BUSINESS LOGISTICS AND ITS IMPORTANCE IN COMPANY´S COMPETITIVENESS

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Abstract

This paper focuses on business logistics, its importance and areas of solution. Nowadays, businesses are forced to increase efficiency and to optimize their processes because of high competition and demanding customers. Business logistics plays a key role here. The primary objective of business logistics is to ensure optimal material, information and value flow in the company's transformation process. Business logistics is essential for securing products or services from supplier to consumer because it includes everything from acquisition from wholesalers and suppliers to manufacturing, storage and delivery to customers. Company´s owner should have a strong knowledge of its logistics systems to ensure maximization of profits and to be able to give customers the most positive experience possible. There is a need to constantly monitor the functioning of individual supply chain articles because the occurrence of an error can affect the entire chain and the product or service may not reach its customer in the required time, quality, quantity and at the optimal cost. It all depends on responsible employees and owners, as they perfectly know the logistics processes and can detect the waste and inefficiency in them. In this paper, the authors will provide the results of the research that has been realized in the Slovak manufacturing company and the authors will point out how the specific solution in business logistics can save the company's costs, which of course also affects the profit. In future research, the authors will deal with the use of individual methods to optimize logistics flows and processes in the same company. Successful business logistics provide a competitive edge against other organizations and customer needs can be fulfilled in a more efficient manner. For all of this reasons, the authors think it is very important to deal with business logistics at present and it is very actual topic.

Key words: logistics, business logistics, effective logistics processes, logistics flows, competitiveness.

1. INTRODUCTION

In an advanced market economy, only a business that can meet the increasingly demanding customer needs can succeed with a solid supply of new and high quality goods or services. However, it is not sufficient to buy or produce quality goods or to provide quality service. Care should be taken to ensure that the right product is available, with the right quality, at the right customer, in the right amount, at the right place, at the right time, and at a reasonable cost. Just logistics helps to solve so-called "Seven Rs".

The role of logistics in today´s and tomorrow´s profitable companies will change as the value of products changes, and also as the value that buyers or customers ascribe to product changes. This statement represents a new concept for many logistics managers, who were trained in transportation, warehousing, and other such functions to conduct their activities based on lease-cost or other hand measure priorities. Modern logistics managers must find innovative ways to help their companies improve profits, increase market share, improve cash flow, open new territories and introduce new products. However, logistics neither creates demand nor product. Logistics is the organization that responds to demands, and creates a bridge between that demand and those who supply it. A professional and integrative approach is clearly needed (Quayle & Jones, 2001).

Currently, logistics is a recognized scientific discipline in Slovakia, which, as a relatively comprehensive theory of minimizing logistics costs in providing maximum logistics services under the condition of environmental friendliness, models the flow of materials and services (Bartosova & Kral, 2016). Logistics is a modern science discipline that enables to optimize processes of material security, to realise the storage of material and dispose of it, and related activities. At present, information plays an irreplaceable role a component of logistics that aims to provide comprehensive information not only on quality and quantity, but also on destination, method of transport, method of the use, and other attributes of the logistics process.

To the organization, business logistics is important in several ways. First, business logistics provides an opportunity for the firm to create a sustainable competitive advantage for itself by designing a system which fulfills customers' needs better than the competition. For example, the company could offer faster, more accurate, and more consistent order filling and delivery than competitors are capable of providing. Secondly, due to its complexity, a superior logistics system is a proprietary asset that cannot be easily duplicated. Many companies have begun to view business logistics as an effective competitive weapon.

In the paper, the authors will focus primarily on business logistics and try to demonstrate how a particular business logistics solution can significantly reduce costs and thus increase the company's competitiveness.

The paper is composed of 8 sections. In the first chapter, *Introduction*, authors emphasize the importance of logistics in today's modern world and describe business logistics as the basis for business competitiveness. The second chapter, *Logistics and system approach,* deals with the system approach, which is one of the most important foundations of logistics. Then it includes division of logistic systems, micrologistics and macrologistics systems are described. Term of business logistics is mentioned as a subset of micrologistics. The third chapter, *Business logistics and its subjects*, deals in detail with the theory of business logistics and describes its individual subjects - purchasing and supply logistics, production logistics and distribution logistics. In the fourth chapter, *Analysis of production batches in the particular manufacturing company*, the authors realize the analysis of production batches in particular manufacturing company and provide results of this analysis with calculation of costs on current production batches. The fifth chapter, *Suggestions and recommendations*, contains suggestions and recommendations for merging production batches and calculation of costs for new level of production batches. In the sixth chapter, *Results*, authors provide comparing before and after merging production batches and calculation of potential cost savings. The goal of the seventh chapter, *Conclusion*, is to summarize of all results the research realized by authors. The eighth chapter, *References*, consists of references of literature resources used by writing the paper.

