot of paper work, which has a positive impact on the environment. Moreover, by the statistics of each product, another paper-free procedure, the supplier can anticipate better the product demand and decrease the overproduction and the warehouse stock. By these actions the overall logistics footprint is minimised.

**Information sharing (over the supply chain)**: Masoutis has adopted cross-company information sharing. By that, two or more companies can access data of another company and vice-versa. The company shares its data only with big suppliers, such as Procter & Gamble, Unilever, in order to avoid the "bullwhip effect". Bullwhip effect describes the big fluctuations of a product stock in the warehouse (Lee, et al., 2000). Our company by providing data according to the supplier's products only succeed to minimise the stock in the warehouse and meet environmental standards by reducing warehouse emissions. Thus, the supplier knows the location, time and the quantity of the products that he has to deliver which avoided complimentary actions such as a second route. As a result, the fuel emissions are lower. In addition as the supply chain assistant 8 denoted, "*donot forget the fact that we share our information not our profits*".

**Inventory control**: Being one of the largest and more innovative warehouses in Greece, the company implemented an IS to control their inventory. By that, time is saved in picking while the distances which are covered by the electric forklifts are reduced. Consequently they save huge amounts of energy and fuels. Moreover, when a senior manager has to order another load from a supplier, they are advised the inventory control system to check the remainder stock and the weekly and monthly flow of each product. As a result, they can easily forecast the product demand and order the exact needed amount of products, hence reduced the stock in warehouse and improved the green warehouse performance. They can also perform monthly checks in the inventory and correct any potential mistakes. Keeping under control their inventory, they know exactly the volume of the emissions they produce and what actions need to take to reduce the emissions. As the warehouse employee 3 declared, "*By following the instructions from the product, it not only saves the environment but also saves our times, which make us much happier*".

**Internet and Barcodes**: By using the Internet, paper works were minimized, i.e. they replaced faxes with emails. Internet also provides the firm with new solutions or options to become even greener in its functionality. Moreover, the company is not a small super market chain but covers every corner of northern Greece. As a result, they sell services as well as papers, books and magazines. Concerning the environment they are planning to provide these products online in order to improve their ecological face. As for barcodes, maybe barcode does not have a direct positive impact to the environment but it is the driving force for IS which actually provide greener solutions and functions..

**Global Positioning Systems (GPS)**: In the case study company, they use GPS to locate their trucks and any traffic congestion. By checking the traffic daily in cities they can set a better route in order to save fuels and to present more environmentally friendly face. The warehouse employee 2 (the driver) stated, "*GPS is one of the best inventions I have even seen during the 20 years of driving. It keeps me always posted and helps my vehicle to consume fewer fuels*".

### 4.5.1 Warehouse Management System

All the above and some other IS provide data in a general Warehouse Management System (WMS), which only the senior managers can access. According to that they can prevent discrepancies in the operations, which can cause a negative impact on the environment. For instance, a senior manager reported that 2 months ago through the system they managed to predict the meat production for the next 2 months. Thus, they closed down one of the three massive refrigerators in order to gain money and energy. By that the warehouse emissions decreased substantially comparing to the previous years. The WMS also includes the reverse logistics operation. They provide the optimum route to collect the returns from customers or stores. In doing so, they are trying to minimize the returns and the product's waste. Reverse logistics is a significant part in logistics and the case study firm pays a lot of attention to keep its supply chain green, both ways.

## 5. Discussion on benefits vs. costs for the company

The retail sector has made considerable effort to become greener in their supply chain, but with the rising cost they reached to a point that becoming green is expensive and futile. For instance, the case study company is spending huge amount of money trying to build greener stores and a greener warehouse. The top management executive commented: "*Since we decided to build a green warehouse the costs have raised almost double as we anticipated. However, we proceeded and eventually we did not regret at all*". According to the same manager, they could have spent almost half amount of money if they have chosen un-ecological ways of infrastructure and operation. This verified by the literature as Green products and services are often more expensive than ordinary ones (Philipp & Militaru, 2011). It is difficult to quantify the cost of going green. However, in this case the cost savings increased since the adoption of green techniques in their logistics. Moreover, they can measure the Return on Investment (ROI) of green logistics in sales, market share, happier customers and employees and enhancement of the brand. In addition, as the procurement manager 1 claimed, "*A better future for our kids is a benefit as well*".

