Advanced Logistic Systems – Theory and Practice, Vol. 14, No. 2 (2020), pp. 31-39.
https://doi.org/10.32971/als.2020.012

OPTIMIZATION POSSIBILITIES IN FINAL PRODUCTS INVENTORY SERVICES

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Abstract: The study is focusing on the internal companies' logistics services to increase the efficiencies of final products inventory. Competitiveness and effectiveness are important factors in the manufacturing and services processes, where those needed to serve out the whole logistics networks for different sectors. The article provides an integrated overview of a fictitious company' final products inventory activities and its intensification. There are three related area of the inventory activities: packaging, forms of final products load and the related vehicle unit services. This paper shows alternative solutions to improve the sensitivity of the final products processes. The methodology enables to find the right resource allocations for the efficient operation in the service of inventory operation.
Keywords: supply chain, optimization, SCM, CRM

1. INTRODUCTION

Companies deliver their final products to the customer by using the material flow processes, which is the most efficient way and in the shortest possible lead time. Achieving efficiency is based on the analysis of the manufacturing processes of the material flow system, as it is generally more complex than the material flow system of services [1]. Logistics deals with the organizations and planning of the physical flow of materials from the source of material to deliver to the customer.

The final goods of the production plants are handled by the service providers whose performs the logistics tasks. The main task is the preparation of the delivery processes with the required customer' products. Thus, there are necessary to create a stable and economical supply chain of packaging process, which is in line with the fulfilment of the orders specified by the customers.

The operational bottlenecks can be identified by mapping logistics activities, which can make visible the errors in the system and increase the efficiency of the current system. I have used in-depth study to search for a method to defining bottlenecks. Thus, the barriers of the system can be identified based on the complex logistics processes of the supply chain. Namely, it is caused by the capabilities of the given technology, which is already performed for predefined set of tasks. However, these efficiencies can be achieved by fine-tuning based on the overall processes to increase and improve our capacities of service.

In this case, the base company entrusts the logistics activities to a specialized logistics service provider for self-sufficiency. As a result, a Third-Party Logistics System Provider (3PL) appears in the customer service processes for enterprise supply chains. Thus, the 3PL provider guarantees a smooth and constantly evolving service of sector in supply chain. The difference between the Third- and Fourth Party Logistics System Providers, that the 3PL is only cover dedicated parts of the supply chain, while the 4PL is even responsible for the management and implementation of the entire supply chain [2].

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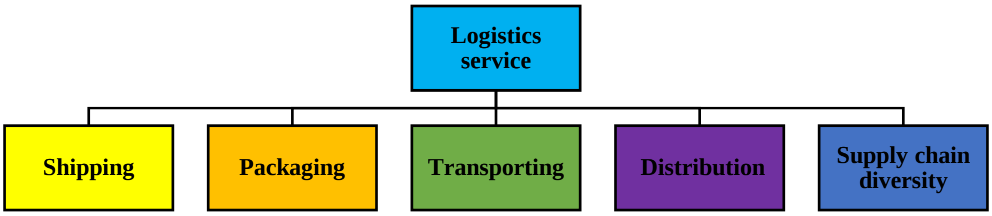

Figure 1. Interpreting a logistics service

As Figure 1. represents the supply chain can be interpreted among several members of the market, where certain market conditions have a significant impact on companies' processes. Economical operation helps to be stay competitive.

The Logistics outsourcing is defined as a service of several logistics activities, which can be the following [3]:

1. Shipping,
2. Packaging,
3. Transporting,
4. Distribution,
5. Supply Chain diversification.

Based on the literature, Capgemini is one of the global leaders in outsourcing service providers. In addition to the above mentioned levels, it can be interpretable the control of the complex logistics network.

Based on the concept of supply chain management, the aim is that maximally satisfying the customer needs and thereby creating value. In this collaboration, the participant companies jointly determine the supply chain' market performance and optimize the whole material flows.

2. ANALYSIS OF THE FINAL PRODUCTS' PROCESSES AT THE BASE COMPANY

2.1. Interpretation of base company' supply chain

Supply chain developments are closely linked to globalization, technology, and market members. Each trusted partner is connected on multiple layers belong the complexity of the market, where identified several aspects of logistic services, like design and restructure of the supply chain to rescheduling the planning of available resources in final products' processes. It examines several criteria systems, such general motivations, customer’s needs and service process efficiency [4].

Research and development (R&D) could be available by reducing operating costs. In long term, the companies must preserve the position of market and the business leaders.

Flexibility is not a negligible factor to suit customer’s needs. Due to the large amount of research on the related streams the most relevant thematic motivations [5] of the companies must be summarized.

Table I.