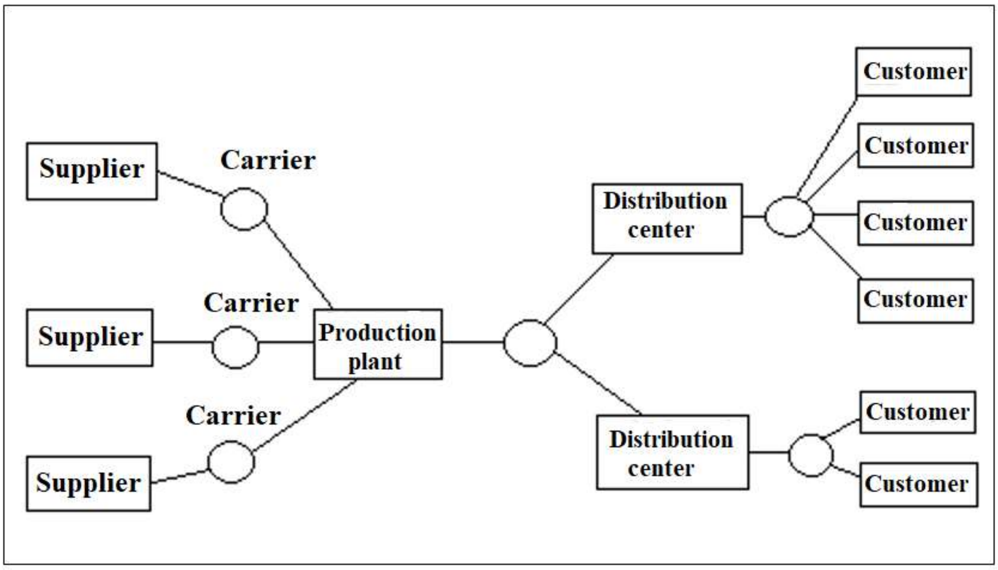
2. LOGISTICS AND SYSTEM APPROACH

Before the authors focus on business logistics, they have to define logistics in general. Pernica (2005) defines logistics as a discipline that deals with the overall optimization, coordination and synchronization of all activities whose concatenation is essential to the flexible and cost-effective achievement of a given final (synergistic) effect.

The importance of logistics is increasing with increasing globalization. Companies are under intense competitive pressure, and logistics takes a strategic position in this situation (Chijioke, Vu & Olatunji, 2018). It helps businesses to improve customer service, on which is the primary focus since of the early 1990s. It allows to reduce costs and thereby achieve higher profits. The effectiveness of this scientific discipline increases with the development of information technology. A system approach is absolutely necessary for its success. Understanding the interrelationships plays a key role in increasing the efficiency of the system as a whole (Drahotský & Řezníček, 2003).

System approach is one of the most important foundations of logistics. It is itself a system; it is a network of related activities designed to manage the flow of material and personnel within the logistics channel. This system is shown in Figure 1. It shows a simplified example of a network of relationships and links that logistics must manage in a distribution channel (Drahotský & Řezníček, 2003).

Figure 3. Distribution channel

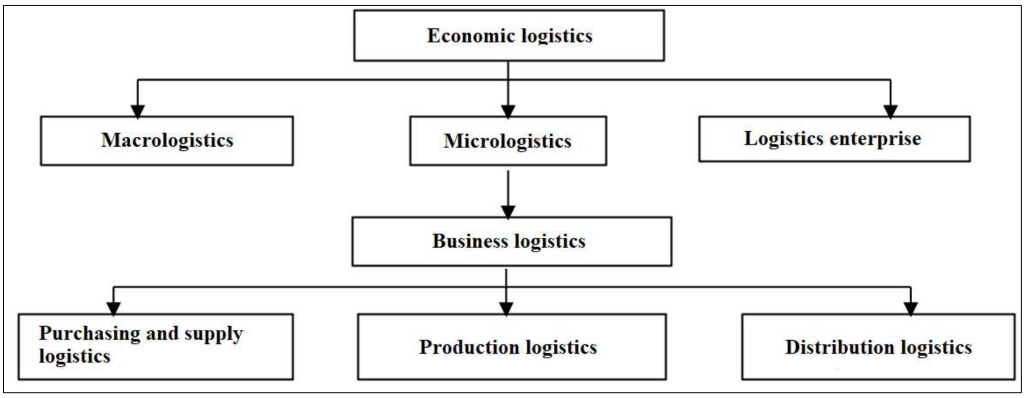


Source: Lambert, Stock & Ellram, 2005

Customer demands continue to grow (Cyrus & Vogel, 2018). An integrated logistics system, supported by an integrated logistics information system, is required to meet their requirements. Information technology has a significant impact on the development of logistics. The basis of the logistics system is the handling of orders. Imperfect communication can result in loss of customers, increased transportation and storage costs, or increased inventory maintenance costs. Therefore, to support logistics activities, computers are used to a great extent in order handling, inventory management, performance measurement, but also in the transport process (Drahotský & Řezníček, 2003).

Logistics systems can be broken down from the perspective of different experts but also from different economic interests. For the purposes of the paper, the authors will be guided by the following figure, with which they will continue to work.

Figure 4. Division of logistics systems



Source: Sixta & Mačát, 2005

Macrologistics systems solve the problems of mass movement from the point of view of national economy, so their view goes beyond the boundaries of individual companies and sometimes even states. Most macrologistics decisions affect logistics costs and hence business profits (Sadaf et al., 2018).

Micrologistics deals with logistics chains inside an industrial plant or between plants within a single enterprise. The subject of the research is a pre-production process (purchase of materials from suppliers), own production process (handling means, company warehouses, transport technology, information and decision-making system) and post-production processes (sale and delivery of products to customers) (Křížová et al., 1994).

Business logistics is a subset of micrologistics that includes business systems in circulation and in production. Within these systems, we deal with issues of material flow, energy and information, both in terms of time and space, inside and outside, as well as storage, handling, transportation, and so on.

