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Improving Road Transport Operations using Lean Thinking

Jose Arturo Garza-Reyesa,*, Juan Sebastian Beltran Forero, Vikas Kumarc, Bernardo Villarreald, Miguel Gaston Cedillo-Campos, and Luis Rocha-Lona 

a Derby Business School, The University of Derby, Derby, DE22 1GB, UK  
b Warwick Manufacturing Group, The University of Warwick, Coventry, CV4 7AL, UK  
c Bristol Business School, University of the West of England, Bristol, BS16 1QY, UK  
d Departamento de Ingeniería, Universidad de Monterrey, San Pedro Garza García, 66238, México  
c National Laboratory for Transportation Systems and Logistics, Mexican Institute of Transportation, Querétaro, 76703, México  
f Instituto Politécnico Nacional, ESICA Santo Tomás, Mexico City, 11340, México

Abstract

This paper documents a case study where the transport operations of a world leading provider of paper-based packaging solutions operating in Bogota, Colombia, were measured and improved using lean concepts, methods and tools. The methodology consisted of: (1) direct observations of the transport operations; (2) collection and analysis of data; (3) creation of a Transportation Value Stream Map (TVSM); (4) measurement of the Transportation Overall Vehicle Effectiveness (TOVE); and (5) proposal of improvement recommendations. The TVSM identified six wastes: waiting, resource utilisation, excess movement, over-production, over-processing and behavioural. The TOVE measure resulted in an efficiency of 54%. The study proposed improvement recommendations based on the results of the TVSM and TOVE.

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1. Introduction

Transportation and distribution are considered tertiary economic activities [1]. However, globalised markets and international trading have transformed this activity from being a less important, and perhaps even forgotten, business element into a differentiating factor that adds service value to customers [2] and significantly impacts the overall operational performance of organisations. This has forced many manufacturing organisations to not only...
focus on improving their ‘factory-based operations’ but also their logistics and transport operations. Specifically, the improvement of road transport operations has been traditionally and mainly addressed through mathematical modelling and new generation algorithms supported by powerful software tools [3]. However, recent research has demonstrated the suitability and effectiveness of lean thinking to also drive such improvements [4,5,6,7,8]. Since its conception by Toyota Motors several decades ago, strong evidence suggests lean as an effective method which aids organisations to be more competitive [9]. This has contributed to make lean the most influential paradigm in manufacturing [10]. Nevertheless, despite its wide success and acceptance worldwide, its application to road transport operations has been limited [7], but the aforementioned evidence indicates that its application has now started to be more widely explored in this industrial sector.

In terms of the results obtained from the application of lean thinking to drive improvements in road transport operations, the results obtained from the study of Villarreal et al. [4] showed a 27% reduction in the number of distribution routes while distance travelled was also reduced by 32%. Similarly, after the application of lean thinking in a Mexican organisation that processes and distributes bottled beverage, Villarreal et al. [5] reported a reduction of average serving time from 40.6 mins to 18.7 mins, a significant reduction of the average route preparation time from 90 mins to 23 mins and of the average route closing time from 60 mins to 16 mins. Similar improvements in the reduction of number of routes, distance travelled, excess service time, demand not satisfied, and emission of harmful gases as well as increases in Transportation Overall Vehicle Effectiveness (TOVE), average number of clients served per route and vehicle capacity utilisation were also reported by Villarreal et al. [6], Villarreal et al. [7] and Garza-Reyes et al. [8].

This evidence motivated the authors of this paper to apply lean thinking concepts, methods and tools to measure and drive the improvements of the road transport operations of a world leading provider of paper-based packaging solutions operating in Bogota, Colombia. This organisation currently operates in 34 countries around the world with more than 340 production sites, and around 45,000 employees worldwide. In Colombia, the case organisation operates a total of four corrugated factories located in Barranquilla, Medellin, Cali and Bogota. In particular, the Bogota site distributes its products inside the central region of Colombia. Due to a constant growth in demand, the site has increased its production capacity through capital investment in new equipment. This had resulted in the dispatch and distribution departments to be stretched and converted into bottlenecks within the transforming value stream of the organisation’s products. This paper therefore documents a case study where the road transport operations of the case organisation were measured and improved using lean thinking. The paper adds evidence to the recent scholar research which shows the suitability and effectiveness of lean thinking for the improvement of logistics and transport operations.

2. Analysis of road transport operations

2.1 Methodological approach

The overall methodological approach followed to improve the road transport operations of the studied organisation by using lean thinking is showed in Fig. 1. In this case, the road logistics operations were divided into four contexts, namely: (1) Initial activities Not in transit, (2) Service clients, (3) Transit, and (3) Final activities Not in transit. The first included activities from preparing orders and routes until leaving the manufacturing plant, whereas the second included activities that were exclusively related to the service of customers. The third included activities’ time between the manufacturing plant and customers, and between one costumer and other. The fourth corresponded to those activities carried out after the order had been delivered and until the route was closed. For every context, a TVSM and TOVE analyses were conducted by following the steps shown in Fig. 1. TVSM is a tool adapted by Villarreal [11] from the traditional Value Stream Mapping (VSM) tool [12] to support the improvement of efficiency initiatives in road transport operations. TVSM focuses on identifying wastes related to transport activities [4]. On the other hand, TOVE is an extended version of the Overall Equipment Effectiveness (OEE) indicator used by the lean’s Total Productive Maintenance (TPM) approach to improve the effectiveness of production equipment [4,11] and the Overall Vehicle Effectiveness (OVE) measure proposed by Simmons et al. [13]. Besides the traditional availability, performance and quality metrics considered by OEE, TOVE does not only consider these three within the context of road transport operations/wastes but also the administrative availability
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