THE ECONOMIC ASPECTS INTRODUCING A MILK RUN SYSTEM IN A MANUFACTURING COMPANY

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Abstract

Optimizing the processes and costs in all areas of activity is one of the fundamental goals of any company, whether it be in terms of sustainable development, or in order to generate optimal business outcomes. The present case study describes the introduction of a milk run system into the internal logistics of manufacturing companies and any specific outcomes that follow the introduction of this system.

Company system settings that include a milk run should lead to a reduction of costs associated with handling and transporting material, semi-finished products and goods. Chain optimization using this system reduces the number of transport runs, identifies the best delivery route, ensures that each of the stops is visited only once, and suggests options for receiving and delivering goods at the same time. It also allows for the most effective use of the working hours for each employee.

In order to evaluate the effectiveness of the implemented system, a variety of parameters were tracked, such as the number of transfers, the total number of pallets transported, maintenance costs, the cost of operating hours and fuel consumption. The conclusion of this paper shows tangible results in the form of savings that are present when using a milk run system compared with the situation before the introduction of this system.

Keywords: Milk run, lean manufacturing

1. INTRODUCTION

Global competition forces most companies to allocate their resources as effectively as possible, to increase their profits and to opt for long-term profit maximisation. To achieve this, they use various business software and tools. One of these methods is lean manufacturing. This method not only focuses on the productive part of a company, but it also expands to all business processes, including lean logistics. The logistic technology of a milk run is one of the methods of lean logistics that aims to optimise material flow and costs for the year. The impacts of applying the milk run method into the internal logistics of a production company is examined in this article and the economic evaluation of applying this method in practice is the main focus.

2. THEORETICAL ASPECTS OF THE MILK RUN METHOD

During the development of logistics itself, logistic technologies that began to be used in practice were formed. Based on feedback, the suitability of each technology for the given field was assessed. This is due to the fact that it is not always possible to apply the same logistic technology to a different field. Before applying a certain technology into practice, many phenomena (such as production, economical phenomena, etc.) need to be evaluated. The following are currently considered to be the most significant logistic technologies: Kanban, Just-in-Time, milk run, Quick Response, Efficient Consumer Response, Hub and Spoke, Cross-docking, concentrated storage network, combined transportation, Automatic Identification, computer integrated technologies of preparation and management of production and circulation, and communication technologies [1].

The milk run method was assessed as the most optimal logistic technology to be applied into the internal logistics of the production company in this case study. The milk run method originates from England where the principle was based on regular milk collections from individual farmers to the dairy. A milk run is a transportation concept with pre-established routes and regular collection intervals. This specific supply system is based on the circulation of packages. Goods-filled packages are transported to the consumer while at the same time the empty packages are collected from them for refilling. Material distribution from the storage unit takes place in accordance with a prearranged schedule and route plan, At precisely defined locations and at specified times, the material is unloaded and at the same time the empty transportation packages are taken into the storage area [2]. Several factors need to be considered when applying the milk run method; such as the location of the company in the environment, the material storage arrangement, the production facility layout, transport units, information system, etc.

3. APPLYING THE MILK RUN METHOD IN A PRODUCTION COMPANY

Process and cost optimisation in all areas of activity is one of the fundamental goals of every business, both in terms of sustainable development and in generating optimal business outcomes. This study aims to characterise the process of implementing the milk run system in the internal logistics of a production company and assess the outcomes after its application.

In order to assess the outcomes of implementing this new system, it is necessary to characterise the situation before the implementation, including the definition of information on served areas, handling equipment, establishment layout, etc.

3.1. Conditions before implementation of a milk run system

As already mentioned, cost optimisation is one of the key objectives of every company. In this case, the production company has decided to find and implement a system that leads to lower costs for consumed fuel in internal logistics.

One example of mismanagement that the company started to address was the use of handling equipment and its subsequent optimisation with respect to the original conditions. The original conditions before the milk run system was implemented are shown in **Fig. 1**. This is a record from a GPS device placed in one of the forklifts that move between warehouses and production facilities. It shows a series of unsuccessful entry attempts and repeated routes that lead to increased fuel consumption and thus increased costs.

Fig. 1 GPS record of a forklift

3.2. Handling equipment used by the company

The production company in question falls into the category with 250 to 499 employees and employs a wide range of handling equipment in its internal logistics. For purposes of monitoring diesel consumption, these were mainly forklifts, but also included a loader and a tractor. The latter types of handling equipment, however, are used only intermittently. The forklifts are of various brands, e.g. Linde, Mitsubishi, Toyota, Fiat, Saxby, etc. Examples of individual forklifts are shown in **Figs. 2, 3 and 4**.