By distributing **green products** the company has broadened the market share by adding another portion of people in their target group, the environmental friendly consumers. After some months it was discovered that the profits from this part of people overtake the cost of manufacturing and distributing green products. As for **transportation and distribution** is concerned, the decision of buying ecological vehicles was taken under serious consideration. So far, the board is pleased by that decision because they spend less money in fuels and services. By developing the optimum route of product distribution for every day according the day's needs they save money in fuels and pointless trips. For implementing **green warehousing** they went to great lengths to establish a fully innovative and contemporary environmental friendly warehouse. However, as the time goes by, their profits overcome the cost by the reduction on the energy bills of the warehouse. Moreover, following green procedures to storage and distribute products they save much space in the warehouse, providing them the opportunity to store other kinds of products. By that they can storage every single product which circulates in the Greek retail market, addressing by that to a bigger target group which can provide financial benefits.

As mentioned in the analysis section, the company, by using green **reverse logistics** saves big amounts of money, reducing the products waste and increasing their usability.

Use of **IT and e-logistics** the company believes that they have achieved major financial benefits. As the top management executive 3 claimed: "*We have been trying for years to bridge the gap between environment and financial profits in our supply chain. By using e-logistics, we have built this bridge much faster*". This is achieved by using **EDI, information sharing over the supply chain, electronic inventory control, Internet and barcodes** and **GPS technology.** Last but not least, the company decided to implement a **green warehouse management** which produces financial benefits by helping and supporting all of the above techniques.

After the analysis in section 4 as well as this discussion it is apparent that the combination of logistics, environment and IT not only protects the environment but also offers financial benefits for the case company. Warehouse employee 1 claimed, "*Since we have applied the IT in our logistic plan, it is easily noticeable the financial benefits especially in reduced workload and reduced products' waste".*

Moreover, the **government's pressure** towards green logistics has also been a major driver for the adoption of green practices. A green supply chain can cost money to build but it can save you money from government's fines. As the top management executive 1 stated, "*do not neglect the fact that, we are getting a lot of pressure to become friendlier with the environment by the government. So, the WMS besides everything else helps as to absorb this pressure and become green and legal at the same time*". In summary, the company's profit has risen since they adopt the green supply chain strategy. The return of the green investment came quickly and there was no time that they regretted this action. Also, by promoting even more ecological products they managed to broaden their market target and obviously their market share. As a result, the company strongly believed that green logistic techniques provided not only financial gains but also competitive advantage. This is in line with the literature that Green logistics can provide financial gains and competitive advantage in the firm (Rao & Holt, 2005).

# 6. Conclusions

*Customer's consciousness* and *governmental pressures* are two of the main reasons that urged firms to become greener in the supply chain. Nowadays, the embodiment of green logistics in company's strategy is common worldwide. Although, the above company does not manufacture products but only distributes them, contributes in a greener supply chain between partners and suppliers by encouraging their suppliers to create ecological products. Moreover, they have already adopted the Just in Time technique with some suppliers and they are trying to apply it in every supplier. By that, they decrease the time of storage and the warehouse emissions According to the green warehousing the above company uses renewable sources of energies such as solar energy (Preuss, 2005). Many interviewees noticed that the customers are not always ecologically-conscious thus, they are not willing to pay more for a greener product. As a result, companies face the challenge to make the products and the entire supply chain process more ecological by keeping the same product's price (Braithwaite & Knivett, 2008). E-logistics can facilitate and improve the firm's image towards the environment in the inventory management through information sharing as the case study company does by sharing records and reduce the delays and the paperwork. In addition, e-logistics can help through postponement by delaying the manufacturing of the product until the customer orders it by reducing the inventory in warehouses (Park & Roome, 2002). Furthermore, through these systems companies can manage more than one warehouse at the time reducing the general stock and inventory and helping the warehouse management through disaggregation (Sarkis, et al., 2004). With the right guidance and operation E-logistics can provide environmental protection. IS which measure the performance is useful in supply chain. The traditional IS in supply chain are focus-oriented around accuracy, cost and time. Nowadays, firms must implement the environmental responsibility as another core subject into their IS (Bhagwat & Sharma, 2007). Software suppliers are trying to help firms out to measure their emissions in economical terms and to capture the CO2 emissions from their supply chains. They even provide models to describe the ecological performance of the firm (Braithwaite & Knivett, 2008). Companies can adopt a green model which actually measures the green performance of the firm according to some indicators or standards and provide solutions in order to become greener. Moreover, through this model they can compare themselves with other companies in the same sector (Consulting, 2003). Also, companies in retail sector can convince their suppliers to adopt a green strategy and restrict them to use some chemical elements which are harmful to the environment. In addition, constant training and feedback to the workforce about green procedures are needed. Creating awareness of green logistics' benefits could produce a greener culture and more ecological operation. Although our results show that the overall benefits of adopting green logistics are visible, implementing green logistics might result in increased bills and extra expenses especially at the induction period.

