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Analysis and Rationalization of Logistic Processes within Company X

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ABSTRACT

In this master thesis the procurement process in the Company X in Kosovo and their associated logistics costs are discusses. Based on the analysis the rationalizations of listed logistics procurement process are set as the primary goal in this thesis.

In the firs part of this master thesis are presented opening remarks.

In second part we show the basic concepts of the logistics enterprises;

In the third part of this paper the results are presented that were obtained on the basis of:

- Systemic approach to capturing spatial - temporal transformation of material goods and the costs incurred through all parts of the company within the procurement process,
- The selection of the dominant group on the basis of material goods via Pareto-ABC analysis.

The Fourth part presents the results that were obtained on the basis of:

- Selection of reference lines delivered with the introduction of its own fleet, based on the Pareto-ABC
- Analysis of the selection of transport routes (routing) based on the method of "pendulum"
- The procedure for the determination of transport capacity, where the number of vehicles count on the basis of transport requirements (c1) and the ability of the transport fleet (Wq).

After ABC analysis is conducted for the purpose of gradual introduction of company own fleet, in those directions where delivery is generating the highest transport costs and determine the costs that would occur during the formation and operation of company own fleet for a period of twenty years has led to the following conclusions:

- Distinguished funds to transport milk by someone else (leased) fleet annually: 403465.58 [euro]
- Distinguished funds to transport milk using company own fleet at annual level: 238772.15 [euro].

The difference in segregated funds before and after implementation of the proposed measures, on an annual basis, is 164693.42 [euro] or 40.81 [%]. The total logistics costs before the intervention were: 521415.32 [euro], and then after the intervention they are:

356721.89 [euro], representing a decrease of 31.59 [%].

By applying appropriate methods, mention above, for analysis of the current situation an insight is given into the complete process.

As we presented above, after the process of improving the current situation was made, a comparative review of the cost price of existing and improved conditions and on the basis of these data an approach in giving the final considerations has been made. As an end result a reduced logistics costs, and successfully carried out rationalization process of Inbound Logistics appeared.

KEYWORDS

Logistics, Procurement, Company, Transport, Rationalization.

*FOOTNOTE:

Information in this Master Thesis was provided from the owner of the analyzed Company X, who asked that his name, his Company name and names of his suppliers not to be disclosed.

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- Director of Company X, the person who provide me for a relatively short time almost all necessary information, and with his guidance and excellent inputs throughout the thesis.
- Diellza Berisha, my college and friend, who help me and support me.

This Master Thesis I dedicate to my family: father Faruk, mother Sabira.

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GLOSSARY OF TERMS:

- C_t - Total cost of delivery for the Self neither fleet
- N_{ad} - Number of arrange drivers
- C_{dc} - Daily Costs for arrangement of one driver
- GPI - Gross Personal Income
- D - Distance between Company and Farm "1",
- N_{tt} - Number of turn needed for transport
- C_f - Consumption of fuel on 100 km
- P_f - Price of fuel
- C_o - Other costs,
- D_i - Distance between Company and Farm "i"
- C_s - The cost of storage [euro per day/ m²]
- C_e - Labor costs per day per square meter
- GWPI - Gross workers personal income
- Sa - Storage area,
- C_E - Daily energy cost per square meter
- C_o - Other costs are estimated on [10%] of employers cost and energy cost.
- $T_{i.g}$ - Total average stocks of the i-group [unite measurement – u. m.]
- $P_{i.g}$ - Price of i-group of material goods [euro/ u. m.]
- $I_{n.d}$ - Interest rate on non-term deposits within a year [%]
- C_t - Transportation costs
- C_{ul} - Costs of unloading
- C_s - Costs of storage
- C_i - Costs of inventories
- $C_{\log.}$ - Total cost of procurement logistics

- Q - Maximum load capacity for which it paid the fare, [t];
- V_p - Travel speed (exploitation) [km / h];
- H - Distance transportation or autonomous movement distance [km];
- G - Total mass transportation or means of transport in loaded condition [t];

