Improvement of the Logistics and Transport Operations of an Integrated Waste Management Company - Application to a Real Case in Portugal

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Abstract
One of the strategies of companies today is, instead of directing their investments on expanding the business, focus more on cost rationalization and business transformation, in order to improve performance and reduce operating costs. In this sense, logistics represents a key function in improving the operations related to the transportation and storage of materials, always focusing on reducing costs and providing a superior level of service. In this work, we analyze the functioning of the Portuguese waste management company "Ambitrena - Valorization and Management of Waste, S.A.", with the objective of understanding the operation methods in relation to the logistic service provided. The service is represented by the decentralization of its parks and lack of effective communication between areas, often resulting in inefficient services, and therefore we intend to analyze a possible optimization of the management of logistics operations. A study will be carried out (data collection was performed through unstructured interviews, non-participative direct observation in the company's parks, and through consultation and analysis of various written documents) on what could be the new structural configuration (centralized configuration) of the company's logistics service. Finally, we present a proposal for centralization of logistics operations in order to reduce the cost of cargo transportation, improve the logistics performance of the company, and its customer service. The centralization of logistics management can positively reduce logistical costs by concentrating information and decision-making in the Lisbon park, will allow for better coordination and planning, and transversally to reduce inactive vehicle time.

Keywords: Waste management, Logistics, Transportation, Centralization, Coordination

Introduction

It is a fact that companies are achieving significant competitive advantages by the way they configure and manage their supply chain operations (Chase, Jacobs & Aquilano, 2006). The supply chain is a channel that extends from raw materials to processed products to end customers, through components that serve to complete the same products (Kotler & Keller, 2012). Its management involves understanding the interconnectedness of the companies that relate to each other through upstream and downstream connections, that is, from the supplier of the raw material to the end customer, and of the processes that produce value in the form of products and services (Slack, Chambers & Johnston, 2010).

Logistics, as one of the activities of the supply chain process, plays a very important role in improving business efficiency. According to the Council of Supply Chain Management Professionals (2010), it brings together the planning process, implementation and control of procedures for an effective and efficient transport and storage of goods, including the related services and information, from the point of origin to the point of consumption, according to customer requirements.

Transportation is the operational area of logistics that moves and positions the stock geographically. Because of its fundamental importance and perceived cost, transportation has traditionally received a considerable amount of attention from management, with almost all companies, large or small, having transportation managers (Bowersox, Cooper, Closs & Bowersox, 2012; Soares & Mendes, 2017).

In this article, we intend to analyze a possible optimization of the logistics operations management of the Portuguese company *Ambitrena - Valorização e Gestão de Resíduos, S.A.* (hereinafter referred to as Ambitrena).

Although the huge increase in global competition may justify opting for decentralization, the main objective of this work is to lower total costs, making Ambitrena's transportation network more efficient by centralizing logistics management, while maintaining the level of service provided. Therefore, the following objectives are considered for this work:

a) Concentrate planning and coordination decisions of the logistics service, while maintaining distributive readiness, capacity and flexibility;

b) Reduce vehicle downtime and consequently the number of vehicles necessary, confirming the reduction of costs with cargo transportation.

Literature review and research questions

Logistics undoubtedly contributes to a good organizational performance. Studies addressing its influence have shown that the good performance of logistics activities is associated with better organizational performance (Green, Whitten & Inman, 2008; Fugate, Mentzer & Stank, 2010).

Smith (2000), cited by Fugate et al. (2010), defines logistic performance as encompassing efficiency, effectiveness and differentiation, and in line with this

definition, some studies have assumed that efficiency and effectiveness are mutually exclusive. Mahoney (1988), cited by Fugate et al. (2010), argues that there is a clash between efficiency and effectiveness, so companies can only be either efficient or effective.

Another study (Selldin & Olhager, 2007) finds that companies that select supply chains of only one of the dimensions have an inferior financial performance compared to their competitors who choose efficient and effective chains. Therefore, companies should try to achieve both dimensions simultaneously, and should not regard efficiency and effectiveness performance as inversely related.