General motivations for competitive operation

Close control	**Profit maximalization**	**Costs reduction**	**Continuous development**
Motivations	Quality Management	Operational costs	Well-trained staff
	Leader's sector	D+F	Focuses on main activity
	New markets	Investments	Flexibility
	New services	Health care	Precision

I classified the motivations of competitive operation into three main groups in Table I.: 1) profit maximalization, 2) costs reduction, and 3) continuous development. Based on the systematization described, the delivery of requested products is important to achieve the maximally satisfaction of customers.

In addition, companies could be minimizing the resources allocations and maximizing the profit by operating the system efficiently [6].

In the next chapter, I sum up the logistics activities related to my research. After the analysis of logistics systems, the individual processes can be optimized, and I can develop innovative and modern solutions.

2.2. Logistics service' main tasks

In this study, I collect the most relevant forms of product's handlings and its characteristic processes to identify the systems' bottlenecks along the whole supply logistics chain.

The basis of logistics handling is the final products of the production companies. The base company requires the provision of high-quality and constantly evolving logistics services.

Delivery tasks of schedules require an integrated customer-centric production programming in the following fields of sectors:

1. production,
2. packaging,
3. delivering.

As the scientist literature proves, that logistics outsourcing is usually for cost reduction of the company, because the large variety of customer needs generate more and complex logistics tasks.

Market participants strive for continuous material flow according to customer needs. The logistics activity of the fictitious company is based on a complex pulling industrial production, which is implemented by several logistics units of different types and volumes. Thus, the extended logistics network and demand nodes make the cooperation relationship stronger among the Logistics providers concerned in long-term cooperation.

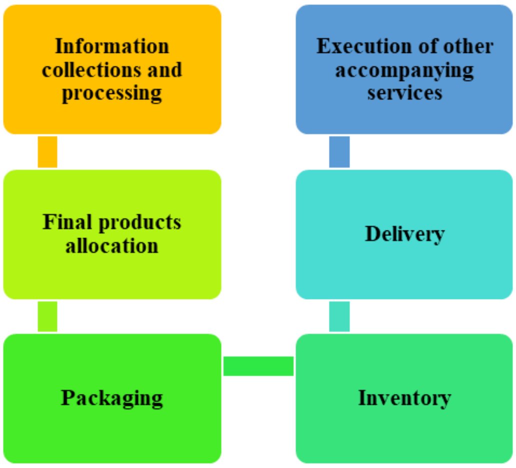

Figure 2. Logistics tasks of final products' handlings

The Figure 2 represents a wide range of task in the logistics activities, which include information data processing, allocation of the final products, packaging processes, warehousing and other documentation and service tasks. Otherwise, companies also need more attention to compliance with the legal regulations related to the activities and the local regulations.

Model I defines the units and quantities of the fictive company in the area of logistic services (LOG units) in Table II.

Table II.

LOG units' parameters

LOG	**Production capacity [t/day]**	**Shift number [n]**	**Shift periods [n x hours]**
A	420	2	2 x 8
B	600	3	3 x 8
C	550	2	2 x 8
D	840	2	2 x 8
E	270	2	2 x 8

Based on the parameters of Logistics units, these are characterized by continuous operation, which means that the production may forward the goods in the next stage of the material flow. Production is not able to keep the final products in own areas. LOG B unit is accepted because this priority logistic plant is opened in 24 hours.

In the next section, I describe the logistics peculiarities of the fictitious company, which can be examined through various analyses.

I assume that customer service is fulfilled among the planned production programming and scheduling (PPS) [7]. The fundamental difference between the two is, that the production programming is time-based and unsorted, while production scheduling uses continuous time plotting and sequencing [8].

3. MODELLING AND DEVELOPING THE LOGISTICS SYSTEM OF THE FICTIVE COMPANY

I examine the typical forms of the assumed units over a specific period with the evaluation of the data packets provided by the available logistic factories.

With this mind I define the specific model system of the logistics streams in production, handling and delivering in Figure 3.

Figure 3. Base company complex model system

There are several packaging options to consider when scheduling delivery. The features of LOG units are summarized below:

1. RAIL (D1, D8, D15, D21, D27): railway wagon, in bulk,
2. ROAD (D2, D9, D16, D22, D28): road truck, in bulk,
3. RAIL (D3, D10, D17, D23, D29): railway bag wagon, in bulk,
4. ROAD (D4, D11, D18, D24, D30): road closed vehicle, palletized bags,
5. RAIL (D5, D12, D19, D25, D31): railway container wagon, in bulk,
6. ROAD (D20, D26, D32): road closed vehicle, container,
7. RAIL (D6, D13): railway container, palletized BIG-BAG bag, railway wagon,
8. ROAD (D7, D14): in a road BIG-BAG bag on a palletized, closed vehicle.