3. BUSINESS LOGISTICS AND ITS SUBJECTS

The micrologistics system of business logistics is being built with the aim of comprehensive optimization of material and information flows within the company. Its task is to plan, organize, manage and control these flows from suppliers to customers. In the area of supply, distribution and return flows, it acts as a link to the company's external environment (procurement and sales markets) (Seidl & Tomek, 2012).

Business logistics serves to support business goals, a set of tasks that provide measures to ensure optimal material, information, and value flows in the company's transformation process (Sponte, 2018).

The basis of business logistics is considered to be the material flow, which is mainly composed of movement:

- auxiliary and consumables,
- production aids,
- work items,
- rejects,
- means of transport,
- waste.

We understand the material flow as an organized movement of all the objects that are necessary to realize the production process in the production system and between the elements of the production system and its surroundings (Dupaľ & Brezina, 2006).

The content of enterprise logistics is (Dupaľ & Brezina, 2006):

1. Organizing, planning, securing, implementing and controlling all relocation and storage processes in the enterprise.

2. The actual realization of physical processes, which are expressed by material flow.

3. All those activities that relate to, respectively, related to information flow.

For business logistics to play its primary role, to optimize the movement of material in the enterprise, it is necessary to integrate the sub-systems into an integrated system that coordinates and manages the material and relevant information flow (Dupaľ & Brezina, 2006).

Entities determining business logistics are as follows:

- purchasing and supply logistics,
- production logistics,
- distribution logistics.

3.1. Purchasing and supply logistics

It presents a summary of logistical tasks and measures in the preparation and implementation of the purchase. Its essential task is to secure the production process and the entire business operation of the enterprise with the necessary resources. Consequently, it must deal with:

- market-oriented tasks linked to contracting,
- physical tasks and material flow management; goods.

These tasks are related to problems that must be addressed in purchasing and procurement logistics (Dupaľ & Brezina, 2006):

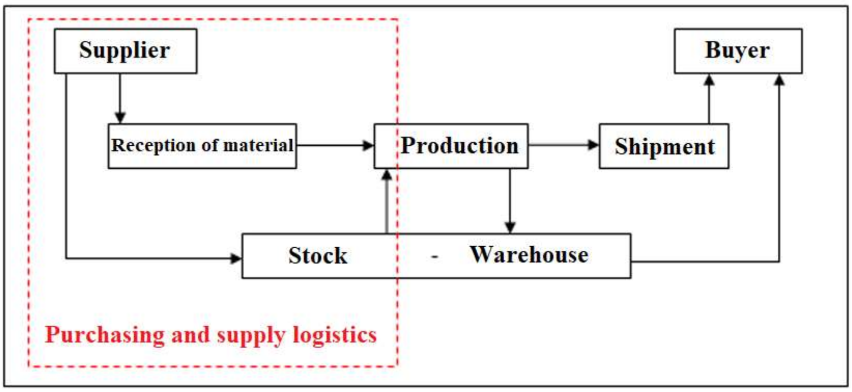
- reconciliation of purchasing and supply with production,
- checking the quality of purchased material,
- minimizing purchasing and shipping costs,
- choosing an appropriate purchasing and supply strategy,
- qualitative selection of the supplier.

A group of authors has developed a supplier evaluation model where it defines the basic approaches, guidelines and principles for assessing their quality. The aim of this model is to increase the efficiency of supply chain management, which allows for a better response to emerging situations and calms the needs of the logistics company (Kovacova & Kliestik, 2017).

A selected supplier should be the one who meets the best criteria in a combination of quality and price. A supplier, manufacturer and customer should be involved in the process of increasing competitiveness, creating a new, complex process. The authors are talking about so-called controlled cooperation, which exceeds society, this approach is called "supply chain management - SCM". The supplier is evaluated on the basis of multi-criteria analysis, using the following criteria (Lizbetin et al., 2015):

- price,
- quality (quality certificate, number of complaints),
- reliability (delivery deadline),
- delivery time,
- flexibility (supplier's willingness to accept change),
- responsibility (for poorly rendered service),
- identification/prevention of risks (willingness to identify and prevent risks),
- development of the supplier (willingness of the supplier to innovate and modernize the development of cooperation).

Figure 5. The boundaries of purchasing and supply logistics



Source: Dupaľ & Brezina, 2006

3.2. Production logistics

Business logistics comprises logistical tasks and measures that are necessary to prepare and run the production process. It includes all activities related to the material and information flow of raw materials, production and auxiliary materials from the input warehouse to production, from the stock of semi-finished products and purchased parts through individual production stages, intermediate storage and assembly to the finished goods warehouse. These activities then need to address issues related to (Dupaľ & Brezina, 2006):

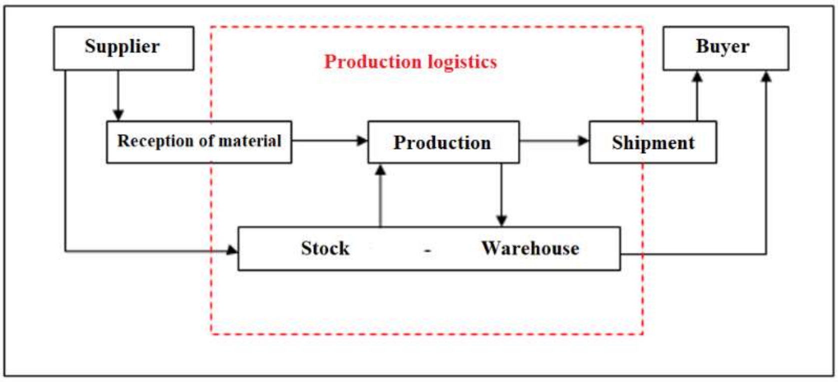
- production planning,
- structuring production from a logistical point of view,
- MAKE OR BUY strategy,
- arranging physical and information flows,
- newer production management systems.

