

# Cross – Docking A Successful Method in Warehouses: A Case Study of a 3PL Provider

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## Abstract

Aiming to minimize transportation costs and increase supply chain effectiveness, methods, such as cross-docking, have been developed. Cross – docking enhances lean manufacturing, through minimization of time wasted, equipment, labor, thus optimizing the distribution process. The factors that have to be considered, so that cross-docking is properly implemented, are the effective products' and information flow, the use of information technology, the distance between suppliers and their customers, the location of the cross-docking terminal, the coordination between inbound and outbound flows and the demanded quantity of goods. Advantages of cross-docking are the decrease in overall supply chain cost, decrease in the cycle time of order, improved customer service, reduction in inventory and storage space. Nevertheless, cross-docking is not always suitable for all organizations. The establishment of advanced, and thus expensive, information technology constitutes an obstacle. The effectiveness of cross-docking can be evaluated through simulation techniques and advanced tailor-made software, so as to meet the needs and the requirements of each company. This paper investigates the operational aspects of a cross-docking system, by analyzing the case of a 3PL provider, operating in Thessaloniki. The aim of the paper is to discuss the effectiveness of cross docking implemented by a leading company in outsourcing.

**Keywords:** *cross- docking, lean manufacturing, shipment, 3PL providers.*

## 1. Introduction

In comparison to the recent past, the role of supply chain management has been upgraded and shifted from a strict coordination between supplies, production, storage and shipment to a complicated system dealing with all the functions of supply chain. According to Martin (2005), supply chain is a system which consists of processes or functions, which in turn are analyzed into both activities and items. The ultimate purpose of this system is the decrease in supply chain costs and the improvement of customer service.

Consequently, it becomes apparent that the organizations always try to find ways to increase the profitability of supply chains and decrease logistics costs. Within this framework, three methods of decreasing the cost of supply chain management have been developed: a) distribution network optimization,

b) shipment consolidation, and c) cross – docking (Gümüő and Bookbinder, 2004). This paper deals with the third method, namely the method of cross – docking.

The basic idea behind cross – docking is the directly shipment of finished goods from the production line, without having these items stored in a warehouse. In fact, the primary objective of the cross – docking method is to enable the integration of shipments of different size to a unique shipment with full truck loads, so that transportation costs can be minimized.

The present paper tries to investigate the role of cross – docking management in the framework of the supply chain management and how it can be a competitive offered service for 3PL companies. This study aims at exploring the impact of cross – docking on 3PL, the factors that contribute to its effective implementation and operation, as well as the obstacles that exist in its use, which in the future should be solved in order 3PL companies to gain maximum competitiveness from using it. Based on the objectives of the paper, the study of the available international literature and the case study of a leading 3PL company, the research questions that this research will try to answer are the following:

1. What are the factors that contribute to the effective implementation of cross – docking method for 3PL companies?
2. What can the adoption of cross – docking offer to a company?
3. What are the obstacles that exist in the effective implementation of the cross – docking method for 3PL?
4. How can a company achieve better costs through its supply chain by using cross-docking?

