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Research Article

Sequential Milkrun System

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Abstract:

Milk-Run system is a logistics supply method that aims to combine and place the products or materials required by companies into vehicles in the most efficient way. This system collects goods from multiple suppliers and ensures that vehicles are filled at an optimum level. It ensures controlled management of transactions with regular reporting, continuous monitoring and automatic information e-mails.
Within the scope of the study, important processes related to the Milk-Run management process were emphasized and the reasons for the application were highlighted. Logistics and supply chain have played important roles in supporting the operations of businesses aiming to meet customers' demands. It is a sustainable management model that helps all businesses that implement it reduce their costs, optimize their processes and reduce their carbon footprint.

1. Introduction

Mil-Run is the name given to a circular expedition. It takes its meaning from the cars that collect milk from farms for dairies. In this type of transportation, trucks collect products from one or more suppliers and deliver them to one or more points.
In Milk-Run industrial operations, it is expressed as carrying out the special flow of materials delivered from manufacturers (sub-industry) to factories according to the customers' production schedule on a daily basis, with a planning according to the constraints of both parties (production, stock and goods acceptance) [1]. If we talk about the goals determined by the supplier within the scope of this planning;

- Being able to buy products from different manufacturers,
- Saving time,
- Eliminating stock costs,
- Speeding up production are important main factors.

Within the scope of planning, it is necessary to collect from multiple points and provide frequent material flow in the shortest time and at the specified time. Within the framework of this approach;

- Regular material flow,
- Preventing single-load shipments,
- Preventing unwanted part shipments,
- Shipping small amounts in multiple trips,
- Thus minimizing the customer's stock amount

There are some important differences between Milk-Run and traditional logistics methods. In traditional logistics methods, materials are collected separately from each supplier and taken to a central warehouse. This causes more time and fuel consumption. In the Milk-Run method, materials are collected from multiple suppliers using optimized routes and taken directly to the production facility or destination [2]. In this way, time and fuel are saved, while environmental impacts are reduced. An example screenshot of the menu structure used in the Milk-Run system is shared below in figure 1.
In the Milk-Run system; unauthorized people can only be allowed to access or perform operations in certain areas. Authorizations can be managed optionally and defined from the screens.

Figure 1. *Milk-Run Operations*

Figure 2. *An example screenshot of the Milk-Run system*

Users who log in to the system can see the relevant menus and perform operations according to the authorizations they have. Users with admin authorization can access all menus.

2. Sustainable Management Process

It would be correct to call the Milk-Run system a process management. This management system is an important investment for logistics operations. At the same time, the process is transparent and traceable for both the supplier, the manufacturer and the company undertaking the logistics. For this reason, there is no hidden cost in the invoicing of the ongoing operation cost. This also leads to long-term work for the supplier and the company undertaking the logistics. In short, we can say that this is a sustainable working model.

Retail and e-commerce sectors generally use the Milk-Run method successfully because they have large distribution networks. In these sectors, businesses collect products using optimized routes and increase customer satisfaction by providing faster delivery times. There are some important differences between Milk-Run and traditional logistics methods. In traditional logistics methods, materials are collected separately from each supplier and taken to a central warehouse. This causes more time and fuel consumption. The Milk-Run method is an important part of sustainable logistics practices. With optimized routes and regular supplier visits, Milk-Run helps reduce fuel consumption and greenhouse gas emissions [3]. Additionally, more efficient logistics processes enable businesses to reduce their environmental impact by reducing energy use and waste.

3. Cost and Time Optimization

It is very important to reduce cost items in a supply chain. Cost optimization should be considered as a whole and all hidden costs, which are the real pitfalls of logistics, should be taken into account.

It is an important component of the supply chain from the delivery of shipments to reverse logistics operations with a strict follow-up process. Milk-Run management is a preferred system to save as much time as possible and reduce costs. Operational costs are reduced by using fewer vehicles and fuel. Thanks to optimized routes, delivery times are shortened and customer satisfaction is increased. In addition, the effectiveness of the Milk-Run method depends on the ability of businesses to quickly adapt to demand fluctuations and supply chain changes (figure 2). Businesses should constantly develop planning and backup strategies to make their logistics processes flexible and adaptable.

4. Route Optimization for Logistics Companies

Its basic principle is to increase the efficiency and cost-effectiveness of logistics operations. It achieves this by combining shipments from suppliers or customers and using regular, optimized routes. In this way, more work can be done with fewer vehicles and fuel savings can be achieved. In addition, technological innovations and digital transformation processes can further develop Milk-Run applications. Processes need to be planned by considering the geographical locations of suppliers and customers, demand volumes of the equipment to be transported and delivery frequencies. In this direction, it is mandatory to determine routes and timetables. When determining routes and timetables; the most appropriate and efficient route should be selected by considering traffic conditions, weather conditions and other logistics factors [4]. In addition, it should regularly update routes and processes

according to market conditions and business needs. The goals of route optimization include planning routes between multiple addresses, optimizing routes by distance, time, and cost. In other words, route optimization is about improving a driver's ability to reach a destination in the most efficient manner. The goals of route optimization include planning routes between multiple addresses, optimizing routes by distance, time, and cost. Logistics analyzes and software should be used to plan and optimize routes and determine the most appropriate and efficient routes. The aim of route optimization is to ensure that the right products and quantities are collected on time and that delivery processes operate smoothly [5]. Route optimization software uses various algorithms to quickly compare different routing options and choose the best one. The problem that arises in line with the parameters and constraints specified by the user is solved within minutes with optimization algorithms**.** The visual activity explaining the Milk-Run system before and after application is shared in figure 3. Milk-Run helps to better manage stock levels and reduce storage costs.