Production logistics is basically a subset of the complex logistics of supplier-customer relationships or chains. Its complexity, the scope of the engagement are directly proportional to the complexity of the production process (Valaskova et al., 2018).

Currently, manufacturing companies are exposed to demanding customers and constantly increasing their requirements. Customers demand high quality, a variety of special product modifications, fast delivery and so on. For this reason, the company must look for new strategic concepts in order to respond flexibly to customer wishes and ensure high availability, reliability of supply, flexible production, etc. (Kanovska, 2018).

The desired flexibility can be achieved mainly by deliberately influencing the production time of a particular product, which also includes unwanted high non-productive times. In particular, storage, inter-operation transport and handling, unsuitable production technology have a share on them (Křížová et al., 1994). For illustrative purposes, the share of storage and transport costs is on average up to 15% of the product's selling price (Lehutova et al., 2013).

Figure 6. The boundaries of production logistics



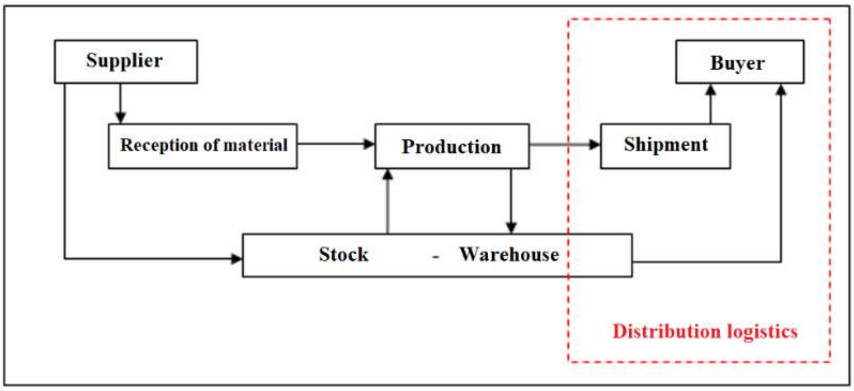
Source: Dupaľ & Brezina, 2006

3.3. Distribution logistics

Distribution logistics deals with all activities related to the flow of goods from finished goods warehouses to the sales market, including information. It presents a summary of logistical tasks and measures for the preparation and implementation of distribution. In particular, it addresses the following issues (Křížová, Gregor & Rakyta, 1994):

- where are the stocks,
- where are the warehouses,
- how to cost-effectively share deliveries,
- what storage and picking systems will be used.

Figure 7. The boundaries of distribution logistics



Source: Dupaľ & Brezina, 2006

4. ANALYSIS OF PRODUCTION BATCHES IN PARTICULAR MANUFACTURING COMPANY

When processing the paper, the authors cooperated with the Kinex Bearings, which produces rolling bearings. It is a manufacturing plant situated in the territory of the Slovak Republic, namely in Bytča. It belongs to the bearing group KINEX BEARINGS, which, with its portfolio, has become one of the world's leading suppliers of standard and special rolling bearings for use in various industrial applications.

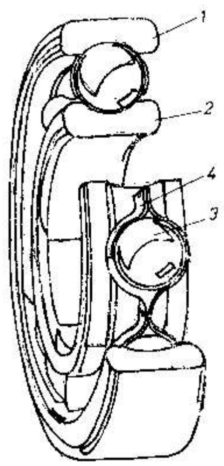
The main task and objective is to ensure the delivery of a complete bearing range produced in individual plants, to develop cooperation with customers and to provide them the services according to their requirements. In order to maximize their satisfaction and achieve a flexible response to market demands, KINEX BEARINGS integrates R&D, planning, production and business activities. Almost all production is oriented through KINEX BEARINGS, a. s. to foreign markets. Kinex Bytča, a. s. is currently focusing on three major bearing application segments: automotive, textile and aerospace.

4.1. Characteristics of rolling bearings

Rolling bearings are components that serve to transfer forces between moving and fixed machine parts and reduce friction between them. They have many advantages over sliding bearings, such as less friction coefficient and associated lower power losses, simplified machine design and maintenance, less lubricant consumption, and the ability to produce with higher revolutions.

Usually, a rolling bearing consists of an inner and an outer ring, between which rolling elements roll along the integrated raceways. Rolling elements are required to be kept at the same distance from each other and do not touch. This feature is provided by a cage. The inner ring is mounted on the shaft pin, the outer ring is housed in the machine body (frame). Rolling bearings can be used in virtually all machines. Their main task is to reduce the friction between the shaft and the part in which the shaft is mounted by means of the rolling rotating elements between the outer and inner rings of the bearing. There is also a second possibility of rolling bearing design - it can consist of an outer sleeve and a shaft. In this case, the raceways are integrated on both the shaft and the outer sleeve. The following figure shows the cross-section of the rolling bearing and its individual parts: 1. outer ring, 2. inner ring, 3. rolling element, 4. cage.