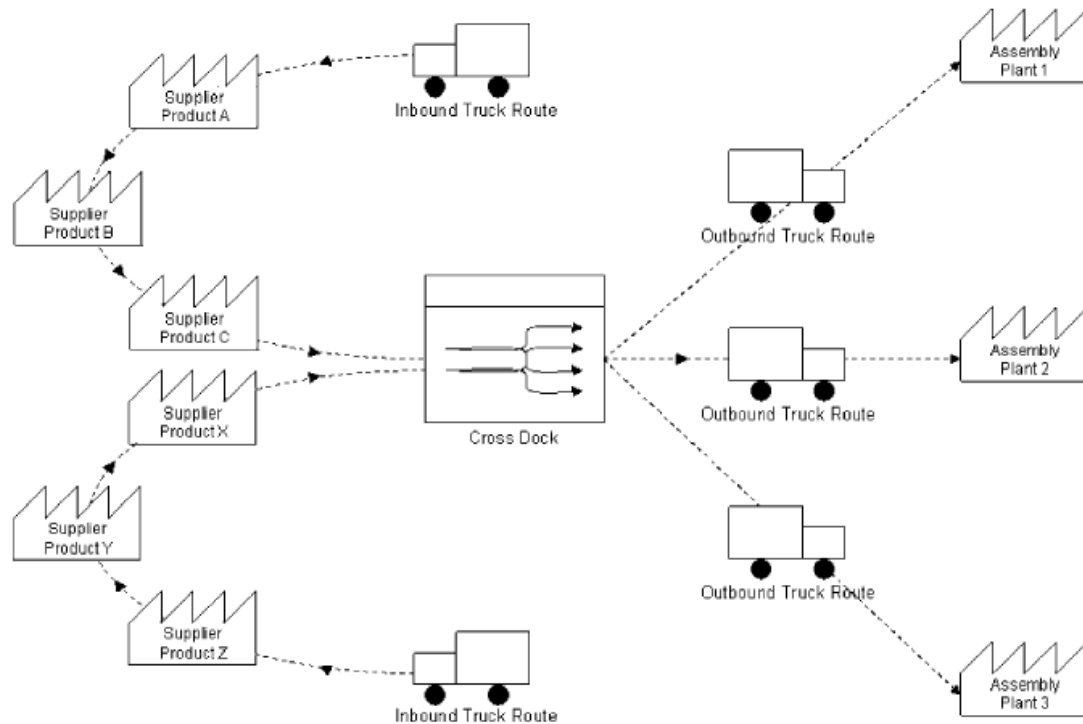
## **2. Prior Research**

Casadesus and Castro (2005) mention that the improvement of an organization’s quality has a positive impact on the improvement of supply chain effectiveness. More precisely, five methods regarding the increase of supply chain’s effectiveness are discussed: stock management, the relationship between the organization and its suppliers, the increase of response time to the customers, the creation of a competitive advantage, the introduction of technology and the enhancement of communications technology. However, the development of ways that minimize the cost of supply chain is not mentioned. Similarly, many other researchers (such as Fynes and Voss, 2002; Olhager and Selldin, 2004; Romano, 2002; Wong, 2003; Zineldin, 2004) do not mention cross – docking when they analyse the factors that contribute to the effectiveness and excellence of supply chain management. As a result, the lack of many researches with regard to cross – docking, as well as its importance in logistics have raised the interest for the conduction of this research.

According to Gümüő and Bookbinder (2004, p. 200) “cross – docking is the practice of receiving goods and quickly processing them for reshipment (minimum handling, no storage)”. Waller et al. (2006, p. 359) defines cross – docking as a process where “warehouses function as inventory coordination points rather than inventory storage points. In typical cross-docking systems, goods arrive at warehouses from the manufacturer, are transferred to vehicles serving the retailers, and are delivered to the retailers as rapidly as possible”.

Boysen and Fliedner (2010, p. 413) describe the cross docking terminal as “an intermediate node in a distribution network which is exclusively dedicated to the transshipment of truck loads”. According to another definition “cross docking involves the movement of material directly from the receiving dock to the shipping dock with a minimum dwell time in between” (Apte and Viswanathan, 2000, p. 291). The operation of a cross – docking network is depicted in the following figure.

**Figure 1.** Cross – docking network



Source: Reeves, 2007, p. 456

As a result, in comparison to a traditional warehouse, in a cross – docking warehouse the products flow almost directly, or within a short period of time, from the supplier to the customer(s) without being stored, they are not recorded as inventory and there is no need to be relabeled or repacked (Apte and Viswanathan, 2000; Boysen et al., 2010).

Reeves (2007, p. 456) states that “a cross dock is simply an intermediate staging area for freight”. In fact, cross – docking is a solution to the problem that many organizations have with regard to their shipment of finished goods, within the concept of lean manufacturing. As Reeves (2007, p. 456) points out, “one of the fundamental tenets of lean manufacturing is the use of small batch sizes and just-in-time deliveries of materials directly to the point of use on the assembly line”. Lean manufacturing is based on the continuous improvement and the reduction of waste in all aspects of production process: time, raw materials, equipment (Quintero and Zwirko, 2008). According to George (2003), lean manufacturing focuses on the maximization of the process speed, by decreasing all the potential wastes. However, the problem with which many organizations come up is that when

the distance between suppliers and customers is increasing, the organization finds it difficult to succeed in an effective and direct shipment with low cost. The method of cross – docking is addressing this problem.