Each local logistics plant has different capacities of packaging. Its causes can be traced back to current technological designs and its characteristics. The number of truck loading charges is influenced by local conditions. Among the charging times 1,5-hour difference may also occur.

The following decisions can be interpreted for the integrated delivery of LOG units:

- Defining a delivery task (type of finished product, quantity, selection of delivery method).
- Choice of packaging method:
  - Storage park-,
  - Truck-,
  - Bag-,
  - Big-bag loading.
- Packaging process (from where, when, where to).
- Scheduling conditions, constraints, and objective functions — with knowledge of the processes:
  - Bottlenecks - presentation of conditions, constraints:
    - Management of storage parks,
    - Technological limitations of presentations:
      - Selection of delivery type for each delivery task,
      - Local availability and use of packaging capacities: loading, unloading and unit load training,
      - Order of serving customer needs,
      - The current state of the system at the time of the decision.
- Simultaneous application of packaging processes for each LOG unit:
  - Big-bag loading options,
  - Different capacities of bagging machines,
  - Distribution of truck loading times.
- Vehicle arrival.

The objective functions are:

1. Keeping inventory at a minimum level,
2. Cost minimization,
3. Demand-driven fulfilment of orders.

To define the γ^{th} delivery task of assignment time:

$$T_{D\gamma} = \sum_{i=1}^{n} t_{Xy} + t_{T\gamma i}^{D} \; [hour] \tag{1}$$

where

T_{Xy} – is the selection of storage park to specifies the loading place of the packaging. [unit].

γ– is γ^{th} tasks of assigned customer' delivery [piece].

$T_{\gamma i}$ –is γ^{th} delivery, which specifies the loading time of the packaging. This time is interpreted from the availability of the vehicle. [hour].

$$t_{T\gamma i}^{D\beta} = \frac{Q_x^{\beta} - Q_{t\gamma i}^{D\beta}}{Q_x^{\beta}} t \, [hour] \tag{2}$$

The γ^{th} delivery task, for the D^{th} delivery mode, for the X^{th} product, and for the i^{th} removal step, where

Q_x^{β} – is the quantity of X^{th} product of the β^{th} package [t].

$Q_{t\gamma i}^{D\beta}$ – is the D^{th} mode of delivery, where the quantity of product by the customer prepared for the β^{th} delivery task from the X^{th} finished product at the i^{th} step [t].

The objective functions of the problem describe the minimization of the cost of delivery tasks, which is the operating cost of the best scheduling variant.

$$C_D = \left(\sum_{j=1}^{\alpha} C_{D\gamma i}(t_{T\gamma i}^{D\beta}) + \sum_{k=1}^{\chi} C_{OR} + \sum_{l=1}^{\delta} C_I + \dots + \sum_{m=1}^{n} C_{OP} \right) TFy = \min \tag{3}$$

where

C – are the cost functions [EUR].

$C_{D\gamma i}$ – are special costs of the loading mode in given period [EUR].

C_{OR} – is the cost of fulfilling the order [EUR].

C_I – are the average prices of inventory in the different storage modes at assignment period of logistics activities. These costs can be determined from current assets and storage facilities [EUR].

C_{OP} – are the maintenance operational costs of each vehicle in the time of staying industrial site, which is proportional to the costs of production, packaging and transport [EUR].

TFy – is assignment period of logistics activities [unit].

Based on the model of framework developments proposals are introduced:

- *Proposal I:* creating a different sift of work schedule: Based on table II one of the logistics plant (B) clearly defined to work in different work schedules. This means that I. work schedule is from 6:00 to 14:00, II. work schedule is 14:00 to 22:00, and III. work schedule is from 22:00 to 6:00. There is a need to ensure a continuous flow of material between the production and logistics unit.
- *Proposal II.:* implementation of technological transformation: My solution would be a technological transformation to charge the storage silos from the production plant so that there is no need for personnel in the area in the evening.

7. Conclusions

Production is closely linked to LOG units because these service providers are performing the logistics tasks to take care of the complex material handling, transport, storage, and warehousing tasks. The alternative solutions are realized by improving the current construction.

The bottlenecks justify the unequal utilization of capacities. The logistics plant serves out customers as overtime after the work schedule.

An optimal scheduling version of the handling of finished products can be developed, which can be scheduled based on the orders of a given period:

- storage silos,
- daily containers,
- storage facilities,
- unit loads,
- bags,
- vehicle charges.

Using the above, an optimal scheduling program can be compiled, which heuristic solution can be used to select the most economical scheduling version.

I am convinced that significant results can be achieved through improvements in the more sustainable operation of current technologies. Continuous technical development remains crucial for companies.

Acknowledgements

The described article was carried out as part of the Higher Education Institutional Excellence Program.

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