Figure 8. Parts of rolling bearing



Source: http://www.sossoukyjov.cz/data/file/Strojnictvi/VY_32_INOVACE_5c/VY_32_INOVACE_5c19.pdf

4.2. Specification of the selected bearing group

Because of the fact that Kinex Bearings, a. s. produces a huge number of types and designs of bearings, for the purpose of the paper, the authors have chosen a group of special double row bearings for water pumps of type R (with one row of rollers and one row of balls) and type K (two row of balls), which they will focus on in the analysis of the production process.

Bearings are identified by type (K or R) and a three or four digit number. The following figure shows a range of bearings within this selected group.

Figure 9. List of dimensional types for customer METELLI

• BR863G-2TIH	• BR675M-2TIH
• BR603M-1TIH	• BR980G-2TIH
• BK249M-1TIH	• BR173.1M-1TIH
• BK2057M-1TIH	• BR076M-1TIH
• BK2233M-2TIH	• BR2084-1TIH
• BK512M-1TIH	• BK352-BM1TIH
• BK608M-1TIA	• BR2082-2TIH
• BK2159M-2TIH	• BR220M-1TIH
• BK621M-2TIH	• BR045M-1TIH
• BR2043G-2TIH	• BR2128G-2TIH
• BK360-BM1TIH	• BR082M-1TIH
• BK279M-1TIH	• BR192.1M-2TIH
• BR2031M-1TIH	

Source: own processing by author

This group is delivered to Italian customer METELLI S. P. A., the largest automotive customer. The bearings then become part of the water pump component at the customer´s manufacturing plant.

4.3. Analysis of production batches of a selected group of bearings

In analyzing production batches for each month, the authors base on „budget" on 2019, which was firmly accepted by the company. Budget is derived from a specific customer's demand (METELLI in this case). Production batch sizes are sorted by type into individual months to meet the required order for the entire year. Production batches are not the same in individual months, such a distribution was carried out by the sales department and subsequently shifted to production. Production deparment is already responsible for planning individual inputs that are needed in specific periods to produce a given number of bearings. The determination of the production batch size was based on empirical estimation. The company does not use any of the relationships to calculate the optimal production batch.

Table 1. Production batch size for the first half of 2019 in pieces

Size of production batches for individual months (pcs) / Dimensional types	JANUARY 2019	FEBRUARY 2019	MARCH 2019	APRIL 2019	MAY 2019	JUNE 2019
BR863G-2TIH	37 600	37 900	52 500	48 400	45 500	52 600
BR603M-1TIH	13 300	9 300	15 200	18 150	21 000	15 200
BK249M-1TIH	32 000	19 700	42 600	32 000	30 200	34 000
BK2057M-1TIH	14 000	10 000	20 700	16 800	17 800	19 800
BK2233M-2TIH	25 200	18 800	27 700	27 300	29 000	29 500
BK512M-1TIH	11 800	9 800	11 800	11 700	13 700	11 700
BK608M-1TIA	11 800	11 400	13 500	14 600	9 400	18 500
BK2159M-2TIH	12 000	8 400	13 000	13 800	14 000	12 700
BK621M-2TIH	8 400	12 000	9 500	11 200	9 500	8 400
BR2043G-2TIH	4 700	4 200	5 100	5 600	8 000	7 900
BK360-BMITIH	10 800	9 800	12 800	13 500	12 700	11 700
BK279M-1TIH	7 700	6 600	11 300	9 400	12 300	9 400
BR2031M-1TIH	7 000	4 000	5 500	7 500	7 000	5 500
BR675M-2TIH	4 700	5 100	6 000	5 600	5 800	6 200
BR980G-2TIH	1 500	2 800	1 350	2 500	2 500	1 200
BR173.1M-1TIH	5 300	3 800	5 200	5 000	5 400	5 100
BR076M-1TIH	2 000	2 500	3 500	2 500	3 000	2 000
BR2084-1TIH	2 500	2 700	3 500	2 100	2 850	3 000
BK352-BMITIH	7 500	6 100	7 800	8 000	8 500	6 800
BR2082-2TIH	3 200	2 000	3 100	3 000	2 700	2 500
BR220M-1TIH	2 200	1 900	2 300	2 100	2 300	2 400
BR045M-1TIH	2 800	2 600	2 800	2 900	2 800	2 900
BR2128G-2TIH	1 700	1 800	1 700	1 600	1 700	1 700
BR082M-1TIH	9 800	7 500	9 900	10 500	12 700	10 300
BR192.1M-2TIH	1 900	3 300	2 800	3 300	1 800	3 300
TOTAL AMOUNT	**241 400**	**204 000**	**291 150**	**279 050**	**282 150**	**284 300**