As Schaffer (2000, cited by Gümüş and Bookbinder, 2004, p. 200) points out, there are three methods of cross – docking in supply chains. The first method is manufacturing cross – docking. This method is distinguished between ‘current’, where the products that are finished are moving from the production line directly to the waiting truck and ‘future’, where the products finished are stored in order to ship later. The second method is the distribution center cross-docking. This method has three categories: a) ‘current / active’, where finished products are loaded directly to a vehicle, b) ‘current / same’, where finished products are stored in a conveyor to ship later but at the same day and finally c) ‘future’, where finished products are stored until they are categorized as ‘current / same’. The third method is the terminal cross – docking, where “products from various DCs are sent to a break-bulk terminal for shipment of mixed loads to customers”.

From the above analysis one can conclude that knowing where and how to eliminate waste is very important for the operation of supply chain, based on the principles of lean manufacturing. In order to effectively operate the supply chain, many companies prefer to invest in outsourcing with regard to some or all the functions of the supply chain to other companies, known as third – party – logistics providers (3PL) (Cain, 2009). The outsourcing of some or all the functions of the supply chain to a 3PL results in an important increase in the operations of the supply chain, since “cross – docking enables a 3PL to move your inventory from receiving to shipping with no interim storage, drastically reducing storage and warehousing costs”, while at the same time “cross – docking allows 3PLs to facilitate fast replenishment of goods” (Cain, 2009, p. 1). Another advantage of 3PLs is that trucks are always available when needed (Charkhgard and Tabar, 2011). As a result, a 3PL provider results in an increase in the overall efficiency of the supply chain, through its contribution to the overall efficiency of the warehouse’s operation; thus it allows the organizations to achieve higher profit margins (Cain, 2006). The following figure depicts some examples of 3PLs contribution to the warehouse’s efficiency.

**A recurring cause of warehousing inefficiency is the poor use of warehousing space, which causes companies to invest in more warehouse area than they actually need.**

**A 3PL can implement strategies to maximize warehouse space, such as: racking, mezzanines, conveyors, and multiple levels which will decrease the overall warehousing cost.**

**The implementation of an efficient stock locating system, as well as timely restocking systems, may be incorporated to ensure that no time is lost attempting to locate missing product, or searching for a product that has not been restocked**

Source: Cain, 2006, p. 1

## **2.1 Factors that contribute to the effective implementation of cross – docking**

The effective implementation of cross-docking has been studied by numerous researchers. The factors that have been identified are mentioned in Table 1 below.

**Table 1. Factors for effective implementation of cross – docking**

<b>Authors</b>	<b>Factors</b>
Apte and Viswanathan, (2000)	Successful handling
	Successful development of information technology
	Successful use of full track loads shipment
	Successful use of the appropriate plans and tools for management
	Advanced technology systems and communication technology
	Volume of business in the area
	Layout and design of receiving and shipping docks
	Accurate and in time flow of information
	Service required for each product
Boysen and Fliedner, (2010)	Schedule of the shipment
	Schedule of the shipment
	Layout of the cross dock terminal
	Product value
Van Belle et al., (2012)	Life cycle of the product
	Distance between the supplier and its

	customers
	Demanded quantity of goods

It should be mentioned that there is a need of implementing other innovations first, so as to effectively introduce the method of cross – docking, such as postponement, systems for the direct response to customers' demands, mass customization and good retail location (Apte and Viswanathan, 2000). Within this framework, Boysen et al. (2010, p. 135) argue that “the efficient operation of such a system requires an appropriate coordination of inbound and outbound trucks, e.g. by computerized scheduling procedures”.

## 2.2 Key elements and obstacles of cross – docking

The main advantage of cross – docking is the decrease in cost of supply chain (Gümüş and Bookbinder, 2004). This is achieved through the shipment of different orders at the same time – period. In addition to that, it has been estimated that with this method the products stay in storage for less than 12 hours (Waller et al., 2006). Boysen et al. (2010, p. 136) state that “economies in transportation cost can be realized by consolidating divergent shipments to full truckloads without depending on (enlarged) inventories at the cross dock”, concluding that the coordination between inbound and outbound flows is an important factor on which the effectiveness of cross – docking method is based.