The empirical investigation by Fugate et al. (2010) indicates that efficiency and effectiveness reinforce each other, and that trying to achieve one does not preclude achieving the other. That said, logistics managers should not have to choose between efficiency, effectiveness and differentiation, but rather, they must achieve all three together, which could make managers more innovative and lead to the development of strategies to overcome these differences. The authors also emphasize the fact that managers should systematically check the logistics results obtained by other companies in the same market sector and compare their logistics activities.

According to Johnson, Scholes and Whittington (2009), and Soares and Mendes (2018), logistics as a primary value chain activity may include the reception, storage and distribution of inputs for the product or service, material handling, stock controls, transportation, storage of outputs or product distribution.

Due to companies' desire to achieve economies of scale, achieved by specialized companies, as well as to satisfy customer demand for shorter and more tailored delivery times, distribution has become an important factor in logistics (Claesson & Hilletofth, 2011). According to Ford, Gadde, Hakansson and Snehota (2003), distribution provides the company with the logistics part that solves the problem of where, when and how often, the customer needs to receive the product or service of a particular offer. In contrast, appropriate adaptations to individual needs are increasingly needed.

According to Madadi, Kurz and Ashayeri (2010), and Bowersox et al. (2012), more than 50 per cent of total logistics costs can be attributed to transportation, an aspect also considered by Ballou (2004) when stating that the most significant element for most companies in terms of logistics costs is transportation. Transportation reduced cost also contributes to lower product prices because it is a component of the total cost of production. As its efficiency increases and offers better performance, both the company and the customer benefit (Ballou, 2004; Bowersox et al., 2012). Efficiency, according to Fugate et al. (2010), refers to the proportion of resources used for the results obtained, and is considered the ability to provide the desired products or services at a cost level that is acceptable to the customer. In a broader sense, it is the ability of the logistics function to manage resources in the best way.

As Selldin and Olhager (2007) point out, companies strive to achieve the best possible performance by increasing information sharing, planning tools, collaboration in forecasting and replenishment or by using third parties.

Hayes, Pisano, Upton and Wheelwright (2005) state that in centralized approaches, standardization of critical operational decisions can improve communication and coordination in the network. Standardization of information systems, databases and other protocols can also help facilitate the exchange of necessary information. The benefits of standardization seem obvious, but in the authors' research there are several examples where facilities are unable to share planning information or basic information due to incompatible information systems.

The network perspective presented by Ford et al. (2003), shows that, depending on the conditions, companies can resort to intermediaries efficiently and at low cost. The authors define network as the result of the choices made by all the companies involved in a given period of time, which makes obsolete the idea of a single channel. There may be a centralization of distribution, which is controlled or managed by a single entity, however, the efficiency of the distribution network is dependent on the activities of the various entities that compose it, and so it cannot be determined by optimizing only the delivery of an entity.

For a buyer, a better shipping service means the prospect of maintaining lower stock levels and/or greater certainty of achieving their operational schedule. The buyer may choose to buy more from the supplier that offers him the best transportation service, so increasing turnover can offset the costs of a better transportation service (Ballou, 2004). On the other hand, according to Melo, Nickel and Saldanha-da-Gama (2009), it may not always be attractive for a company to satisfy all demand, which happens when the maintenance of certain customers generates lower revenues than the corresponding costs. In addition, in some cases a company may intentionally lose customers when the costs to maintain them are too high.

Ghiani, Laporte and Musmanno (2004) argue that a decentralized storage structure can reduce lead times, as they are usually closer to customers. On the other hand, centralized storage is characterized by low installation costs due to greater economies of scale. In addition, it may be the case that the safety stock imposed by a centralized structure is significantly smaller than the sum of safety stocks in a decentralized structure (Ghiani et al., 2004; Özen, Sošić and Slikker, 2012).

