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## REVERSE LOGISTICS AND GREEN LOGISTICS WAY TO IMPROVING THE ENVIRONMENTAL SUSTAINABILITY

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**Abstract:** To survive in today's competitive and changeable marketplace, companies need not only to engage in their products and/or services, but also to focus on the management of the whole supply chain. Effectively managing and balancing the profitability and interconnection of each player and function in the supply chain with including the new trends will improve the overall supply chain as well as individual profit. Logistics are an important function of modern business systems. Consideration of environmental and economic aspects in supply chain design is required to reduce negative impacts on the environment caused by the increasing levels of industrialization. Also, reasons why companies choose to “go green” is that it gives the company a competitive advantage as the customers are demanding now a days that the businesses go green. In this paper, an overview of new trends such reverse logistics and green logistics, as part of green supply chain, is given with analysis of its significance in modern day systems.

**Keywords:** Reverse Logistics, Green Logistics, Supply Chain, Sustainability

### INTRODUCTION

Logistics is a big part of companies' actions. More focus is put on logistics and methods that are practiced within logistics. This is because money can be saved and give a competitive advantage to the company. Another factor that is affecting logistics is the pressure that comes from governments and customers. Governments are putting pressure on companies to be green and choose green options within logistics through legislations and laws. Meanwhile customers are getting more and more aware of greenness. So the importance with logistics and the methods behind are getting more attention than before. Practices such as reverse logistics give companies a competitive advantage when used effectively, and it can also protect the company. It is also a method that is considered to be green and is a part of green logistics.

According to Waters, 2007 [1], logistics can be defined as a: “Function responsible for all movements of materials through the supply chain”. A definition for supply chain management from [1] is: “A supply chain is the series of activities and organizations that materials both tangible and intangible– move through on their journeys from initial suppliers to final customers. Some say that the difference between

supply chain management and logistics is that supply chain management considers the whole chain.”

The Institute of Logistics [2] separates logistics and supply chain management in these definitions: “Logistics is the time related positioning of resources or the strategic management of the total supply chain.” Meanwhile, the supply chain is a sequence of events intended to satisfy a customer. It can include procurement, manufacture, distribution and waste disposal, together with associated transport, storage and information technology.

New trends, reverse logistics and green logistics are subjects that are getting more important in the business world. This paper gives an overview of characteristics and opportunities of those trends. Here are given general introduction on those aspects. According to Mitra (2009) [3], planning and implementing a suitable reverse logistics network could bring more profit, customer satisfaction and a nice social picture for the companies. As a result, a good reverse logistics model in the company gives the company a good competitive advantage and also helps the company to save money and make a better profit. Even though reverse logistics has an important part of the supply chain management,

many companies still use outdated processes that contributes to the supply chain inefficiencies and excessive inventory and costs. But most of the logistics networks are not equipped to handle the return products in reverse channels. An increasing trend is also outsourcing the reverse logistics, since companies do not have the expertise in the subject themselves.

Green logistics is becoming very important in the corporate world, since the demands on companies are getting stricter and the green logistics have to be considered throughout the process in the business. In the late 1980s and in the early 1990s greenness became a catchword in the industry. Since the World Commission on Environment and Development set an establishment of environmental sustainability as a mission for international action, it gave the green issue a remarkable push in the economical and political fields. Then, logistics was a developing subject seen by many as an opportunity to adopt a more green and environmental face [1,2,3].

### CONCEPTS OF LOGISTICS AND SUPPLY CHAIN

#### » Logistics

Logistics is the terminology used to describe the transportation, storage and handling of products as they move from the source of raw materials, through the production system to their final point of sale or consumption.

Starting from the early '60s, many factors, such as deregulation, competitive pressures, information technology, globalization, profit leverage, etc., contributed to the increase of logistics science in the form we know it today. Its core activities have been fundamental to economic development and social life, but during the past 50 years that logistics has come to be regarded as one of key determinants of business performance, subject for professional and academic study with objectives to organize logistics in a way that maximizes profitability. The calculation of profitability, however, has included only the economic costs that companies directly incur. The wider environmental and social costs, traditionally excluded from the balance sheet, have been largely ignored, until recently. Over the last few years, those costs have become logistics' components of interest. Logistics management tries to have the "right product", in the "right quantity", at the "right place", at the "right time", with the "right cost". Logistics management must balance two basic targets: quality of service and low cost. According to Council of Logistic Management, logistics is defined as: "process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."