The study of Apte and Viswanathan (2000) mention that another advantage of cross – docking is the decrease in the cycle time of order. This results in the improvement of both the responsiveness and the flexibility of the distribution network.

Apart from this, van Belle et al. (2012) mention that the use of cross – docking in comparison to the use of traditional distribution centers benefit an organization, since it allows improved customer service, reduction in the storage space, faster delivery of finished goods from the supplier to the customers, lower number of overstocks, lower risk of both damage and loss of products, as well as faster inventory turnover. Additionally, van Belle et al. (2012) state that cross – docking offers the following benefits compared to point-to-point deliveries: a) reduction in transportation cost, b) reduction in labor cost, c) shipment integration, d) improvement in the utilization of resources, such as full truck loads. Finally, the authors support that this method allows the organization to meet better the needs of customers regarding the quantities of shipments.

The benefit of improved customer service is also mentioned by some other researchers. For example, Gümüş and Bookbinder (2004) argue that the method of cross – docking aims at improving customer service, since cross – docking allows the organizations to transfer the products from their origin directly to their destination with a minimum dwell time in between (Apte and Viswanathan, 2000).

In addition to that, many researchers focus on the advantage that cross – docking offers with regard to the reduction caused in the organization's inventory (Apte and Viswanathan, 2000; Waller et al., 2006; Boysen et al.,

2010). Apart from this, the study of Waller et al. (2006) has indicated that since the retailer is not carrying inventory in the distribution center through the use of cross – docking, the retailer benefits from the bullwhip.

On the other hand, one main disadvantage of cross – docking is that the technology which is being used may be quite expensive (Apte and Viswanathan, 2000). In addition to that, when there is a distance between the warehouse and the distributions centers in retail supply chain, as well as when there are a lot of stores, then economies of scale have a negative impact and may outweigh the benefits of cross – docking. More precisely, the research of Waller et al. (2006) has reached to a relevant and interesting conclusion, by examining the inventory of retail supply chain. Given the fact that “cross-docking, by definition, takes cycle and safety stock out of the distribution center, allowing for more physical capacity for new product”, the more the number of stores that an organization has, the less the benefit of cross – docking. The justification behind this, is the fact that as the number of stores is increasing, the possibility that one store has higher demand in comparison to others is also increasing, resulting in economies of scale. As a result, economies of scale should be stable during time, so as cross – docking does not have a negative impact.

The above mentioned advantages and disadvantages are summarized in Table 2 below.

**Table 2. Advantages and disadvantages of cross-docking**

<b>Advantages of cross – docking</b>	<b>Disadvantages of cross – docking</b>
Decrease in cost of supply chain (Gümüş and Bookbinder, 2004)	Quite expensive technology (Apte and Viswanathan, 2000).
The products stay in storage for less than 12 hours, the retailer benefits from the bullwhip (Waller et al., 2006).	There is a distance between the warehouse and the distributions centers in retail supply chain and economies of scale have a negative impact (Waller et al., 2006).
Economies in transportation (Boysen et al., 2010).	The more the number of stores that an organization has, the less the benefit of cross – docking. (Waller et al., 2006).
Decrease in the cycle time of order (Apte and Viswanathan, 2000)	
Improvement of customer service, reduction in the storage space, faster delivery of finished goods from the supplier to the customers, lower number of overstocks, lower risk of both damage and loss of products, faster inventory turnover (Van Belle et al., 2012)	
The transfer of the products from their origin directly to their destination with a minimum dwell time in between (Gümüş and Bookbinder, 2004)	
Reduction in the organization’s inventory (Apte and Viswanathan, 2000; Waller et al., 2006; Boysen et al., 2010).	

### **2.3 Evaluation of cross – docking effectiveness**

The various alternatives regarding cross – docking techniques, as well as the result of the system can be evaluated through simulation techniques (Apte and Viswanathan, 2000). The information which is required in order to make a simulation technique includes: the layout of the equipment, the specifications of the equipment, flow charts for the product, the schedule regarding the receiving and shipment of products, and the capacity of the warehouse.