Source: own processing by author

Table 2. Production batch size for the second half of 2019 in pieces

Size of production batches for individual months (pcs) / Dimensional types	JULY 2019	AUGUST 2019	SEPTEMBER 2019	OCTOBER 2019	NOVEMBER 2019	DECEMBER 2019
BR863G-2TIH	45 500	18 800	46 000	45 100	45 200	42 400
BR603M-1TIH	15 300	9 500	17 100	15 200	20 900	12 400
BK249M-1TIH	28 500	14 100	36 000	31 100	39 150	31 500
BK2057M-1TIH	14 700	10 000	19 000	20 700	17 900	16 000
BK2233M-2TIH	19 000	18 600	31 200	23 900	28 800	23 600
BK512M-1TIH	11 700	7 000	11 800	11 800	11 800	11 700
BK608M-1TIA	13 200	7 500	19 500	13 200	14 100	13 200
BK2159M-2TIH	12 400	6 900	13 000	14 000	14 500	11 700
BK621M-2TIH	6 500	7 000	8 000	10 000	7 500	7 500
BR2043G-2TIH	7 600	5 800	9 400	7 500	7 000	4 300
BK360-BM1TIH	12 200	7 500	13 200	12 700	12 700	11 500
BK279M-1TIH	9 400	4 700	8 900	9 400	9 400	7 000
BR2031M-1TIH	5 000	4 000	5 000	7 500	6 500	6 000
BR675M-2TIH	5 600	4 300	6 200	5 600	5 800	4 700
BR980G-2TIH	1 350	1 400	2 200	2 100	1 450	1 500
BR173.1M-1TIH	6 000	3 300	5 500	5 600	5 500	4 500
BR076M-1TIH	3 000	2 500	2 500	2 500	3 000	2 500
BR2084-1TIH	3 000	2 100	3 000	2 500	2 000	3 200
BK352-BM1TIH	7 500	3 800	8 000	8 500	8 900	7 000
BR2082-2TIH	3 300	2 000	3 000	2 700	3 500	3 200
BR220M-1TIH	2 200	1 400	2 500	2 300	2 300	1 800
BR045M-1TIH	2 800	1 400	3 300	3 000	3 100	2 700
BR2128G-2TIH	1 800	2 000	1 900	1 900	1 800	1 500
BR082M-1TIH	9 800	7 000	11 300	9 000	10 400	10 000
BR192.1M-2TIH	3 700	2 400	2 800	2 300	2 800	2 800
TOTAL AMOUNT	**251 050**	**155 000**	**290 300**	**270 100**	**286 000**	**244 200**

Source: own processing by author

Based on the above tables, we can see that not all bearings are produced in large batches because annual orders are not in such volumes. In this paper, the authors are focusing on production batches of smaller volumes and then they become the subject of improvement. They think it is unnecessary to move with larger batches because there would not be enough capacity. They have set the "signaling number" to 5000 pieces because the production of the shaft starts on the machine SAY 8/32, whose output power is just around 5000 pieces. This means that in improving production in terms of production batches, they will focus on those batches that do not exceed this volume.

Based on the above tables, the authors could calculate the total number of bearings for all dimensional types for the entire year 2019. The planned number of produced bearings for the whole year for selected type dimensions was 3 078 700 pieces.

From the annual data, they calculated the average monthly production batch:

3 078 700/12 = 256559 pieces rounds after rounding.

Machine capacities are needed to produce enough amount of bearings. When determining the capacities, the authors based on the calculated average monthly production batch size and then they adjusted the capacities.

The capacity of the workplace (in a particular operation) depends on the following factors: machine performance, number of machines, number of shifts per day, number of days of machine operation per month and machine availability. Machine performance is determined by the number of components produced per shift (7.5 h). The machines are usually operated only during working days (20 days per month), but some of them are operated in continuous operation (based on an average of 30 days). Usability of the machine is given by the coefficient - most machines work with an efficiency of 85%. The authors do not count with 100% efficiency, because they take into account the average loss of production equipment, production equipment failures, absence of personnel due to holidays and sick leave, which is in the long term 15 - 20%. An exception is the ADASH machinery, whose coefficient is up to 0.95, which means that there is a minimum of losses on this machine.

The authors got the capacity numbers after multiplying all these factors. They had to calculate the number of capacity to every machine needed for production selected bearings.

The production of a particular group of bearings consists of the production of its components - the production of the shaft and the production of the outer sleeve and then the assembly is following. The authors had to recalculate the capacities of the production facilities involved in all these operations (totally 27 machines).

After recalculating capacities, they came across a lower number than the one required for three machines. While the S50CNC and SEL101C have a capacity lower than required, it is sufficient because only 80% of the components pass through these machines. The lower capacity of the JUS PV 2 is also sufficient, because the operations on this machine relate only to the R-type.

By adjusting the production batches, the authors can mainly reduce the cost of setting up the machines. The machine must always be adapted to the bearing currently being manufactured.

The total time to set up the machine is as follows: number of settings per month * length of time to set one machine in man-hours. The result is also in man-hours.

The authors have to consider, that they have to set up every machine 25 times a month, because the company produces 25 dimensional types of bearings. For every machine are stated how many man-hours it take to set up a machine. While the machine is being set up, the costs of individual employees (downtime in production) and adjusters are generated. The costs of individual employees (production operators) represent the hourly wage (McKinlay, 2018). Direct personal costs per one setting are the product of the length of one setting in man-hours, the direct unit wage, and the coefficient of statutory deductions. The coefficient of statutory deductions is 1.4 for operators and also for adjusters. The authors then calculate the total cost on setting as the product of the number of setting for a given month and the direct personal costs per one setting. They do not take into account the number of machines in this calculation, because only one machine is always setting by type.

In this way, the authors have calculated the cost of setting up the machine for the production of shaft, for the production of outer sleeve and assembling for both the production operator and the adjuster. The calculation for these employees was similar, the difference was only in wage per man-hour. Here are summary tables for both operator and adjuster.

