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Green logistics at Eroski: A case study

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ABSTRACT

In today's highly competitive environment, *green* logistics issues are gaining interest. This paper analyses how logistics managers could lead the initiative in this area by incorporating environmental management principles into their daily decision-making process. A case study is given to show how they can turn practices into *green* while simultaneously meet the efficiency objectives. We have chosen one of the leader companies of the Spanish food distribution sector to check this hypothesis. The study covers the introduction of several changes into its fleet management and the implementation of a methodology to solve vehicle routing problems with environmental criteria minimisation.

1. Introduction

In today's highly competitive environment, *green* logistics issues are gaining interest. Nevertheless, it is not easy to find literature references on this topic (Richardson, 2001). In fact, the literature review shows that this topic was not discussed until 1990 (Srivastava, 2007), when *green logistics* was considered as a relevant social and economical issue. This paper mainly focuses on studying how companies can have positive environmental effects by making some operational changes in their logistics system. There are different perspectives and theories to approach the topic, but there is a lack of research into case studies. Therefore, further research into case studies is necessary to validate those theories (Aronsson and Brodin, 2006). For that reason, this paper uses an example of a case study to discuss how *green* practices can achieve both economic and environmental objectives.

Since the early 1990s environmental regulations and consumer pressures have encouraged many companies to add the environmental component to supply chain management (Wu and Dunn, 1995). In the past, organizations divided responsibility to ensure environmental excellence among activities in product development, process design, operations, logistics, marketing, and waste management. Currently, trends call for integration of environmental management with ongoing operations (Srivastava, 2007). This not only increases complexity in the chain but also may equally lead to conflicting interest between economic and ecological requirements (Ebinger et al., 2006).

Environmental issues can impact on numerous logistical decisions throughout the supply chain such as location, sourcing of raw material, modal selection, and transport planning, among others (Wu and Dunn, 1995). Most researchers seem to be worried either about exploring ways to achieve environmentally sustainable logistics practices and about determining strategies considered as most cost-effective for managing and responding to environmental issues in logistics. Therefore, decisions regarding these activities at strategic, tactical, and operational level will determine the environmental impact (Quariguasi Frota Neo et al., 2008). Nevertheless, there are many cases in which effects of changes at operational and tactical levels clash with objectives at a strategic level (Kohn and Bodin, 2007).

In this paper, we concentrate in transportation, which is one important aspect at the operational level of *green* logistics. The activity of transport causes a high rate of negative effects on the environment, such as pollution, noise or congestion. Thus, an efficient use of transport resources, which aimed at the selection of vehicle types, the scheduling of deliveries, consolidation of freight flows and selection of type of fuel, among others, can help to mitigate these problems. Nevertheless, these decisions also represent company strategic responses to a set of factors such as external influences, company demographics (size and nature of business, and internal policy) and available technology (Kam et al., 2006).

Different authors have suggested a set of environmental practices that focuses specifically on logistics both from the purchasing management (Carter and Dresner, 2001; Bowen et al., 2001) and from supply chain perspectives (Zhu and Sarkis, 2004; Sheu et al., 2005), where transportation is one of the aspects taken into account. Included here are measures aimed at prioritising shipment consolidation in planning and programming of flows, and at choosing less polluting forms of transportation, among

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others (McKinnon, 2000; Schade and Schade, 2005; Zachariadis, 2005). Also there are other authors who focus their research on evaluating the external effects of transport to internalise them through taxation (Bickel et al., 2006; McKinnon, 2006; Ubeda et al., 2006). As a result, companies would have to absorb those extra charges into fleet costs, thereby enhancing their motivation to find ways to reduce their CO_2 emissions.

This paper studies the decisions made at an operational level to reduce the environmental impact of transport activities at Eroski Group (hereafter referred as Eroski). It discusses ways to optimise its fleet efficiency and examines the impact of those practices on the profitability of its operations and on the environment. This is followed by a description of a methodology to design green transport routes. The paper finally presents some concluding comments and suggestions for further research.

2. Case study: greening Eroski

Eroski, a leading name in the food distribution sector in Spain, began its activity in 1969 with only 88 workers. Now, after 35 years, Eroski has generated more than 30,000 jobs and manages around 2000 establishments. In 2006, Eroski has consolidated sales mark over €6400 million. The causes for this success were, among others, the improved competitiveness of the company sales outlets, an efficient management of the firm, and a strong contribution of the ALIDIS International Alliance[1] .

Similarly, Eroski fosters a vocation to social responsibility and environmental-friendly management. Ever since its creation, the group work on sustainable development initiatives and participate as a member with full rights in the World Agreement promoted by the United Nations. Recently, in 2005, Eroski created a discussion group within their strategic planning towards year 2008, called *Green Transport Forum*, whose main goal was the reduction of the environmental impact of their transportation activities.