From the above analysis it can be assumed that the method of cross – docking results in a reduction in the logistic cost, since it leads to decreased transportation cost, increased delivery time of products from the suppliers to the costumers, without an increase in inventory (Sung and Song, 2003) and by improving customer service (Apte and Viswanathan, 2000). Apart from the reduction in transportation cost and in inventory holding, other advantages of cross – docking are the improved customer service, the shorter delivery time and the reduction in the storage space van Belle et al., 2012). In fact, cross – docking is related to the lean manufacturing, which focuses on the more frequently and faster deliverance of products, at the lowest cost, without any wastes in time, labor, and equipment.

## **3. Research Methodology**

The purpose of this study is to investigate whether the process of cross-docking represents an effective logistics practice, by interviewing, in depth, a representative of one of the leading 3PL providers in the region of Thessaloniki. The interview was enabled by a semi-structured questionnaire that was constructed based on the review of literature on the concept of cross-docking. The case study results are presented below. The type of interview, that took place in the firm's offices, was the interview in depth and the outcomes are figured out below. There is a research limitation, namely the fact that only one case study is analyzed, but this aims to present the strategy followed by the market leader.

### **3.1 Case Study**

#### *3.1.1 Company's profile*

The company has a long history in the field of logistics, representing one of the most competitive 3PL companies in Thessaloniki. The company's facilities include warehouses for both dry and cold storage, railway and cross dock facilities. Furthermore, the company owns both frigo and silo trailers, as well as liquid food tanks.

Besides the assets that support the logistics functions, cutting edge Information Technology has been adopted, including ERP, WMS, and wireless technology that facilitate prompt execution of warehouse tasks. Due to the upgraded skills of the IT department, an internal network has been developed, supporting on line information sharing. Further applications have been established, in order to handle routing issues, along with communication



and data exchange systems. The company focuses intensely on customer service, and therefore has established email, proxy, report intranet and file servers, trying to enhance internal circulation of information that reaches final customers.

Moreover, the company is committed to excellence and is certified according to ISO 9001:2008, ISO 22000:2005 (HACCP) and Safety & Quality Assessment System (SQAS), covering all business units.

The company's structure includes the finance, the technical and the new projects departments that are in line with the transportation, the warehousing and the marketing departments. Furthermore, it provides a variety of services, such as dry and cold storage, picking, distribution, repacking, reporting-invoicing, liquid- food transport, dry and frozen products transport, railway transport, office renting and cross-docking.

The company's clientele consists of well known multinational companies and major chains of super markets. The majority of products that are being handled include foodstuff under controlled temperature.

### *3.1.2 The cross-docking process of the 3PL Company*

The cross docking process is "considered to be of pivotal importance to the company under study, as it enables the cargo receipt and temporary storage in a loading area, waiting for loading on another truck within 24 hours", according to the interviewee. The cross docking process facilitates the prompt distribution of products that have short life cycle (fresh produce, chicken, eggs, fresh fish and dairy products). Thus, the companies that exploit this option can be categorized into food companies and super markets. In more detail, the process refers to the fact that products from various distribution centers are sent to the break-bulk terminal for shipment of mixed loads to customers.

But the process is mainly supportive, and not a primary one, as it depends on the customers' demand. Therefore, there is no dedicated personnel to this task, and the time between the customer order till the cargo shipment is only one day. The revenue percentage that is derived from this task reaches just the 3% of total revenues. The relevant charge is based on the number of pallets, namely charge per import/export of pallet. Cargoes from multiple shippers arrive at the company's premises, which are then consolidated into a full truck load, and further distributed to multiple consignees.

The facilities needed for the cross docking process include large space for loading, as well as multiple ramps, which already exist at our premises, namely the loading lane, so that no additional investments were realized. A corresponding scheduling process must be executed, though, regarding both the area for the pending shipments and the number of the required ramps. In the first case, the number of pallets per day is needed, as well as the interim time between receipt and shipment. In the second case, the number of trucks that have to be handled per day, and the number of import pallets per truck have to be registered.

The information system that supports the process of cross docking is the WMS, and in case there are interfaces with the customers information system, real time information is realized. The reason why the company under

investigation is selected by the clients as the cross docking partner is because it enables the move of their inventory from receiving to shipping with no interim storage, drastically reducing storage and warehousing costs.