The logistics activities can be classified into a) core and b) supporting.

The core activities take place in every supply channel and those are: goods transport, storage, inventory management, overall material handling and related information processing. They contribute the most to the total cost of logistics or they are essential to the effective coordination and completion of the logistics task.

Support activities vary from company to company and a comprehensive list includes:

1. Warehousing (Space determination, stock layout, configuration, stock placement)
2. Materials handling (equipment selection & replacement policies, order-picking procedures, stock storage & retrieval)
3. Purchasing (supply source selection, purchase timing, purchase quantities)
4. Protective packaging (designed for handling, storage, protection from loss/damage)
5. Cooperate with production/operations (specify aggregate quantities, sequence & time production output, schedule supplies)
6. Information maintenance (info collection, storage & manipulation, data analysis, control procedures)

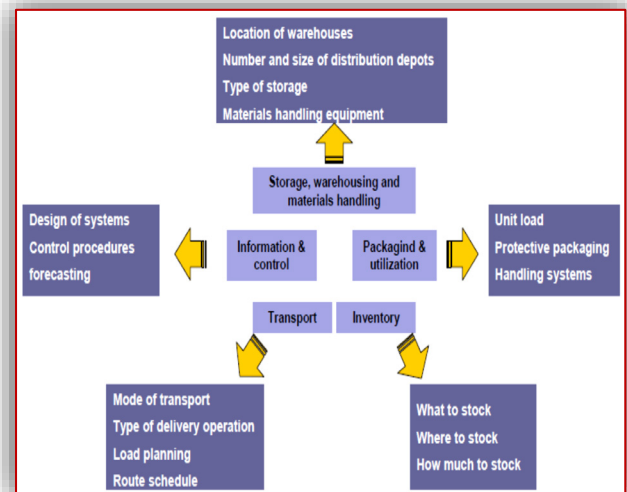


Figure 1. Key components of Logistics

Illustrative presentation of key components of logistics is given at the Figure 1, according to Rushton all (2014) [4]:

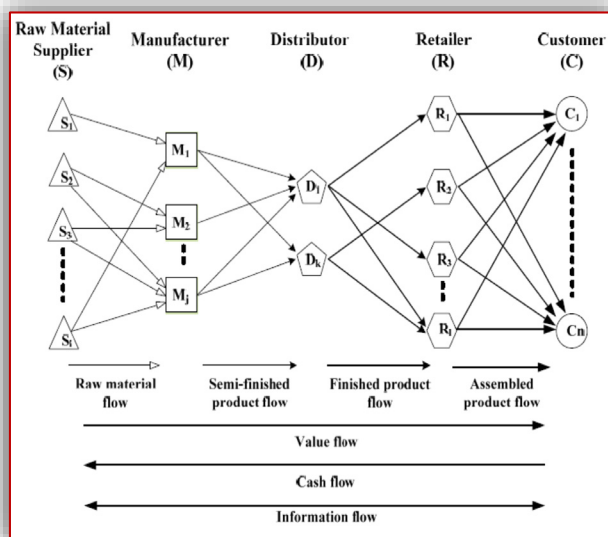
#### » Supply Chain

A supply chain is a network consisting of a chain of activities, facilities, people and other resources directly or indirectly involved in fulfilling goods to customers. The main objective of supply chain is to satisfy the customer requirements. This term "supply chain" came when Cooper et al. [5] addressed it as the extension of logistics.

Supply chain consists of all stages involved directly or indirectly in fulfilling a customer request [5]. It is

a multistage system involving a constant flow of information, material and product between different stages. Each stage of the supply chain performs different functions. The complexity of the chain may vary from industry to industry and from company to company. Supply chain performance has become a critical issue in many industries due to increased competition. Supply chain has its own unique set of market demands, operating challenges and issue remains essentially the same in every case.

A typical supply chain consisting of different levels e.g. supplier, manufacturer, distributor, retailer and customer, who work together in an effort to acquire raw materials, convert these raw materials into specified final products and deliver these final products to retailers (shown in Fig. 2). It is, therefore, a network of companies which influence each other [6].



**Figure 2.** Supply Chain Network

As demonstrated in Figure 2, the materials flow and products flow start from raw material suppliers to final customers. This is called supply flow or value flow across downstream side. In the upstream side [4], the cash flow occurs when stakeholders of supply chains exchange their products or services for some form of payment to satisfy customer needs [8]. The information flow occurs in both directions and is related to materials, customer demands, facilities, cash etc.

