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## Analyzing alternatives for green logistics in an Indian automotive organization: A case study

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### ABSTRACT

Green logistics is an important aspect of production system in today's world. It combines various efforts to quantify and control the environmental effect of production activities in an enterprise. This research is intended to emphasize upon the ways by which organizations can accomplish positive ecological effects simply by modifying their logistics practices. This paper presents a case study of an Indian automobile company by analyzing alternatives for green practices along with organizational objectives. It is imperative to focus on the green practices in context of Indian automobile sector as the volume of vehicles in India has increased considerably during last few decades. Accordingly, this paper attempts to improve the performance for sustainable adaptation of green practices of an Indian company by selecting the best alternative obtained from the use of Analytical Hierarchy Process to analyze alternatives for green practices in the assembly and packaging processes. Alternatives have been evaluated on the basis of three criteria i.e. green efficiency, factor of safety and ease of operation. The study revealed that clinch joint is the most appropriate alternative for assembly operation while carbon positive packaging material is the best alternative for packaging.

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### 1. Introduction

Due to the global economic growth and worldwide network of supply chains, the logistics network has become more complex and distantly located. Larger distances covered in the transportation tend to increase emissions, resulting in larger environmental problems. The term "Green logistics" is related to planning, controlling and implementing the flow of logistics by incorporating modern logistics techniques with an aim to minimize the environmental hazards (Chang and Qin, 2008). This flow of logistics should also achieve the satisfaction of the customers as well as the organization goals along with the aim of reducing the effect of these activities on the environment (Rodrigue et al., 2001). In this view, green logistics is the ability of the organization to deliver products and services in an environmental friendly way along with the economic efficiency. Green logistics also refers to the ability of an organization to preserve resources, decrease waste, increase

working efficiency, and fulfil the societal requirement for ecological fortification (Lai and Wong, 2012). The domain of green logistics and production can be illustrated as practices that focus mainly on the reduction of the environment related problems such as greenhouse gas emissions during manufacturing operations, issues pertaining to noise, accidents etc. Sbihi and Eglese (2010) defined green logistics as a sustainable approach to produce and distribute goods by taking environmental and social factors in consideration. The concept of green logistics can also be useful in defining sustainability in environmental, economic and social terms (Lozano, 2012). It is important to have a balance between preservation of the environment, prosperity and the quality of life while implementing triple bottom-line approach. Firms can exploit the advantages of efficiency improvement and several other benefits such as market shares and increased profit by the introduction of green concept in the logistics systems (Rao and Holt, 2005). Green logistics highlights various practices followed to reduce the environmental problems of logistics operations, specially related to greenhouse emissions, transportation, packaging, noise pollution and to achieve sustainability among economy, environment and society (Lai and Wong, 2012). Green logistics issues are gaining

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interest due to its relevance in today's highly competitive environment. Due to the evolving environmental awareness and regulations in the early 1990s, many companies decided to supplement the green element to their supply chain management policies (Wu and Dunn, 1995).

The research on green logistics is still in the preliminary stage. Literature clearly indicates that the social and economic relevance of green logistics was first highlighted in 1990 (Srivastava, 2007). Various environmental requirements and practices such as transportation, warehousing, inventories, packaging have been discussed by various authors in the past (Singh et al., 2012; Singh, 2011; Wu and Dunn, 1995; Carter and Dresner, 2001; Bowen et al., 2001; Zhu and Sarkis, 2004; Sheu et al., 2005; Ebinger et al., 2006). Authors such as Dey et al. (2011), Rao and Holt (2005) and Porter and Vanderlinde (1995) have presented different researches on the sustainability and environmental considerations in the firms to decrease risks and to recover the competitive state of the firm. To justify that ecological performance of vendors has an impact on the green performance of a firm, authors such as Ateş et al. (2012) and Vachon and Klassen (2006) have studied the ecological investment decisions and the collaboration actions with suppliers in relation with logistics. In an innovative study presented by Palanivelu and Dhawan (2011), a number of green warehouses with minimum emission were discussed. These warehouses can be made by equipping energy saving equipment, using solar installations. In another work by Iakovou et al. (2010), an analytical model was proposed to investigate the economic and environmental effect of locating a part of manufacturing operations near markets. Abduaziz et al. (2015) have discussed that logistics in an automobile industry involves the integration of manufacturing operations, assembly operations, and distribution activities. They also proposed a simulation model for the assessment of green logistics activities in automobile industry to assist managers and decision makers obtain an in-depth understanding of green logistics and its environmental impacts. Green logistics in automotive industry focus on reducing the harmful greenhouse gases and optimal utilization of energy as discussed by Abduaziz et al. (2015). In a recent study by Lu and Geng (2015), an industrial transformation model and implementation of green manufacturing were suggested to reduce harmful environmental emissions. These emissions can pose serious threats to anthropological health and the environment. Numbers of cases are found in the literature to show the successful implementation of green logistics. One of such studies is presented by Ubeda et al. (2011) who successfully depicted that the green logistics practices can be implemented without compromising with performance of an enterprise. It is also true that the most of the manufacturing enterprises cannot afford the high acceptance costs of considering green concepts in the logistics. Enterprises are also devising modern methods of prioritizing customers' demands based on least negative environmental impact (Niesten and Lozano, 2015). This will also involve various stakeholders along with environment towards the improvement of organization's sustainability (Lozano, 2012a). Under the domain of green logistics, green packaging is another important issue which has been given importance in the literature. Authors, such as Zhang and Zhao (2012), emphasized upon the role of government in development of new and innovative green packaging materials. They also suggested to standardize the packaging materials with the active participation of government and established institutions. Some efforts regarding the minimization of waste weight by reducing packaging volume were also discussed in the literature (Palanivelu and Dhawan, 2011). It was found that the packaging corresponds to 23% of all waste weight. It is also found that the reduced packaging saves the environment as all packages have to be transported among retailers and waste processor.