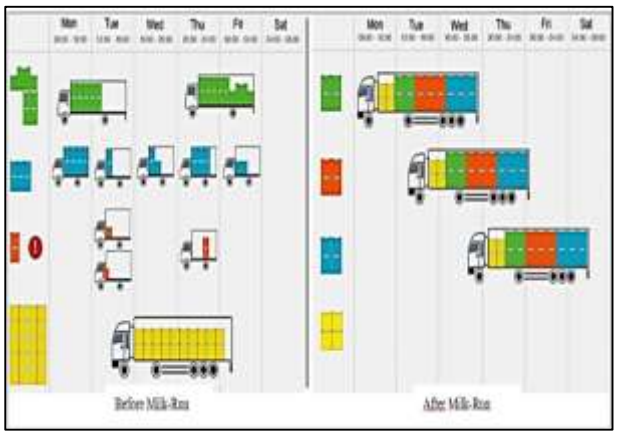

Figure 3. *Before and after the Milk-Run system application*

4.1. Static Routing

Master data defined according to daily needs and not changed are included in the static routing system. The text file created by the company and sent to the Milk-Run system daily is imported, materials are received and packaged according to the information in the file. Then they are assigned to static (predefined) routes. After the plan is completed, the processed data is transmitted to the company via the application. Static routing is triggered automatically at certain times.

4.2. Dynamic Routing

In the Milk-Run system, a daily pool system is used like a warehouse. This pool should be considered to have pallets that cannot be placed on any static route. All pallets that cannot be placed on vehicles are collected in this pool. Later, if desired, trucks can be assigned manually from this pool. If all trucks are full and pallets are left in the pool, dynamic routing is done for the pallets remaining in the pool. In dynamic routing, all pallets in the pool are taken and new dynamic routes are created according to suppliers, unloading points and pallets in the pool. Routes are created up to the minimum truck level that the pallets in the pool can fit.

4.3. Manuel Routing

The authorized person in the company can select the desired pallets and trigger manual routing by making multiple selections from the pool. A "start time" is given for manual routing. New manual routes are created based on the start time. Manual routing is a slightly more limited version of dynamic routing.

Benefits of Route Optimization

If we list the benefits of route optimization;

- Reduces fuel costs
- Reduces vehicle maintenance costs
- Improves customer experience
- Resets manual route planning
- Allows you to respond to unexpected changes in real time
- Increases the number of daily deliveries
- Increases driver satisfaction
- Allows you to deliver products faster
- Increases profit while reducing costs

As listed above, it is obvious that the benefits of routing are extremely important in the operation of the Milk-Run system.

5. Damage to Supplier Production in Poorly Maneged Milk-Run System

Milk-Run is a lean logistics solution. In traditional logistics, there are more individual vehicle-to-plant shipments. In a Milk-Run route, a truck stops at all supplier locations and returns to the plant [6]. In logistics, milk transportation requires commitment to all stages because any delay in the supply of inputs can halt the entire production process. The system requires very reliable suppliers. Poor planning and lack of accurate information about operational capacity and processes can lead to inefficient supply deliveries. Dealing with third-party suppliers and shipments can lead to higher risks of delays. Furthermore, Milk-Run distribution is more effective in mass production contexts. The complexity of the system can lead to inventory management errors when production requires a wider variety of materials or components. Any error

in handling any of the materials or components can disrupt production.

6. Results and Discussion

It would be appropriate to consider the cost optimization of the logistics company that will manage the process in detail. In order for the operation to be successful, it is extremely important to cooperate and communicate with your suppliers and carriers. This will ensure that both parties benefit from the process and work quickly, efficiently and harmoniously. Appropriate performance criteria and key performance indicators should be determined to measure and evaluate the performance of the processes. This will positively affect the efficiency of the process by monitoring the effectiveness and success of the process. At the same time, continuous improvement opportunities will be captured.

The Milk-Run method provides great benefits in logistics and supply chain management when applied correctly. By using this method, businesses can both reduce their environmental impact and increase customer satisfaction, thus becoming more successful and competitive. This system is a sustainable working model that protects nature and the environment. At the same time, it is a good investment in the future as a sustainable model.

In short, we can say that Milk-Run is a management system that helps businesses reduce costs, optimize their processes and reduce their carbon footprint. The subject studied here is interesting and a number similar works reported in the literature [7-11].

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
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