The factors that contribute to the successful management of cross-docking consist of the following, according to the degree of importance: (1) the life cycle of the product, (2) the product value, (3) the successful handling regarding the physical flow of the products, (4) the successful use of full track loads shipment, (5) the successful use of the appropriate plans and tools for the management of cross – docking procedures, (6) the routing of the vehicles used in the cross – dock, (7) the schedule of the shipment, (8) the successful development of information technology, so as to better manage the flow of information, (9) the accurate and in time flow of information, as well as the service required for the items, which affects the stock – out cost negatively when it is high, (10) the layout of the cross dock terminal, (11) the demanded quantity of goods, (12) the distance between the supplier and its customers, (13) the distance between the warehouse and the distribution centers, (14) the volume of business in the area, the layout and design of receiving and shipping docks, (15) the location of the cross – docking terminal.

The advantages that derive from the cross-docking process, according to the degree of importance, are: (1) the lower risk of both damage and loss of products, (2) the faster delivery of finished goods from the supplier to the customers, (3) the decrease in cost of supply chain through the shipment of different orders at the same time – period, (4) the economies in transportation cost realized by consolidating divergent shipments to full truckloads without depending on (enlarged) inventories at the cross dock, (5) the products stay in storage for less than 12 hours, (6) the decrease in the cycle time of order, resulting in the improvement of both responsiveness and flexibility of the distribution network, (7) the reduction in the storage space, lower number of overstocks (8) the faster inventory turnover, (9) the reduction in transportation cost, (10) the improved customer service, (11) the shipment integration (full truck loads), and (12) the reduction in labor cost.

Besides the advantages, the most common problems that derive are the lead times of each order, and the possibility of full truck load.

## **4. Discussion**

Casadesus and Castro (2005) have mentioned five ways to increase supply chain's effectiveness, as they are already mentioned in the section of literature review. Cross-docking is not included in those methods. However, as our case study indicates, the practice of cross-docking facilitates the achievement of those methods, as it represents a practice for inventory management, facilitates the increase of response time to the customers, and increases competitive advantage, always supported by the available information technology.

The company under study recognized all the factors mentioned in literature review (Apte and Viswanathan, 2000; Boysen and Fliedner, 2010; Van Belle et al.,2012), as factors that contribute to the effective implementation of cross – docking. The ranking of those factors, though, provides additional insight into the company's priorities. Of highest importance

are the product features to be regarded, as they refer to perishable goods. Furthermore, the distribution and routing process, along with the relevant tools are highly rated, whereas the location of the cross-docking centre and distance among the supply chain members are not held to be of major importance.

This is also the case for the advantages of cross-docking, where the ranking arranged by the interviewee increases its contribution. The most critical issues refer to the minimization of damages and losses. Improved customer service follows, thus resulting in improved responsiveness, whereas cost and inventory management issues follow.

As long as the technology used in cross-docking is considered, no additional cost needs to be occurred, since the WMS that the 3PL already has established and exploited, is utilized. So the opinion that expensive technology is needed to support the specific task (Apte and Viswanathan, 2000) may be misinterpreted. The value adding service that the company under study provides refers to the development of interfaces with the interested clients, so that they share real time information with their clients.

## **5. Conclusion**

Companies in the new changing globalized environment, search creative ways to insert to their supply chain in order to minimize their costs and manage effectively their inventory levels. Cross-docking operations increase throughput at critical distribution points by unloading shipments directly onto outbound transport, which eliminates the need to store freight.

In the present paper, the role of cross – docking management and the competitive advantage that it can provide are examined. The framework of the a 3PL company that offers successful cross-docking services has presented in order to point out the impact of cross – docking on 3PL and the factors that contribute to its effective implementation and operation.

Based on the international literature and the case study of a leading 3PL company, factors that contribute to the effective implementation of cross – docking method for 3PL companies have been mentioned. The systems for a successful cross-docking must include automated material handling, order processing and warehouse management systems as well as strong relationships between supply chain partners. Furthermore the obstacles that a 3PL company may face in the effective implementation of the cross – docking method were discussed as well as the parameters that may can lead to competitive advantage through cross docking. Clear and continually communication with all involved members, sharing of information, quality and product availability are a few characteristics that may lead to effective and profitable cross-docking.

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