Fig. 2 Linde forklift [3]

Fig. 3 Mitsubishi forklift [4]

Fig. 4 Toyota forklift [5]

3.3. Layout of the production company's facility

Implementing a milk run system is linked with a precise definition of conditions, which are in this case time and route. It is necessary to set the exact times at which the regular driving routes occur and it is also necessary to clearly predefine and map the route along which the material is transported.

Fig. 5 shows the layout of the production company and marks the planned transportation route and the individual loading points, or more precisely individual warehouses in which the production goods and material for the respective milk run are prepared. In the individual warehouses and at designated points, the material is prepared and then distributed to production buildings, production lines, etc.

Fig. 5 Layout of the production company's facility

3.4. Monitored values for determining the outcome of applying the milk run method

In the internal logistics of a production company, costs linked to the use of forklifts are studied over the long term, whether that be operating and maintenance costs or costs for fuels. Refuelling is monitored for each forklift. The long-term value of pumped fuel is recorded with respect to engine operating hours. In addition, the company also monitors and evaluates the workload of the respective forklift for the needs of storage management and the needs of the production part of the company. Therefore, overall fuel consumption within the company is summarised for all handling equipment. Fuel consumption is then converted into a monetary value. In order for the long-term assessment to be possible, the monetary equivalent value of fuels is compared with the total production of the company in measurable units. This way, the fuel consumption (diesel in this case) is assessed per ton of the company's production.

3.5. An evaluation of the monitored values

The company decided to implement the milk run system into its internal logistics at the beginning of 2014. After completing the preparatory phase, primary steps of the selected method were implemented in April and May

2014, and since June 2014, all the steps of the milk run system have been implemented. All the values within the monitored period are summarised in **Table 1**, which clearly shows the changes in the amount of consumed diesel to total company production.

Table 1 Summary of the costs for diesel in comparison to the total production volume [custom elaboration]

Month	January 14	February 14	March 14	April 14	May 14	June 14
Total consumption [CZK]	162,599.29	173,563.58	155,930.29	137,336.21	115,633.70	100,261.09
Production [kg]	4,005,958	4,569,593	4,134,850	3,931,094	3,572,603	4,849,460
Diesel consumption per 1 t	**40.589**	**37.982**	**37.711**	**34.936**	**32.367**	**20.675**
Month	July 14	August 14	September 14	October 14	November 14	December 14
Total consumption [CZK]	100,543.67	99,413.33	126,597.99	91,444.44	105,347.61	76,750.03
Production [kg]	4,398,987	4,357,446	4,403,732	4,033,248	4,343,495	2,585,285
Diesel consumption per 1 t	**22.856**	**22.815**	**28.748**	**22.673**	**24.254**	**29.687**
Month	January 15	February 15	March 15	April 15	May 15	June 15
Total consumption [CZK]	96,813.55	121,398.43	112,242.68	78,841.16	87,395.01	84,900.46
Production [kg]	3,750,438	4,100,781	4,832,062	3,902,723	3,464,224	4,574,027
Diesel consumption per 1 t	**25.814**	**29.604**	**23.229**	**20.202**	**25.228**	**18.561**

From the above table, it is clear that before the milk run system was implemented, namely from January to March 2014, the ratio of diesel consumption per 1 ton of the company's production was between 37 to 40 points, while when some of the milk run system principles were applied in April and May 2014, the values for the monitored ratio decreased. However, rapid and significant lowering is apparent after June 2014, when the system was fully implemented. The values of the monitored variable were lowered by almost one-half. From this survey, it is then clear how the application of the milk run system positively affected the production company.

Aside from the listed values and facts, the company also monitors the mileage driven and costs for maintaining the handling equipment, especially forklifts. The company has also seen significant cost savings in these parameters.

4. CONCLUSION

The primary feature of lean manufacturing processes should be the precise timing of goods delivery in required quantities for production. However, it is necessary to achieve this while optimizing logistics costs. The objective of the investigation described by this article was to assess the economic aspects and some other effects of applying a milk run system into the internal logistics of a production company.

The economic aspects were assessed during the monitoring of long-term fuel consumption in the internal logistics of the production company and during the subsequent conversion of these values into a monetary value, which for objective assessment, was compared to the total production of the company. Within this assessment, it was determined that the ratio of fuel consumption per production was lowered almost by one-half after the milk run system was implemented (an annual savings of more than one-third were stated).

Other economic benefits of applying the milk run system can be assessed from the perspective of decreasing costs for the operation and maintenance of handling equipment, optimizing manpower, etc.

ACKNOWLEDGEMENTS

This work was supported by the specific university research of the Ministry of Education, Youth and Sports of the Czech Republic No. SP2015/112.

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