- L - Length road section under special conditions, for example: big ups, limits the profile of roads and the like.
- V - Outer volume of the means of transport in the regime of movement, [m³];
- $G_{p.m}$ -Total consumption drive and other materials (fuels, working liquids and gases, oil, grease, spare parts, components and auxiliary generators, etc., [t];
- T - Total time the means of transport to the capital repair and other guarantees as an indicator of the reliability of the means of transport, [h];
- N - Power engine [kW];
- $V_{\max}$ - Maximum speed [km / h].
- $A_{i1} + A_{i2} + ... + A_{in} = A_i$ - Inventory number of vehicles of the same group (the same payload)
- $Q_{i1} + Q_{i2} + ... + Q_{in} = Q_i$ - Quantity of transported cargo from the same group of vehicles
- $D_{i1} + D_{i2} + ... + D_{in} = D_i$ - The observed period of time (inventory days for units of fleet)
- A_{iQ} - Inventory number of vehicles calculated on the basis of full productivity
- C1 - Vehicle number calculated on the basis of transport requirements
- AOP - Automatic Data Processing

1. OPENING REMARKS

1.1. OPENING

Every company that deals with manufacturing or manufacturing activity, in respect of transformation of labor with the aim to create and add value, must pay special attention optimal use of available resources.

The optimal utilization of resources implies implementation, control and management of processes in the company by realizing minimum total cost. The term company's logistics is linked to the Spatial-Temporal transformation of material goods from sources (suppliers) to the mouth (customers) in optimal mummer.

From the above it can be said that the enterprise logistics is a instrument to increase profitability of the entire company system, by watching the flow of material goods and raw materials, and the associated logistics costs.

The main objective of this final paper is to streamline the process of logistics procurement of raw materials and the dominant raw material (milk) for the production company X, analyzing the structure and types of logistic costs and the proposed measures and solutions for their reduction.

Bearing in mind that in a market economy it a takes great competitive "struggle" to reach out to the customer, who is important to finalize those actions that preceded that one item is produced and made available at the right time, but also at the right price and adequate quality, it is especially important that optimization of operations in a company is done.

In order to evaluate overall performance, both in terms of organization and in an economic enterprise special space for optimization offers the area of "company logistics" which is being taught at the University for Business and Technology in Pristine. Company Logistics have, in my opinion, an essential field of study for any future engineer at any field at technical colleges.

It closely links expertise in selected areas and specific activities in the economy where this knowledge is applied, giving an overall picture of the business and the processes occurring in a single economic entity including proposed measures and solutions for rational improvement of this business.

It is precisely this possibility, which logistics provides us with, through certain scientific methods and primarily through systematic observation of connections and relationships in the space-time transformation of material goods from the supplier to the user to a specific product, we used to primarily:

Part 1:

- Presented opening remarks;

Part 2:

- Show the basic concepts of the logistics enterprises;

Part 3:

- Comprehend the whole process of procurement of material goods for the functioning businesses;
- Perform an initial selection of material goods that need attention;
- Capture process of spatio-temporal transformation of material goods from supplier to the manufacturing process and the associated information with them;
- Established through which instances of the company that process takes place;
- Establish responsibilities and liabilities of entities involved in the activity;
- Determine the cost of generating tangible good at spatial-temporal transformation throughout the procurement process;

- Make a selection of the dominant group of material goods (based on the selected criteria);
- Determined in detail the logistical costs and expenses that are forming for the observed dominant group;
- Critically analyze the current state of implementation of logistics processes;
- Identifying problem points observed during the study; make a selection of the reference points of the problem as a place of potential reserves for rationalization and improvement;

Part 4:

- Select a specific area within the logistics costs where there will be an attempt to execute the rationalization and improvement;

Part 5:

- Give a theoretical "way" to improve the existing situation;

- Perform the improvement of the current situation of implementation of logistics processes and give a final opinion and make a comparative analysis of the current and the improved condition.

1.1 Defining the basic hypotheses and research objectives

The basic starting assumption is that on the basis of analyzing the existing system of logistics procurement, find potential space (problematic points) to rationalize the existing logistics costs.

