ANALYSE OF MATERIAL SUPPLY OF THE ROBOTIZED WORKPLACES

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Abstract

This paper represents the sketch of the new method of material supply to the robotic workplaces in a company from automotive. This work concerns the analysis of the contemporary state and the sketch of the new method of importing materials in the form of milk run. This article deals with the analysis of the costs of the contemporary state and the new one. The next point in the analysis is the comparison of the demands of both methods, especially on space and number of employees. The aim of this work is to analyse the efficiency of incorporating the new method of material supply in a particular company.

Keywords: Material supply, logistics, analysis

1. INTRODUCTION

The term logistics describes a process that involves planning, execution and management of material flow. Material flow in a company should be as little cost-intensive as possible. If the supply of production workplaces is carried out by means of an optimal logistic process, it can result in significant savings [1].

Suitable logistics management can lead not only to lower cost of material supply, but it can also increase the available production space. More space in production areas is a result of a suitable supply of material, where the individual workplaces do not require unnecessarily large stock of material, but only the amount optimal to prevent the stoppage of the production process due to lack of material [2].

2. MATERIAL SUPPLY TO PRODUCTION FACILITY

There is a number of possible ways and means available to provide material in production. This article is focused on the analysis of material supply in a company from the automotive field, which is why the analysis will take into consideration the most widely used methods of automotive material supply in the form of trucks.

The basic division of these trucks is into powered and non-powered ones. Powered trucks are further divided into tow, forklift, and low-lift ones. This division of trucks is not complete, but it is sufficient for the purpose of this work [3].

The analysed company currently takes advantage mainly of powered forklifts. The total number of available production trucks is 17, and they provide the material necessary for the production of all production facilities. These trucks are either of diesel or accumulator type. The important fact is that all the trucks can also be used as tow trucks, and the trucks laden with material can be harnessed one after the other.

2.1. Analysis input data

At the beginning, it was necessary to gather the input data for the material flow analysis. This analysis was not focused on all production technologies and therefore the entire production hall, but only on one of its sub-sections. This sub-section involved 6 selected automated workplaces. These workplaces were analyzed as a whole.

The production cycle of these workplaces, which ranges from 40 to 100 seconds, represents an important condition. The diversity of the processed input material, caused by the different sizes and quantities of the

material processed at the individual workplaces, is another limiting condition. This number varies from 3 to 5 pieces of components. The individual parts are kept in different packages.

These input components are manufactured directly within the production area in large production batches and the total area required for their storage on pallets in stacks is 280 m^2. The entire stock of the individual parts was stored in work in progress warehouse. The supply from the warehouse to the automated workplaces can be performed using 3 different routes of 290, 350 and 400 meters. The length of each route includes the journey from the warehouse to the automated workplace, the journey with an empty pallet from the workplace to the packaging material warehouse, and the journey from the packaging material warehouse to the work in progress warehouse. The total number of runs taking into account the required production volume and the production cycle is 1 650 runs per month. The costs per hour of forklift operation have amounted to 10 Euros.

2.2. Analysis of current state of supply

At present, the company supplies material by means of the aforementioned forklifts. The current status of supply is based on a forklift run, which carries a single pallet with components. The company management sees the current state of supply as inefficient and therefore initiated a calculation of the supply costs within the scope of the analysis while maintaining the status quo, as well as the costs of supply in the form of milk run. **Table 1** contains the calculation of supply costs using the existing method.

Table 1 Cost analysis of existing system

Route no.	Length [m]	Monthly millage [m]	Total run time [h/month]	Pallet handling [h/month]	MTH/month	Costs of forklift truck [€/month]
1.	290	478 500	95.7	1	96.7	967
2.	350	577 500	115.5	1	116.5	1165
3.	390	643 500	128.7	1	129.7	1297

The advantage of this system is that it requires no additional investments in the handling equipment or new packaging. The supply requires 6 pieces of forklifts, based on the assumption that they supply other production technologies within the production hall at the time when they do not supply the selected automated workplaces. 6 pieces of forklifts are required to avoid collisions of requirements for material supply of the individual automated workplaces.

2.3. Forklift run with 2 pallets at the same time

If the individual forklifts supplied 2 pallets at the same time and did not take a single pallet only, the number of runs per month would be half, i.e. the total of 825 runs. These more efficient runs would reduce the cost of component supply by half, in comparison with the current method of supply.