According to Ballou (2004), with regard to transportation, when the volume of cargo is significant, having a service of the company may eventually become more economic than outsourcing. However, some companies are forced to have their own transportation, even at higher costs, because they have special needs such as fast, reliable delivery, special equipment that is rare in the market, specialized cargo handling or a service that is always available.

Soares (1994, 2003) considers that the most relevant trends for the future are the increase of quality in service companies, due to the increasing weight of services in the current economy, and the extension of quality operations to all functions and hierarchical levels of an organization.

Ballou (2004), and Moon, Cha and Lee (2011) argue that among some strategies, cargo consolidation, as a result of the economies of scale that are present in the cost-freight structure, may be a strategy to be adopted in logistics planning. Orders from customers arriving at a warehouse could be combined with orders arriving later,

which means a reduction in average shipment costs. The potential reduction in customer satisfaction resulting from lengthening delivery times would have to be offset by the cost-benefit of order consolidation. Bowersox et al. (2012) ensure that, as a rule, the larger the load and the longer the distance it is transported, the lower the cost per unit, and consolidation requires innovative programs to combine small loads into consolidated and on-time movements.

According to Kim (2012) and Saharidis, Kouikoglou and Dallery (2009), coordination and control of production and inventory can be beneficial for the whole chain. Madadi et al. (2010) and Özen et al. (2012) mention in their studies that collaboration between buyers and the supplier or applying collective orders results in lower costs when compared to a decentralized strategy. However, according to Arshinder and Deshmukh (2008), lack of coordination can result in poor supply chain performance. The consequences result in inaccurate forecasts, low capacity utilization, excessive stocks, inadequate customer service and high costs and response time.

According to Federgruen (1993), the centralization of orders, even in the absence of centralized stock, enables economies of scale in order costs and allows a better observation of demand behavior over a given period of time, which may facilitate a quick and flexible response, as well as the decision on future tasks to be assigned to each warehouse.

Mintzberg (1993), Baligh (2006), Lee and Jeong (2010) and Wong, Ormiston and Tetlock (2011) argue that centralized structure allows decision making to be located in one part of the organization, while decision making in a decentralized structure is dispersed among many people in the organization.

According to Hayes et al. (2005), companies can centralize all critical operational decisions and dictate standard policies and procedures for all facilities. However, there is a difficulty in finding the appropriate intermediation between centralization and decentralization, which is usually a source of intense disagreement between facility managers and corporate directors (who prefer a more centralized approach).

Haeys et al. (2005) and Salcedo, Hernandez, Vilanova and Cuartas (2013) report that centralized management is most appropriate when facilities produce similar products, serve similar customers, value homogeneity, and operate in environments with similar constraints. The centralized framework can enable the company to exploit learning curve economies and improve process performance more efficiently than decentralized frameworks. In contrast, Baligh (2006) and Lee and Jeong (2010) argue that the fact that decision-making in a centralized structure is dependent on an individual, it can lead to delays in task completion, due to the necessary bureaucracy.

The analysis by Dutta and Fan (2012) identifies that the main differences between the two forms of organizational structure are that, in a centralized system, the company can install a central monitoring system to collect information on departmental investment opportunities, while in decentralized systems innovation is greater.

The demand for fast and accurate responses in cargo transportation often causes conflicts in companies, even more so when communication is not fluid. Centralized structures typically allow for greater efficiency and decision control, suitable for small

businesses with facilities operating in similar environments, but on the other hand, decentralized structures generally allow for greater flexibility and greater innovation, which is convenient for larger companies.

There should be an appropriate balance, as there are neither fully centralized nor completely decentralized companies, and it is up to managers to find the balance in the definition and implementation of organizational policy, according to the pressures of the internal and external environments of the company.

Research question

After reviewing the literature and taking into account the objective of this case study, it was decided to propose to Ambitrena a change in its structure, namely centralizing the logistic management, in order to concentrate the route planning decisions.