Therefore, the main objective of this paper is to streamline the process of logistics procurement of raw materials that is the dominant raw material of the Company X in Kosovo. Therefore we analyses the structure and types of logistics costs, and propose measures and solutions to improve the current situation.

In other words, the aim is to find the optimal relationship between the effects of logistics and logistics costs incurred in the implementation of the procurement process.

1.2 Research Methods

In the third part of this paper the results are presented that were obtained on the basis of:

- Systemic approach to capturing spatial - temporal transformation of material goods and the costs incurred through all parts of the company within the procurement process,
- The selection of the dominant group on the basis of material goods via Pareto-ABC analysis.

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1.3 Basic information about the Company X in Kosovo

Company started to operate in 1992 as a family dairy and one of the first dairies in the area of valley Dukagjini. This Company produced the traditional way of origin and taste and represents the crown of many years of work and experience in the production and processing of dairy products.

Years of experience, in following recent trends in technological processes and continuous investment in modern technology that has resulted in a range of 40 products. Milk is produced in the villages of valley Dukagjini daily dairy is delivered with over 40,000 liters of milk.

For the quality of the product great attention is paid because on the basis of product quality Companies quality is perceived. Confirmations of good quality are numerous medals won.

Modern market requires its suppliers not only good quality but also evidence of long-term consistency of their quality. Important support of mutual trust between producers and buyers are international quality standards.

Therefore, dairy Company X identified and introduced the first in a series of ISO 9001: 2000 as IHACCP which is a prerequisite for doing business in the global market.

1.3.1. ORGANIZATIONAL STRUCTURE OF THE COMPANY

The company currently has 120 employees, of which 60% are in production while the rest are the management team and administrative service. Of the total number of workers 15 are with a high school diploma, while others employed in administrative jobs with higher and secondary education.

In Figure 1 shows a schematic representation of the organizational structure of the company.

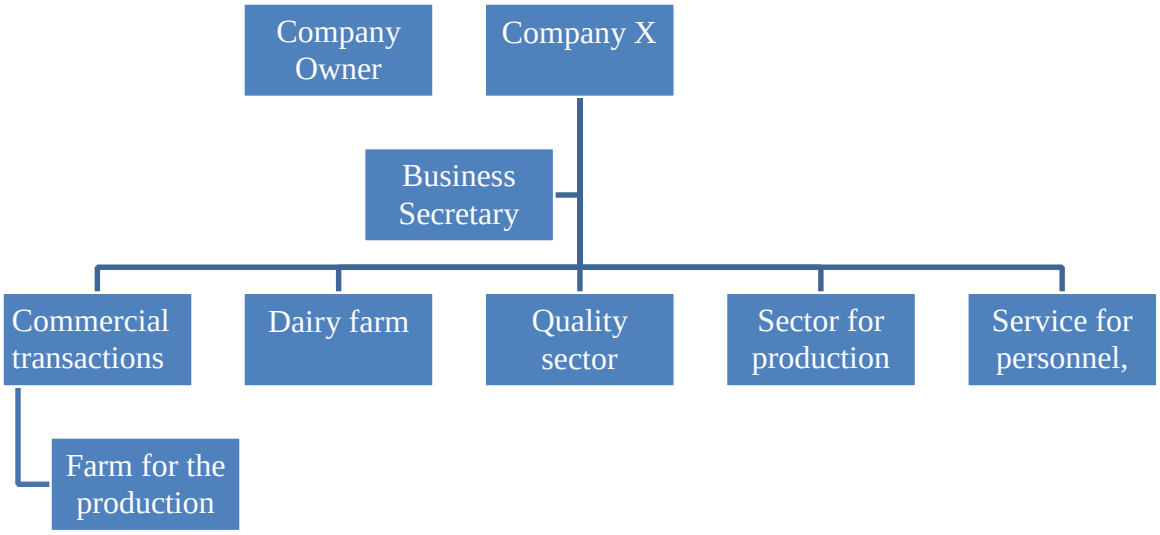


Figure 1: Macro-Organizational chart of the Company X in Kosovo

Based on the macro-organizational chart of the enterprise it was not possible to gain insight where the place for logistics procurement is in the organizational structure of the company. The company has no separate organizational unit that deals with company logistics. The tasks in the field of enterprise logistics, in organizational terms, are to diversify different services in various sectors.