Supply chain management is a combination of activities, approaches, and knowledge utilized to efficiently integrate raw material suppliers, manufacturers, distributors, retailers, and customers, so that goal is produced and distributed in right quantities, to the right locations and at the right time while minimizing system-wide costs and satisfying service level requirements. Additionally, these activities can be analyzed at strategic, tactical, and operational levels that concern the different

decision-makings about the source, location, production, inventory and transportation from a time perspective (Strategic – Long term, Tactical – Medium term, Operational– Short term) [37].

#### » Differences between logistics and SC

Supply chain management is different from the traditional concept of logistics [9]. Logistics typically refers to activities that occur within the boundaries of a single organization and supply chain refers to a network of companies that work together and co-ordinate their actions to deliver a product to market. Logistics focuses its attention on activities such as procurement, distribution, maintenance and inventory management. Supply chain management (SCM) acknowledges all of traditional logistics and also includes activities such as marketing, new product development, finance and customer service. SCM is the planning and execution of supply chain activities, ensuring a coordinated flow within the enterprises and among integrated companies. These activities include the sourcing of raw materials and parts, manufacturing and assembly, warehousing and inventory tracking order entry and order management, distribution across all channels and ultimately deliver to the customer. The primary objectives of SCM are to reduce supply cost, improve product margins, increase manufacturing throughput, and improve return on investment.

#### CONCEPTS OF REVERSE LOGISTICS AND GREEN LOGISTICS

##### » Concept of Reverse Logistics

The business concept of Reverse Logistics (RL), as a new trend, has received growing attention in the last decades, mostly due to the environmental and regulatory impacts, competition, marketing motives and direct economic motives. With the legislative measures go up, there are not many options left with the companies, than to go to RL practices. New organizational paradigms have been created as environmental issues play a more important role in cooperative strategies, according to presentation of Gonzalez-Torre et al., 2004 [10]. The various aspects in integrative collaboration can be a valuable source of increased performance for organizations willing to consolidate their RL processes (Ravi et al., 2005) [12].

In following paragraph, are given few definitions for good presentation of this new trend in logistics. Definition according to [10] is as follows: “Reverse logistics is a process in which a manufacturer systematically accepts preciously shipped products or parts from the point for consumption for possible recycling, remanufacturing or disposal.” Another definition by [11] is that RL is “the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related

information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.” Ravi et al. (2005) [12] indicates that RL refers to a set of programs or competencies aimed at moving products in the reverse direction in the supply chain (i.e., from consumer to producer). A growing number of companies start to focus a lot more on the reuses, remanufacturing, recycling and disposals of products and materials in their environmental management practices. RL involves planning, implementing, and controlling an efficient, cost effective flow of raw materials, in-process inventory, finished goods, and pertinent information from consumption to retrieval or proper disposal of the product. Figure 1 is a representation of forward logistics and reverse logistics flows.

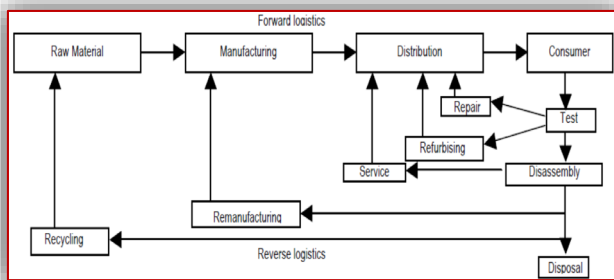


Figure 3. Forward logistics and reverse logistics Flows [14]

With the progressive increase in environmental concerns, the efficiency focus, importance of value delivery through co-creation and co-production as well as the need for improving core competencies while strategically positioning in the global competitive market, the understanding of RL shifts towards the “coordinated”, “centralized”, “consolidated” and “integrated” network value chain. Although RL have large potential for increased performance and improved customer relationship, the potential value of effective RL is often underestimated. RL leads to the fear of losing control over the organizational processes with the extra work involved in its multi-layer steps and results in the reluctance to pioneer a new organizational structure. But it is underestimated that if RL is used effectively it results in improved firm outcomes such as improved customer satisfaction, decreased resource investment levels, and reductions in storage and distribution costs.