To conclude, it is difficult to become green. There are plenty of tools which can facilitate the procedure and make it less time consuming to implement. Each firm has to measure their performance, to set a benchmark in order to establish and find out more movements and changes which can provide benefits towards the environment. According to the green techniques that have to be part of the supply chain, each of them has its own strategic and management requirements. This paper provides some recommendations and useful information to other companies looking to exploit green IT logistics. This paper however has not covered the entire green logistics field. Thus, further investigation is recommended to cover other green logistics aspects especially for firms under specific circumstances of operation.

## References


Aronsson, H. & Brodin, H., 2006. The Environmental Impact Of Changing Logistics Structures. The International Journal of Logistics Management, 17(3), pp. 394-415.

Bazeley, P., 2009. Analysing Qualitative Data: More Than 'Identifying Themes'. Malaysian Journal of Qualitative Research, 2(1), pp. 6-22.

Bernon, M., Rossi, S. & Cullen, J., 2011. Retail reverse logistics: a call and grounding framework for research. International Journal of Physical Distribution & Logistics Management, 41(5), pp. 484-510.

Bhagwat, R. & Sharma, M. K., 2007. Performance measurement of supply chain management:A balanced scorecard approach. Computers & Industrial Engineering, 53(1), pp. 43-62.

Boks, c. & Stevels, A., 2007. Essensial Perspectives for Design for Environment. Experiences from the Electronic Industry. Production Research, 45(18), pp. 4021-4039.

Boyatzis, R., 1998. Transforming Qualitative Information: Thematic Analysis and Code Development. 1st ed. United States of America: SAGE .

Braithwaite, A. & Knivett, D., 2008. EVALUATING A SUPPLY CHAIN'S CARBON FOOTPRINT – A METHODOLOGY AND CASE EXAMPLE OF CARBON-TO-SERVE, Lyon: Logistics Research Network 2008: Conference Proceedings.

Brundtland Commission, 1987. Our Common Future. 1st ed. Oxford: Oxford University.

Clark, D., 1999. What Drives Companies to Seek ISO 14000 Certification. Pollution Engineering Summer, pp. 14-18.

Consulting, L. G., 2003. Postconflict. [Online] Available at: http://postconflict.unep.ch/humanitarianaction/documents/02_08-04_05-11.pdf [Accessed 21 June 2012].

Edwards, J., Cullinane, S. & McKinnon, A., 2009. GreenLogistics. [Online] Available at: http://www.greenlogistics.org/SiteResources/7ffc66c2-4e53-4c3d-a29d-f62f49458dfa_J.Edwards%20-%20Carbon%20auditign%20conventional%20and%20online%20book%20supply%20chains.pdf [Accessed 2 Sep 2012].

Fiksel, J., 2010. Design for Environment, Second Edition: A Guide to Sustainable Product Development: Eco-Efficient Product Development. 2nd ed. London: : McGraw-Hill Professional.

Fortes, J., 2009. Green Supply Chain Management: A Literature. Otago Management Graduate Review, 7(1), pp. 51-62.

Heying, A. & Sanzero, W., 2009. A Case Study of Wal-Mart ' s " Green " Supply Chain Management. Operations Management, 4 May, pp. 1-10.

Hoek, R., 2004. Using information technology to leverage transport and logistics service operations in the supply chain: an empirical assessment of the interrelation between technology and operations management. International Journal of Technology Management, 23(1), pp. 207-222.