It is necessary at the outset to emphasize that the activities in the field of company logistics are not implement systematically but on the basis of need. The company is not aware of the application of the principles of logistics.

After discussions with the authorities the impression is that there is not even enough interest in the implementation of logistics in its entirety in the company's operations. The level logistics competence is at the pre-logistic level and tasks in the field of enterprise logistics are running uncoordinated, there is no interest in the systematic monitoring of flows of material goods and their associated logistics costs impression that arises is that, because the company is operating profitably, there is no need to deepen knowledge and skills in the field of enterprise logistics and their application in business.

Figure 2 shows a schematic representation of the sector for the production and development

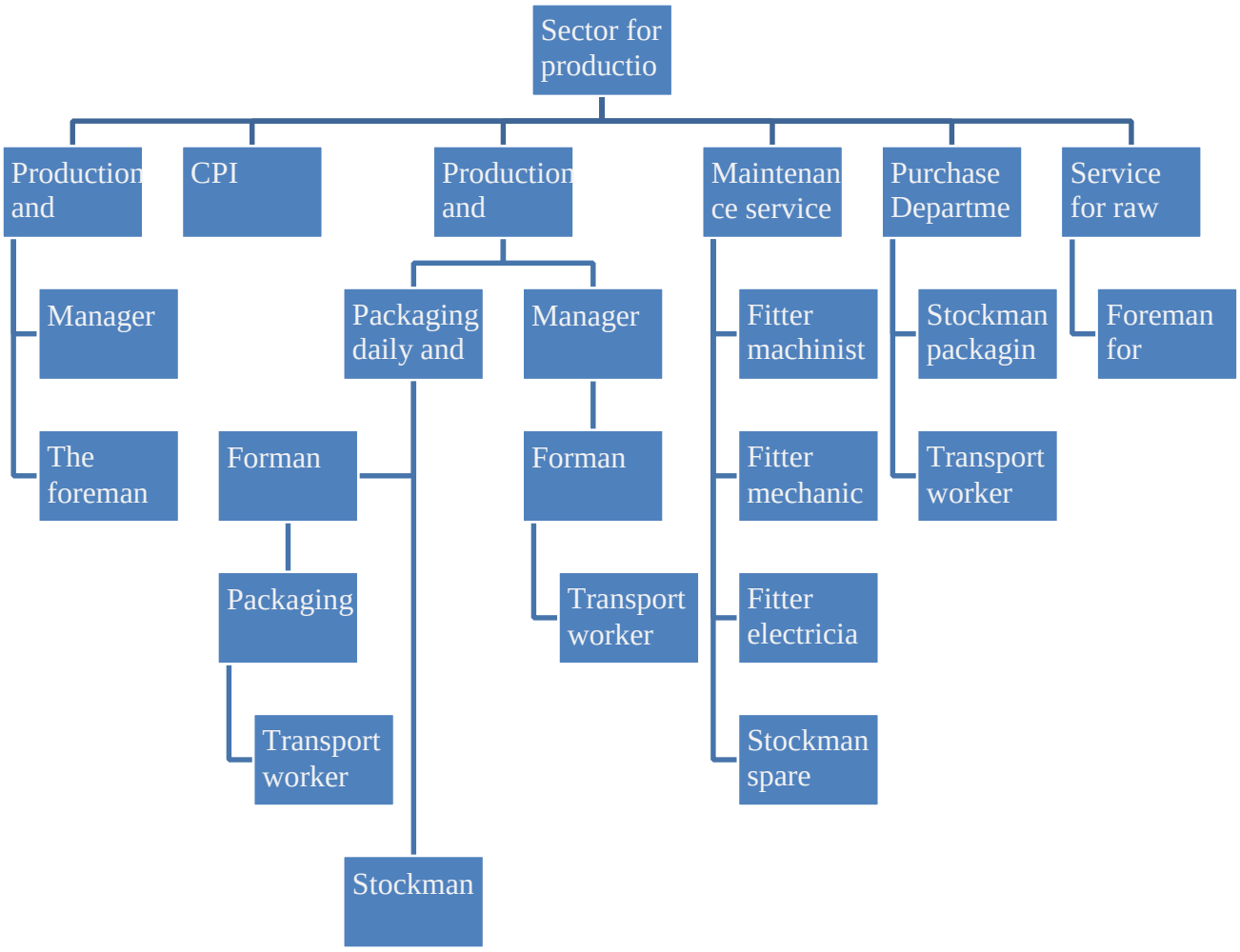


Figure 2: Organizational chart of the manufacturing sector and development

Based on the organizational chart of the sector for production and development, we can determine the exact position for the procurement service. Purchase Department headed by the Procurement Officer in organizational terms is subordinate to the head of the sector for the production and development 2. Within the work service, in addition to purchasing clerk, stock keeper for packaging materials and repo materials and the transport worker 3. For the purchase of the dominant raw material responsibility falls to the production department for