#### = **RL benefits**

In references [11,12,14], they identify five ways that proactive reverse logistics can have a positive impact on profitability:

1. Increased revenues realized from secondary sales
2. Offering new products in place of unsold or slow selling stock
3. Shareholder goodwill from acting with social and environmental responsibility

4. Reduced operating costs from reuse of recovered products and components
5. Higher asset turnover due to better management of returns inventory

#### = **RL challenges**

Within the reverse logistics there are challenges that differ from the forward flow of materials and products. These are challenges according to Srivastava (2008) [14]:

1. Large variations in timing, quality and quantity of product returns
2. Lack of formal product returns procedures
3. Delayed product returns reducing their market value
4. Lack of local competence in inspection, evaluation and disposition of returns
5. Risk of cannibalizing new product markets
6. Lack of performance measurement for return process efficiency

Issues that make it difficult to forecast and allocate resources to return systems in reverse logistics are factors such as timing, quality and the quantity of product returns.

#### = **RL areas**

According to Kaynak et al. (2014) [11], there are five different key areas for reverse logistics

1. Returns prevention and warranty/repair policies
2. Logistics
3. Repair operations
4. Recycling and reuse
5. Product design for environment and service

#### » **Concept of Green Logistics**

Over the past 10–15 years, against a background of increasing public and government concern for the environment, companies have come under mounting pressure to reduce the environmental impact of their logistics operations [19]. The distribution of goods impairs local air quality, generates carbon emissions, noise, and vibration, causes accidents and makes a significant contribution to global warming. The impact of logistics on climate change has attracted increasing attention in recent years, partly because controls on pollution.

According to analyzes literature, here are given few definition for green logistics. Sbihi at all (2007) [15] defined green logistics as: “Green logistics is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors”. According to other definition, the green logistics by Seuring at all (2009) [16] is: “Efforts to measure and minimize the environmental impact of logistics activities, these activities include a proactive design for disassembly”. Activities that are dealt with in green logistics is measuring the environmental impact of different distribution strategies, reducing the energy usage in logistics

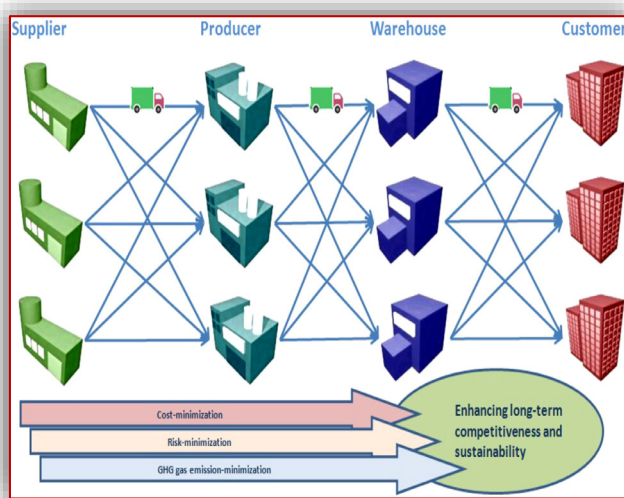
activities, and reducing waste and managing its treatment. In order to be able to deal with these topics companies are now days measuring their carbon footprints, so that the environmental impact of the company's activities can be monitored.

**Green logistics** is a form of logistics which is calculated to be environmentally and often socially friendly in addition to economically functional. It describes all attempts to measure and minimize the ecological impact of logistics activities. This includes all activities of the forward and reverse flows of products, information and services between the point of origin and the point of consumption. It is the aim to create a sustainable company value using a balance of economic and environmental efficiency. A business can gain the following benefits from getting into 'green logistics':

- ≡ Reduction in CO2 emissions
- ≡ Unlocking significant cost savings
- ≡ Heightened supply chain optimization
- ≡ Boosted business performance

#### = Theoretical framework on Green Logistics into Green Supply Chain

Theoretical framework of a general three-stage forward and green supply chain is formulated in Figure 4.



**Figure 4.** Theoretical framework of a green supply chain

As shown in the figure, the proposed theoretical supply chain network is comprised of four levels of entities: supplier, producer, warehouse and customer, and those entities are communicated and connected through three flows: material flow, information flow and capital flow. The material flow in this supply chain network starts from upstream raw material suppliers and moves via intermediate production plants and warehouses towards end customers. The information and capital flow in opposite direction from end customers towards suppliers.