To that effect, the forum works on the identification of *green* operations, the evaluation of them and, if these initiatives show promising results, the group work on them. During 2006–2007, *Green Transport Forum* focused mainly on developing several pilot tests to tackle environmental problems related to the following fields: (a) use of alternative fuels in its fleets, (b) study and re-design of its urban distribution, and (c) reduction of the emissions related to its regional/national distribution network (see at the Spanish website www.imac.unavarra.es/ftv).

In this paper, we are focusing on what concerns to the third field, namely on the reduction of its environmental impact by optimising its fleet planning. Thus, we propose several changes in how they manage their logistics systems such as (i) improving delivery routes scheduling; (ii) reducing the number of trips by adding backhaul movements; and (iii) develop an environmental friendly method to solve routing problems.

We will show the implementation of these practices on the delivery activity of Eroski in the region of Navarre sited in Northern Spain (see Fig. 1). In this region, the distribution network of Eroski consists of 15 delivery points served directly from depot located in Elorrio. Then, Eroski's depot (Elorrio) stocks up on 25 suppliers sited in the surroundings areas. Generally speaking, data follows a regular trend, except during the holidays. Thus, we have studied those delivery processes taking data from one concrete month (1st–28th May 2006).

[1] In September 2002, Eroski and Les Mousquetaires Group, the third biggest European operator, launched the International Distributor's Alliance, ALIDIS, with the purpose of grouping independent distributors not quoted on the share market to improve their market position. In 2005, the two groups making up ALIDIS approved the incorporation of Edeka, a leader in the German distribution industry.

3. Methodology

In this section, we describe the methods use to develop the proposed changes: (i) delivery re-scheduling; (ii) backhauling; and (iii) environmental optimisation. The objective in the first and second initiatives is to find out the optimal number of trips that minimize the total amount of kilometres driven. Fleet optimisation is expected to increase the fleet efficiency and, consequently, reduce the amount of CO_2 emissions (Christie and Satir, 2006; Sbihi and Eglese, 2007a,b). Furthermore, a reduction in empty-running would yield significant environmental benefits (McKinnon, 2000). To avoid this form of vehicle under-utilisation, companies should introduce initiatives to increase backhauling, which permit an additional distance reduction and, therefore, greater energetic efficiency and less environmental impact (Wu and Dunn, 1995; Handyside, 2006). On the other hand, the goal of the third part of the case study is to solve routing problems calculating the cleanest routes. This means designing a methodology that incorporates those routes that minimize CO_2 emissions. Common to all three initiatives is the estimation of CO_2 emissions generated by trucks. This is the subject to which we turn next.

3.1. Evaluating the environmental impact

The estimation of fuel consumption and CO_2 emission for mobile sources requires complex calculations, which can only represent an approximation because of the difficulty of quantifying some variables as driving style, weather conditions, congestion, and the like (Palmer, 2007, Van Woensel et al., 2001). Current research calls for either a fuel-based or distance-based methodology to calculate CO_2 emissions (Palmer, 2007). Table 1, based on The Greenhouse Gas Protocol Initiative (2005) approach, lists some criteria for determining the feasibility for each approach. On the one hand, in the fuel-based approach, fuel consumption is multiplied by the CO_2 emission factor for each fuel type. On the other hand, in the distance-based method, emissions can be calculated by using distance-based emission factors. The fuel-based emission factor is developed based on the fuel's heat content, the fraction of carbon in the fuel that is oxidized, and the carbon content coefficient. Distance-based approach can be used when vehicle activity data is in form of distance travelled but fuel economy factors are not available. The decision on which approach to take depends mainly on data availability.

For these reasons, we are applying a distance-based method for calculating CO_2 emissions, which is based on distance travelled and distance-based emission factors. This requires two main steps: (a) collection of the data on distance travelled by vehicle type and fuel type (e.g. kilometre or ton-kilometre) and (b) conversion of the distance estimates to CO_2 emissions by multiplying the results obtained from (a) by distance-based emission factors.

Our calculations of CO_2 emissions from Eroski are based on the assumption that all carbon burned as fuel is mostly emitted as carbon dioxide (CO_2). Then, we assume that this calculation is primarily dependent only on two factors. They are the type and quantity of fuel consumed. As well, this means that emissions are a function of two factors, namely type of transportation (i.e. the vehicle and its load) and the distance travelled (Ferreti et al., 2007). Nevertheless, CO_2 emissions estimations vary according to the mass of the vehicle and therefore the load carried is an important parameter (McKinnon, 2007).

The estimation of emission factor is carried out following two main steps as illustrated in Table 2. The first one consists on