Indian manufacturing enterprises involve in large scale production, storage and transportation of various products, therefore creating large environmental problems. Today, the top environmental concern is global warming often associated with the large scale emissions of greenhouse gasses from factories especially in manufacturing sector. Various eco-societies, Government bodies, and companies are raising their concerns to deal with this threat. Green manufacturing initiatives are implemented for improving economic and environmental performance (Rehman et al., 2016). Green practices also helps in balancing cost and environmental aspects. It is not very uncommon to observe that the reduced emissions can be possible with only a marginal cost increase (Zhanga and Zhaob, 2012; Pazirandeh and Jafari, 2013; Kim et al., 2009). Keeping in mind the contribution of manufacturing sector in the growth of Indian economy, authors feel the need of research to motivate these enterprises towards adapting the procedures of green logistics in the greater interest of the global ecological framework. It is also evident that the most of manufacturing enterprises are not very rich in resources and majority of these are located in distant places from the target markets. In view of this, Indian manufacturing enterprises need to implement ecologically managed and environmentally sustainable logistics practices for devising strategies for cost-effective management of environmental issues. Therefore, it is important to examine the situations under which green operations are beneficial for Indian manufacturing enterprises, so that it does not result in higher green costs resulting overall loss. It is clear from the literature that most of the research on the green logistics is based on exploring and reducing the ecological impact of various industrial emissions in non-Indian context (Geerlings and Van Duin, 2011; McKinnon, 2003, 2007; Aronsson and Hüge, 2006). Therefore, this research is aimed to cater the Indian manufacturing scenario by evaluating available alternatives to green packaging and green production thus to justify the adaptation using analytical hierarchy process (AHP) through a case study. The AHP approach has been used to select the suitable alternatives in terms of green initiatives for assembly and packaging operations in an automobile company.

The main objectives of this study are:

- Studying assembly and packaging operations in context to automotive organizations.
- Finding ways to make the above processes environment friendly i.e. implementing the green initiatives without sacrificing the efficiency and economy of the organization.
- Evaluating all alternatives on the basis of cost (Benefit-cost analysis).

The remainder of the paper is organized as follows. Section 2 gives the description and profile of the Case Company. Section 3 gives the description of the approach and framework followed in the paper. Section 4 underlines results and appropriate discussion. Finally, conclusion and future scope are presented in Section 5.

## 2. Profile of organization

XYZ Pvt. Ltd. is a 100% subsidiary of a Japanese automobile company, which is a leading name in automobile industry across the globe. It is one of the major two wheeler manufacturers in the world. It is manufacturing a wide variety of products in automobile and power sectors. XYZ Ltd. is engaged in manufacturing of two wheelers in India since March 2001. The factory is spread over 210,000 sq. Meters with a covered area of about 102,808 sq. meters (49%) at Manesar in Gurgaon district of Haryana (Delhi-NCR), India. The current installed capacity is 1,647,000 two wheelers per year, which accounts for 675,000 scooters & 972,000 motorcycles. The

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