Conventionally, the focus of green supply chain is to simultaneously minimize the costs, risk and GHG emissions of a supply chain. Therefore, in order to tackle this challenge, the optimal trade-off among cost-minimization, risk-minimization and GHG emission-minimization will be focused so that long-term competitive competence, profitability and sustainability can be achieved.

#### = Drivers for Green Logistics

In this section, there are described the various drivers for Green Logistics.

##### Mounting energy costs

Increasing power and fuel costs, together with the cost of related raw materials used in infrastructure building and functioning has led to chances for looking into green alternatives that can significantly lead to a reduction in the price. Reducing the power consumed by IT apparatus, energy efficient lighting and cooling, substitutive energy sources, recycling can help develop the business financial issues.

##### Worldwide alarms among over GHG (Green House Gases) emissions and climate change

Many corporate policies now consist of targets for decreasing their impact on the surroundings, according to the environmental protection policies for green gases emissions and climate change. With green initiatives in IT equipment, infrastructure and people having a significant footprint in any business today, identifying and lowering its impact is becoming very important. Green IT initiatives are important for industrial manufacturer and services organization concerning to the environmental issues along with sharing the best procedures in companies across the supply chain.

##### Environmental regulations

The environmental policies in diverse geographies can be largely classified as regulatory (bans, permits and standards), financial (gains for adherence and reduction) and educational (environmental reporting, audits, product labeling etc.). Green initiatives are leading to the development of legislations along all these areas, such as: controlling the carbon trace, implementation of carbon credits, interchangeable sources to make up for some of the savings costs etc.

##### Improved community awareness of environmental issues

Green initiatives are reliant on an end-to-end across supply chains, along-with sharing the best procedures in companies across the supply chain.

##### Impact on the environment at various stages of Supply Chain

The diagram given at the Figure 5, shows Product Lifecycle from the conception to the disposal stage of a typical CPG (Consumer Product Green) company. The early stages of conceptualization and design of a product happens within closed doors. This is

followed by the usage of water and energy. In stages such as raw material extraction, manufacturing, transportation and disposal, the output (air, water and waste) impacts the surroundings.

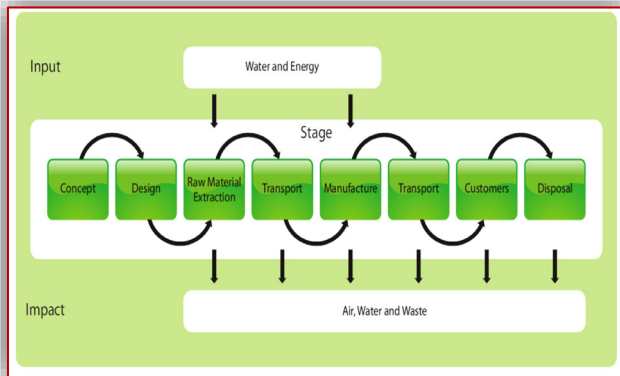


Figure 5: Product Lifecycle and its Impact on Environment

= **Impact of the environment at various stages of supply chain**

The major CPG companies are looking for a greener supply chain to reduce the environmental impacts and offer an eco-friendly service to end consumers. In this chapter of the paper, the focus is done of one of the areas in green supply chain, Green Logistics. With follow four aspects, a successful green logistics implementation can have a positive impact on the overall Supply Chain of the organization:

- ≡ Network Optimization – is the most fundamental type of modeling that can be done to optimize the hierarchy and inter related transportation flows that can bring considerable cost and carbon reduction in the supply chain processes of a consumer packaged goods company.
- ≡ Packaging Reduction – Packaging is an extremely noticeable marketing tool, but it is also a momentous cost to the supply chain, accounting for high percent of the charge of many typical consumer products. This grouping creates an ultimate opening for Consumer Product companies to move towards a greener supply chain and force brand growth by moving to a more sustainable methodology for packaging strategy.
- ≡ Sustainable Procurement – The approach for 'green' procurement should include organization, people, process and technology. It should be treated as a vehicle that provides value, achieves better economics, enhances the brand image and benefits the environment. Through various sustainable initiatives, procurement organizations can realize incremental savings up to 12 % of cost.

These initiatives can include energy, supply, operations and logistics.

- ≡ Warehouse Layout Optimization – Warehousing forms an important part in the CPG industry and is a key to the logistics space. A surplus of techniques and green technologies are available today to warehouse owners to drastically reduce the impact of their buildings on the environment.