Table 3. Total cost and capacity loss per operator

Production section	Costs per operator per month (€)	Costs per operator per year (€)	Monthly loss of capacity (man-hour)	Annual loss of capacity (man-hour)
Shaft	1804,95	21659,40	312,50	3750,00
Outer sleeve	1405,60	16867,20	255,00	3060,00
Assembling	397,43	4769,10	72,50	870,00
TOTAL	**3607,98**	**43295,70**	**640,00**	**7680,00**

Source: own processing by author

Table 4. Total cost per adjuster

Production section	Costs per adjuster per month (€)	Costs per adjuster per year (€)
Shaft	1297,45	15569,40
Outer sleeve	1603,35	19240,20
Assembling	0,00	0,00
TOTAL	**2900,80**	**34809,60**

Source: own processing by author

Loss of capacity is the time in man-hours during which the company could not produce, but there were downtimes due to machine setting. The authors do not take into account all machines when calculating the cost of the adjusters, because, for example, the machine MLL 30 is setting by the operator, so they would calculate the costs in duplicate. There are no costs per adjusters during assembly.

The following table shows the total monthly and annual costs in € for both employees and the loss of capacity in man-hours per operator. The authors did not calculate the capacity loss per adjusters because they only lose capacity once.

Table 5. Calculation of monthly and annual costs for individual employees

Employee	The amount of monthly costs (€)	The amount of annual costs (€)	Loss of capacity per month (man-hours)	Loss of capacity per year (man-hours)
Operator	3607,98	43295,70	640,00	7680,00
Adjuster	2900,80	34809,60	x	x
TOTAL	**6508,78**	**78105,30**	**640,00**	**7680,00**

Source: own processing by author

According to the amount of costs the authors can say that these are considerable amounts. Analysis of production batches gave the scope for improvement and reduction of costs on setting of machines. They will provide some solution for improvement in next chapter.

5. SUGGESTIONS AND RECOMMENDATIONS

This chapter is based on the analysis of production batches planned for 2019. The authors focused on those batches that are below 5000 pieces (machine performance of SAY 8/32 - production of the shaft). They decided to merge the production batches by quarters (3 months), so Kinex Bearings Bytča, a. s. would produce instead of 8 production batches per month 3 production batches. This distribution of production batches will lead to savings from the original number of produced production batches 25 on 20, respectively 19.

From the original table of all 25 dimensional types of bearings from customer METELLI S. P. A., the authors selected 8, which do not meet the volume of 5000 pieces.

Table 6. Size of production batches of the selected group of bearings for the first half of 2019

Size of production batches for individual months in pcs / Dimensional type	JANUARY 2019	FEBRUARY 2019	MARCH 2019	APRIL 2019	MAY 2019	JUNE 2019
BR2084-1TIH	2 500	2 700	3 500	2 100	2 850	3 000
BR220M-1TIH	2 200	1 900	2 300	2 100	2 300	2 400
BR045M-1TIH	2 800	2 600	2 800	2 900	2 800	2 900
BR2128G-2TIH	1 700	1 800	1 700	1 600	1 700	1 700
BR2082-2TIH	3 200	2 000	3 100	3 000	2 700	2 500
BR192.1M-2TIH	1 900	3 300	2 800	3 300	1 800	3 300
BR045M-1TIH	2 800	2 600	2 800	2 900	2 800	2 900
BR2128G-2TIH	1 700	1 800	1 700	1 600	1 700	1 700

Source: own processing by author

Table 7. Size of production batches of the selected group of bearings for the second half of 2019

Size of production batches for individual months in pcs / Dimensional type	JULY 2019	AUGUST 2019	SEPTEMBER 2019	OCTOBER 2019	NOVEMBER 2019	DECEMBER 2019
BR2084-1TIH	3 000	2 100	3 000	2 500	2 000	3 200
BR220M-1TIH	2 200	1 400	2 500	2 300	2 300	1 800
BR045M-1TIH	2 800	1 400	3 300	3 000	3 100	2 700
BR2128G-2TIH	1 800	2 000	1 900	1 900	1 800	1 500
BR2082-2TIH	3 300	2 000	3 000	2 700	3 500	3 200
BR192.1M-2TIH	3 700	2 400	2 800	2 300	2 800	2 800
BR045M-1TIH	2 800	1 400	3 300	3 000	3 100	2 700
BR2128G-2TIH	1 800	2 000	1 900	1 900	1 800	1 500

Source: own processing by author

The authors have merged the production batches as follows. They took three dimensional types (or 2), merged their production batches in three months and planned to produce them in the first month of the quarter. Another trio would be produced in the second month of the quarter, etc. The final sum for the year is unchanged. The procedure is well visible in the following tables.

