Analysis and optimisation of a logistic warehouse in the automotive industry

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Abstract

The automotive industry is one of the most competitive sectors, in which rigour, flexibility, quality and agility constitute the critical factors of success. Warehouse activities and their associated costs play a vital role in logistic functions. Their optimisation and performance assessment may result in substantial value gains for the company. This study was developed at Continental Mabor, with the purpose of developing a proposal to restructure and optimise the company’s warehouse. An analysis of the existing warehouse was carried out and the respective proposals were subsequently presented. The main goal of these proposals was to improve the efficiency of warehouse functions, reduce stock quantities and enhance the capacity to meet customer’s demand. A warehouse management system (WMS) was installed and a suitable bin management solution was defined. This system consisted of a basic WMS to support stock inventory and its location. In addition, this system envisaged warehouse performance and included elements such as the inventory management Key Performance Indicator (KPI) and warehouse productivity.

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1. Introduction

All organisations wishing to be competitive cannot rule out the advantage of appropriate information systems (IS) [1]. There is a great deal of software to provide support in the solution of problems occurring in organisations’ everyday activities, and the industrial sector has increasingly focused on these specific software applications to reach this goal [1, 2]. The IS can offer greater assistance to management and ensures the optimisation of the entire productive system. In this case study of the logistic chain, the IS was also used to eliminate unnecessary expenditures in time, money, materials and energy. There are various specific software programs to support warehouse management operations; one of these is known as the Warehouse Management System (WMS). Its main advantages lie in the reduction of warehouse storage space, as well as greater accuracy in stock information, higher operational speed and quality, as well as an increase in the productivity of staff and warehouse equipment [3, 4]. However, the implementation and use of such software in the context of a company presents various challenges. These are chiefly due to issues relating to its portability and integration with different existing IS, as well as the need for skilled technical staff to implement and manage the WMS [5]. The definition of a methodology to provide assistance for future WMS system implementations is thus very useful, as is the case of Schnellecke methodology. According to Atieh et al. [6], the purpose of automating the warehouse system is to control the movement and storage of products, together with the benefit of enhanced security and quicker handling. The WMS is designed to help reduce costs in effective warehouse processes, as well as to provide reliable results in comparison with manually handled systems [6].

This study was carried out at Schnellecke Portugal, which has been providing logistics services - more specifically in the area of in-house logistics - to the Continental Mabor (CM) company since 2012. These services include the management of raw material warehouses, as well as the supply of production buffers. This study’s main objective was to present a proposal for the restructuring and optimisation of the company’s raw material warehouse (RMW). Various proposals were presented to improve warehouse operation, with a view to doing away with a warehouse outside the factory premises. This paper is divided into five sections: section 1 constitutes the introduction; section 2 presents a review of the literature relating to the subject of IS and WMS; section 3 deals with the methodology used to carry out this study; section 4 describes all the practical work developed at the CM company and presents proposals for the WMS implementation process. It also includes all results obtained through the development of this WMS solution and, finally, section 5 presents the final conclusions.

2. Literature review

Countless technological innovations in distribution sectors have been seen over the last decade. This is largely due to globalisation, competition, rapid market changes and increasingly shorter product lifespans, which are making economies of scale the “drivers” of this change [7-11]. The logistic costs have thus taken on a pertinent role in the global production costs; indeed, they have become essential due to greater product varieties and faster responsiveness imposed by the market. Rouwenhorst et al. [6] defend that the logistics costs of warehouse activities are, to a large extent, defined during the design of the warehouse facility. Hence, it is important to implement strategic planning of this activity and of the actions defined for operational support. The use of Lean Manufacturing tools in logistics has become extremely relevant in this context since their main objective lies in cost reduction, as well as in the elimination of any waste sources within the organisation. To this end, Lean methodology tries to eliminate anything that adds no value to the end product (e.g. storage and movement of raw materials and components). However, these aspects are also considered to be of paramount importance in the value chain, since they affect customer satisfaction and the respective response efficiency to the market [12, 13]. Lean Manufacturing refers as sources of waste seven different causes: surplus production, waiting time, transport, excessive processing, inventory, movement and waste [14]. Thus, and taking the demands of logistics as well as the enumerated principles into account, it seems obvious that these should be developed and directed towards a common goal [15, 16]. The processes involved in the storage and movement of raw materials imply finding solutions for the numerous problems associated with the project itself, as well as to the operation of production/distribution systems and economic efficiency [17]. Studies reveal that, on average, the cost of Order Picking is estimated to be 55% of total operational warehouse costs [18, 19]. The warehouse facility development phase has implications for this activity’s operational and global performance results, as well as for the business itself. Thus, the main objective is to run the activity at a minimum cost. Heragu et al. [20] defend that
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