= **Environmental Benefits of Green Supply Chain Best Practices**

Adopting Green Supply Chain practices results with positive impact in multiple environmental benefits (Figure 6). These benefits are visible across retail chains, Consumer Products manufacturers, Consumer Products logistics and Transportation Service providers. These benefits include improvements in energy and waste reduction, less packaging in related activities, and decreased GHG emissions. Consumer Products manufacturers can decrease GHG emissions and waste by investing in LEED (Leadership in Energy & Environmental Design) certified green buildings and retrofitting their distribution centers to be more environments friendly.

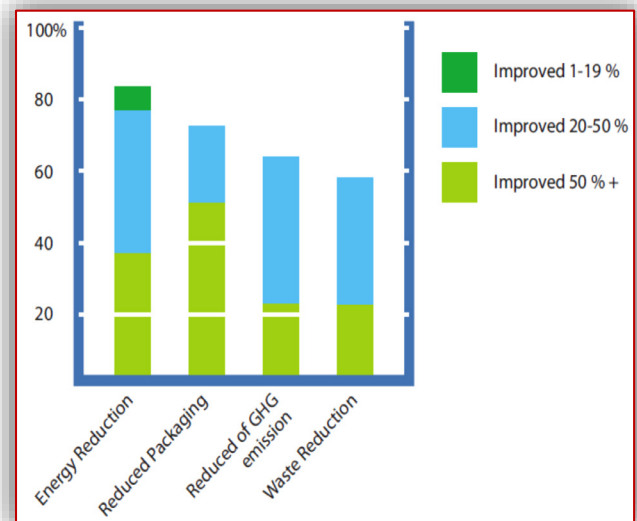


Figure 6. Positive Environmental Impact – Best CPG companies

The above mentioned processes will enable the CPG companies to access carbon credits, where unused credits could be sold to other organizations worldwide.

= **Paradoxes of Green Logistics**

When adapting green logistics, there could be some inconsistencies that might arise [17,18]. The issue is that green logistics is supposed to be environmental friendly, but logistics, in itself, is not very green because of pollution and waste that it creates. So when adapting green logistics, there are some paradoxes that arise as given below:

- ✓ **Cost:** Companies want to get the cheapest way to do things but at the same time they should choose options that are green, which sometimes are more costly to the company. The purpose of logistics is to minimize costs, notably transport costs. The cost-saving strategies that are pursued by logistics operators are often at variance with environmental considerations.
- ✓ **Time/Flexibility:** The modern integrated supply chains provide competent physical distribution systems but on the other hand extended production, distribution and retailing models are consuming more space, energy and generate more emissions.
- ✓ **Reliability:** At the heart of logistics is the overriding importance of service reliability. Its success is based upon the ability to deliver freight on time with the least threat of damage while the least polluting modes are generally regarded as being the least reliable in terms of on-time delivery. The logistics industry is built around air and truck shipments, the two least environmentally-friendly modes.
- ✓ **Warehousing:** A reduction in warehousing demands is one of the advantages of logistics. This means however, that inventories have been transferred to a certain degree to the transport system, especially the roads. Inventories are actually in transit, contributing still further to congestion and pollution.
- ✓ **E-commerce:** The information technology growth has led to new dimensions in retailing, e-commerce. However, changes in physical distribution systems by e-commerce have led to higher levels of energy consumption.

## CONCLUSIONS

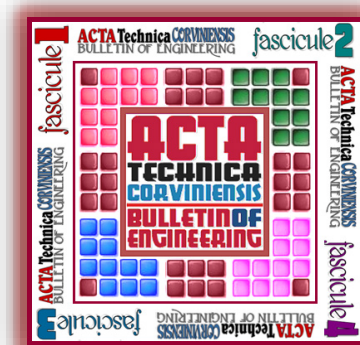
The research finds that logistics is a significant part of the company's operations. This is because logistics can be costly and harmful for the environment. From that reason, specialized logistics companies are finding a match between environmental considerations and profitability. It is becoming acceptable within the industry to adopt green logistics measures. Sometimes they reduce costs, but more often than not they lead to more intangible benefits such as image and reputation enhancement. Reverse and Green Logistics has a still a long way to go ahead.

This paper has given an overview of analyzed literature in our research of what the reverse and green logistics are and what their definitions are. Reverse logistics has been explained as the process where the company takes back the goods for some reason, and green logistics is when the company tries to adapt environmental friendly ways to the logistics chain.

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