James, M., Grosvenor, R. & Prickett, P., 2004. e-Distribution: Internet-based management of a merchandiser supply chain. Supply Chain Management: An International Journal, 9(1), pp. 7-15.

Klassen, R. & McLaughlin, C., 1996. The Impact Of Environmental Management On Firm Performance. Management Science, 42(8), pp. 1199-1213.

Lee, H., So, K. & Tang, C., 2000. The Value of Information Sharing in a Two-Level Supply Chain. MANAGEMENT SCIENCE, 46(5), pp. 626-643.

Lofland, J., 1994. Analyzing social settings : a guide to qualitative observation and analysis. 1st ed. London: Thomson Wadsworth.

McKinnon, A., Cullinane, S., Browne, M. & Whiteing, A., 2011. Green Logistics: Improving the environmental sustainability of logistics. 1st ed. London: KoganPage.

Mortensen, O. & Lemoine, W., 2005. Information Technologies and Supply Chain Integration. A study among manufacturers and transport and logistics service providers.. Netherlands, Workshop Supply Chain Management and Communication Technology. University of Groningen.

Park, J. & Roome, N., 2002. The Ecology of the New Economy: Sustainable Transformation of Global Information, Communications and Electronic Industries. 1st ed. Midsomer Norton: Greenleaf.

Parvenov, A., 2005. SupplyChainDigest. [Online] Available at: http://www.scdigest.com/assets/Reps/SCDigest_Best_Practices_Warehouse_Returns.pdf [Accessed 6 June 2012].

Paulraj, A., 2008. Environmental Motivations: a Classification Scheme and its Impact on Environmental Strategies and Practices.. Business Strategy and the Environment, Volume 18, pp. 453-468.

Philipp, B. & Militaru, D., 2011. KEY FACTORS FOR ENVIRONMENTALLY FRIENDLY LOGISTICS SERVICES IN THE FRENCH REGION OF PICARDY. International Journal of Logistics Research and Applications: A Leading Journal of Supply Chain Management, 14(6), pp. 413-426.

Preuss, L., 2005. The Green Multiplier: A study of Environmentla Protection and the Supply Chain. 1st ed. New York: Palgrave MacMillan.

Rao, P. & Holt, D., 2005. Do green supply chains lead to competitiveness and economic performance?. International Journal of Operations & Production Management, 25(9), pp. 898-916.

Ribeiro, S. K. & Kobayashi, S., 2007. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In: R. Bose & H. Kheshgi, eds. Transport and its infrastructure. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press,, pp. 325-380.

Rodrigue, J.-P., Slack, B. & Comtois, C., 2001. Green Logistics (The Paradoxes of). Business Administration › Production, Operations and Manufacturing Management Papers , pp. 1-11.

Sarkis, J., 2003. A strategic decision framework for green supplychain management. Journal of Cleaner Production, 11(4), pp. 397-409.

Sarkis, J., Meade, L. M. & Talluri, S., 2004. E-logistics and the natural environment. Supply Chain Management: An International Journal, 9(4), pp. 303-312.

Saunders, M., Lewis, P. & Thornhill, A., 2003. Research Methods for Business Students. 3rd ed. England: Prentice Hall.

Scot, J. & Fischer, K., 1993. Introduction: The Greening of the Industrial Firm. 1st ed. Washington: Island Press.

Silverman, D., 2006. Interpreting Qualitative Data. 3rd ed. London: SAGE Publications Ltd..

Srivastava, S. K., 2007. Green supply-chain management: A state-of the-art literature review. International Journal of Management Reviews, 9(1), pp. 53-80.

Triantafyllou, M. K. & Cherrett, T. J., 2010. The logistics of managing hazardous waste: a case study analysis in the UK retail sector. International Journal of Logistics Research and Applications, 13(5), pp. 373-394.

Trunick, P., 2006. A Green Role for Logistics. Logistics Today, 47(6), pp. 26-28.

Ubeda, S., Faulin, J. & Arcelus, F., 2011. Green logistics at Eroski: A case study. Int. J. Production Economics, 131(1), pp. 44-51.

Wang, C., J, V., Mercer, J. & Zhao, Y., 2011. A case-based model facilitating retailing operations going “green”: A proposed research agenda with a consideration of recession. Dalian, Asia Pacific, s.n., pp. 1-4.