In order to achieve the goals defined, it was decided to develop a descriptive and exploratory work. Qualitative data was performed through unstructured interviews with the managing director and traffic chiefs, direct observation in the parks and through the observation of various written documents, about which the company requested confidentiality. Based on the literature review, it was possible to identify a problem in the logistics operations of the company under study, and subsequently to present a reorganization proposal in order to reduce costs.

Therefore, this study aims essentially to answer the following research question:

- How can the management of Logistics Operations of Ambitrena S.A. be optimized?

Methodology

In order to achieve the goals defined, it was decided to develop a descriptive and exploratory work. The collection of qualitative data was done through unstructured interviews with the CEO and traffic chiefs, direct observation at Ambitrena parks, and through the observation of various written documents. Based on the literature review, it was possible to identify a problem in the logistics operations of the case under study, and subsequently to present a reorganization proposal in order to reduce costs.

Ambitrena's logistics service consists of collecting containers, exchanging filled containers for empty ones, transporting, depositing and storing residual waste in Ambitrena's parks for their treatment, recovery and forwarding. The residual waste is subjected to sorting, compaction or transformation processes and is sent to recycling and/or energy recovery units, as shown in Figure 1.

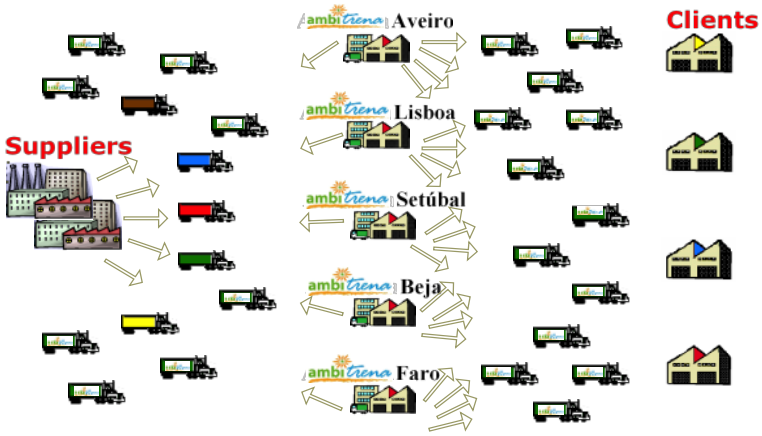

Figure 1 – Current scheme of operation of Ambitrena
Source: Ambitrena

The company has different types of vehicles equipped and adapted for the collection and transportation of the various wastes, with 35 light vehicles, 40 heavy vehicles and 35 industrial machines, distributed in the various parks. Transportation services are designed to optimize company resources, that is, it is constantly tried that vehicles have little vacant time and transport cargo on the round trip, which is not always the case.

It is found that in the logistics area there is a great waste of resources concerning the lack of efficiency and profitability of vehicles. This inefficiency and lack of profitability is further affected by the lack of communication and coordination of services, notably by overlapping tasks, as the same tasks are performed by several people, which tends to cause overlapping double messages, and congest the communication channels.

Frequently, the greatest problem is related to the inaccuracy of the information provided and the lack of cooperation, which leads to the incorrect dimensioning of the operations. Being frequently the case where Ambitrena vehicles carry waste from a park to a management entity, and without considering requests for collection of waste in the same area, new vehicles are sent to respond to this request.

Results analysis and discussion

New or improved processes help companies to minimize threats and seize opportunities. According to Ballou (2004) and Hayes et al. (2005), there is no approach that works equally well in all organizations, or in all situations.

Maintenance and management of decentralized storage, as pointed out by Ghiani et al. (2004), allows Ambitrena to be closer to its suppliers/customers, reducing the collection/delivery times, thus maintaining the level of service.

After centralizing the management of the company's logistics activities, as proposed, and if there is a correct sharing of information, it is expected that the logistics department based at the Lisbon Waste Reception Center would be able to make all decisions regarding the cargo transportation planning and to meet all needs (Mintzberg, 1993; Baligh, 2006; Lee & Jeong, 2010; Wong et al., 2011), so that economies of scale are attained in order costs (Federgruen, 1993).