Table 8. Merged production batches for the first half of 2019

Size of production batches for individual months in pcs / Dimensional type	JANUARY 2019	FEBRUARY 2019	MARCH 2019	APRIL 2019	MAY 2019	JUNE 2019
BR2084-1TIH	8 700			7 950		
BR220M-1TIH	6 400			6 800		
BR045M-1TIH	8 200			8 600		
BR2128G-2TIH		5 200			5 000	
BR2082-2TIH		8 300			8 200	
BR192.1M-2TIH		8 000			8 400	
BR045M-1TIH			8 200			8 600
BR2128G-2TIH			5 200			5 000

Source: own processing by author

Table 9. Merged production batches for the second half of 2019

Size of production batches for individual months in pcs / Dimensional type	JULY 2019	AUGUST 2019	SEPTEMBER 2019	OCTOBER 2019	NOVEMBER 2019	DECEMBER 2019
BR2084-1TIH	8 100			7 700		
BR220M-1TIH	6 100			6 400		
BR045M-1TIH	7 500			8 800		
BR2128G-2TIH		5 700			5 200	
BR2082-2TIH		8 300			9 400	
BR192.1M-2TIH		8 900			7 900	
BR045M-1TIH			7 500			8 800
BR2128G-2TIH			5 700			5 200

Source: own processing by author

In every month, thanks to the merger of production batches, 5 times of machine setting fell out. In March, June, September and December, the number of setting the machines was even 19. Now the authors recalculate the individual cost of setting for both operator and adjuster at 20 setting for 8 months and then recalculate the individual cost of setting for both operator and adjuster at 19 setting for 4 months. The calculations are shown in the following summary tables.

Table 10. Quantification of costs per month and 8 months for individual employees

Employee	The amount of monthly costs (€)	Amount of costs per 8 months (€)	Loss of capacities per month (man-hours)	Loss of capacities per 8 months (man-hours)
Operator	2886,38	23091,04	512,00	4096,00
Adjuster	2320,64	18565,12	x	x
TOTAL	5207,02	41656,16	512,00	4096,00

Source: own processing by author

The authors determined all costs per 8 months when the machines would be setting 20 times. The same procedure will be used to determine the costs for the remaining four months when the number of setting the machines will be 19.

Table 11. Quantification of costs per month and 4 months for individual employees

Employee	The amount of monthly costs (€)	Amount of costs for 4 months (€)	Loss of capacities per month (man-hours)	Loss of capacities per 4 months (man-hours)
Operator	2742,06	10968,24	486,40	1945,60
Adjuster	2204,61	8818,43	x	x
TOTAL	4946,67	19786,68	486,40	1945,60

Source: own processing by author

After merging the production batches, the annual costs for both employees were 61 442,84 €. The total lost capacity by operator on the machine amounted to 6041,60 man-hours.

Table 12. Quantification of annual costs and capacity loss after merging of production batches

Employee	The amount of annual costs (€)	Loss of capacity per year (man-hours)
Operator	34059,28	6041,60
Adjuster	27383,55	x
SPOLU	**61442,84**	**6041,60**

Source: own processing by author

6. RESULTS

After comparing the costs before and after the merging the production batches, the authors found that if the company merged production batches, it would save up to 16 662,46 € per year. Capacity losses decreased by 1639 man-hours per year. If they turn them into man-minutes, they get 98 340 man-minutes. The production of one bearing lasts on average 3,5 man-minutes, which means that in case of such savings the company could produce 28 097 bearings more per year. In case of their sale, if the average price of the bearing is 2,2 € per piece, the company sales would be higher by 61 813,71 €.

Table 13. Comparison of costs and capacity losses before and after merging of production batches

Original costs of setting the machines in €	Costs of setting the machines after merging production batches in €	Savings	Original capacity losses in man-hours	Capacity losses after merging production batches in man-hours	Savings
78105,30	61442,84	16662,46	7680,00	6041,00	1639,00

Source: own processing by author

The authors encourage the company not to accept orders below 5000 pieces of bearings from its customers because it unnecessarily increases the cost of setting the machines due to small batches and generates capacity losses.

7. CONCLUSION

In this paper, the authors provided the results of the research that has been realized in the Slovak manufacturing company and they pointed out how the specific solution in business logistics can save the company's costs, which of course also affects the profit. The greatest emphasis was placed on production logistics and production batches. The 25 dimensional types of bearings that the company sells to its largest automotive customer METELLI S.P.A were the subject of a thorough analysis.

In this case, the authors have encountered a problem of too small monthly production batches for certain dimensional types of bearings that have been subject of improvement. Production batches over 5 000 pieces remained unchanged due to insufficient capacity in case of mergers.

So the authors chose 8 types, which they gradually merged for each quarter. In this way, the company would "pre-produce" bearings for a few months ahead. The whole suggestion is also documented by numerical characteristics. The costs of setting the machines have always been calculated by the operator at the machine and the adjuster. The operator at the time of setting the machine has a downtime and cannot produce, but is rewarded by wage per hour and the company pays for it. The adjuster is directly involved in process of setting the machine. Some machines can be set by the operators on their own, so there are no costs per the adjusters in this case. An enterprise could save up to 16 662,46 € per year in the case of a merging of production batches.

These savings are related to only to the dimensional types of bearings that METELLI buys from the company. The company produces about 80-90 production batches per month, which accounts for about 40% of its total production. If the company would continue in the authors` suggestion and would also merge other small batches of other dimensional types, it would generate a great deal of cost savings.

Too small and frequent production batches are inefficient in terms of costs of setting the machines and capacities. That is why the company should also impose a restriction that it will accept orders greater than 5000 pieces.

Small batches can be seen as some way of wasting. The company should certainly solve this problem in the foreseeable future, and it could save the financial funds and later use them to develop the company.

This study in a particular manufacturing company provides one of the many proofs why business logistics is important for business performance and its competitiveness. When a company is interested in the functioning of individual parts of business logistics - purchasing and supply, production and distribution logistics - this approach can greatly reduce the company's costs that will affect its profits.

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