Table 2 Cost analysis of 2 pallets at the same time

Route no.	Length [m]	Monthly millage [m]	Total run time [h/month]	Pallet handling [h/month]	MTH/month	Costs of forklift truck [€/month]
1.	290	239 250	47.9	1	48.9	489
2.	350	288 750	57.8	1	58.8	588
3.	390	321 750	64.4	1	65.4	654

Such runs are also directly required by the production range of the selected automated workplaces producing series of products for automotive companies, and they always consist of left and right side. This means that when one component for the right side runs out, this component runs out for the other side as well. The supply

of such parts can be executed at the same time, taking advantage of the method when the forklift takes both parts on palettes loaded on top of each other. The quantification of this variant is included in **Table 2**.

The advantages of this option are identical to the advantages of the current state. In addition, this option includes a benefit in the form of savings of the required trucks in the amount of 4 forklifts. The 2 saved trucks can therefore provide any other activity within the company.

2.4. Milk run

The idea of the company is that the supply to automated workplaces will be carried out using the milk run form. The milk run would therefore be used to supply pallets or KLT containers, and the components from the pallets would be reloaded into them. The advantage of this system is the possibility to supply several pallets at the same time - a standard of 4 pieces [4]. The disadvantage is the space requirements for the milk run and the station, where the pallets are picked up on special platforms with wheels, and the forklift has to stack them on these platforms. In case the milk run uses KLT containers, there has to be at least one operator in the warehouse who reloads the components from pallets into KLT containers [5].

The use of milk run with pallets will save 570 runs, and the total number of truck runs will be reduced to 1 080 runs per month. To ensure these runs, the enterprise will need 3 milk runs. The costs of these milk runs are calculated in **Table 3**.

Table 3 Cost analysis of milk run

Route no.	Length [m]	Monthly millage [m]	Total run time [h/month]	Pallet handling [h/month]	MTH/month	Costs of milk run [€/month]
1.	290	313 200	62.7	1	63.7	637
2.	350	378 000	75.6	1	76.6	766
3.	390	421 200	84.3	1	85.3	853

These costs need to be increased by including the cost of purchase of the platforms with wheels. The table clearly shows that even without these costs, the supply of pallets taking advantage of milk runs is more expensive in comparison with forklift runs with two pallets at the same time.

When the milk run uses KLT containers, there is a big advantage based on a uniform supply of the individual workplaces. This would avoid the collisions of requirements of the individual workplaces. The advantages would also include savings at each workplace, where KLT containers would be stored in gravity flow shelves.

The disadvantage of this method is the purchasing costs of special trucks with shelves, gravity flow shelves, KLT containers and platforms with wheels for pallets where bulkier parts, which do not fit into KLT containers, will be stored. Additional costs will include the costs in the form of wages of an operator who will reload the parts into KLT containers. The biggest disadvantage, however, will result from the frequent milk runs, since it should run at least once every 12 minutes. This interval can be shortened by extending the gravity flow shelves, but this would reduce the space acquired as a result of the introduction of these shelves. If it ran at an interval of 30 minutes, for example, it would mean an increase in the number of runs per month by more than double, when compared to the current method of supply. The operating costs would therefore double as well.

3. CONCLUSION

The comparison of cost savings of the individual options is presented in **Table 4**. The table quantifies the savings of the operation of the trucks providing the supplies. In the case of milk run with KLT containers, the

costs are higher in comparison with the existing method, and that is why these costs are not quantified in the table. Route 1, where forklifts run with two pallets at the same time, is the most effective route.

Table 4 Comparison of supply costs

Route no.	Annual costs of existing method [€/year]	Forklift with 2 pallets - saving [€/year]	Milk run - saving [€/year]
1.	11 604	5 736	3 960
2.	13 980	6 924	4 788
3.	15 564	7 716	5 328

The analysis of material supply in the examined company shows that milk run is not suitable for every company working in the automotive industry, although it is very widespread in this field. The analysis has come to the conclusion that the company should choose component supply to automated workplaces by means of forklifts running with two pallets at the same time. The introduction of this system can save approximately € 5 736 a year in comparison with the current method of supply.

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