In addition, learning curve economies could be more efficiently exploited, process performance improved (Haeys et al., 2005; Salcedo et al., 2013) and downtime of all vehicles reduced (Ballou , 2004; Moon et al., 2011). As such, a significant reduction in transport costs is expected, which may subsequently reduce transportation prices, thus obtaining a competitive advantage over competition.

Logistics services have traditionally been evaluated in terms of product cycle speed (e.g. delivery time), order cycle consistency (e.g. delays) and product availability index (e.g. shortages), thus the cost-benefit of cargo consolidation would have to compensate for the potential reduction in these indicators, being the flexibility obtained through better management (Ballou, 2004; Moon et al., 2011).

The logistics department in Lisbon, by obtaining the weekly plans sent by the traffic chiefs, will be able to reach a joint forecast, thus extracting greater benefits, according to Özen et al. (2012).

Note that the decision to change the design of the logistics system has implications for the organizational learning path that will be created. Consideration should also be given to the possible appearance of friction within the company, represented by a major change in the roles and responsibilities of park traffic managers. Part of the reason for the conflict may be that traffic bosses are afraid of losing influence (Aghion & Tirole, 1997). In order to better manage these risks, it will be important to promote a spirit of dialogue and collaboration, desirably subject to continuous improvement actions, as communication is one of the crucial aspects for success.

Conclusions and recommendations

The results obtained allow us to propose to the company the gradual centralization of logistics management operations, to progressively consolidate the efficient management of all parks, paying particular attention to human resources and subsequent performance measurement, to check whether the centralization policy has had a positive impact.

Therefore, the centralization of logistics management can positively reduce logistical costs by concentrating information and decision-making in the Lisbon park, will allow for better coordination and planning, and transversally to reduce inactive vehicle time. The following theoretical optimization proposal was then presented.

Theoretical optimization proposal

Given the objectives and limitations of the case presented and after literature review, it is considered that the best hypothesis is the change in the company's structure, in order to improve the planning, management and definition of routes and services. This

change is based on a route planning problem for a diverse fleet of vehicles that is too decentralized, rather than being shared and planned together. Suppliers and customers to be visited may have a certain amount of waste to be collected and another to be delivered, and as they should be visited only once, the collection and delivery should be done by a single vehicle, so that there is better use of resources.

Therefore, and since the facilities serve similar entities and operate in identical environments, the centralized management of logistics operations (Hayes et al., 2005; Salcedo et al., 2013) in the Lisbon park can be considered as a better hypothesis, as shown in Figure 2.

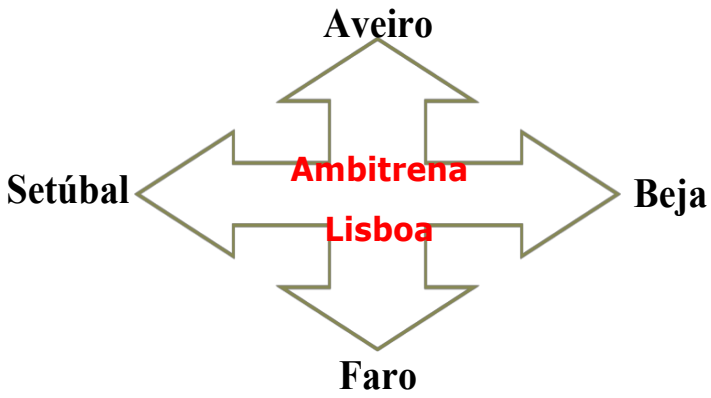

Figure 2 - Theoretical optimization proposal
Source: Authors

We can conclude by stating that one of the limitations of this work concerns the impossibility of analyzing the costs of the decentralized park management.

Following the proposal, additional work should be developed, including the development of a route optimization model, the ideal number of vehicles needed to carry out the trips, the total distance to travel and the time spent.

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