raw materials, it consists of an officer for raw materials and the foreman at the reception of milk 4.

Below, from other organizational units, being singled indirect participants in the procurement process.

In Figure 3 will be displayed organizational chart of Quality.

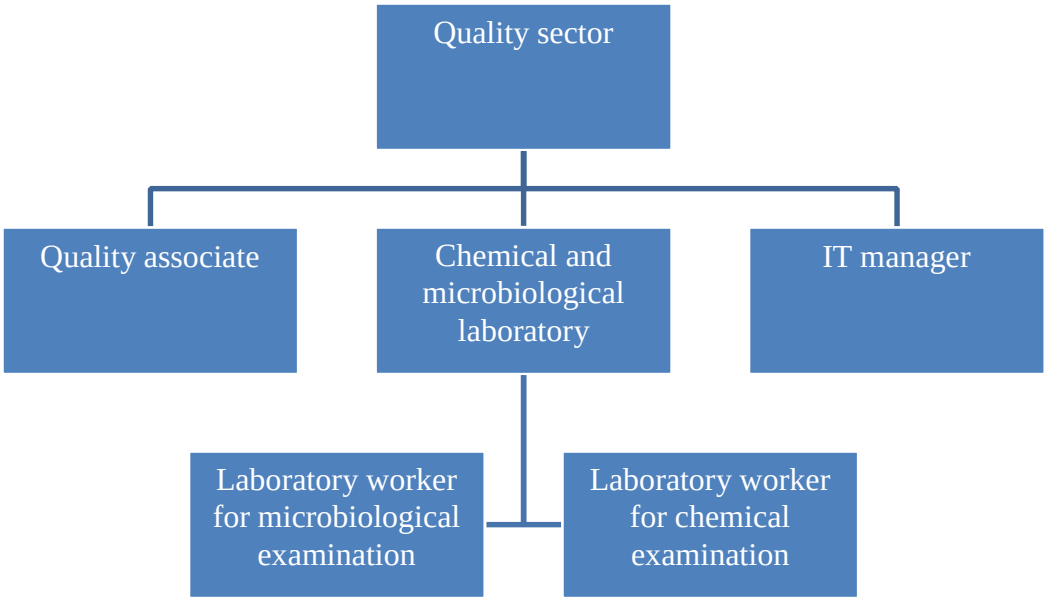


Figure 3: Organizational chart of Quality

At the organizational chart of the Quality sector we can see the composition of the laboratory for control and verification of the dominant raw material for production. Within the sector for economics and finance bookkeeper for materials and gods is situated, and within the commercial sector is the service for transport consisting of two drivers.

2. BACKGROUND INFORMATION

2.1 SUPPLY CHAIN AND LOGISTIC

2.1.1 Supply Chain

Firstly, supply chain is formed by several entities, which is a quiet complex system. Secondly, the activities which are implemented in these entities should be taken into consideration, because of these activities, the flow of goods and customer service in the supply chain can be enabled. Thirdly, supply chain must be treated as a entire system, the relationships throughout the entities should be considered, such as interaction relationship, dependent relationship and the supply and demand balance of finished-product and service.

Figure 4: Simple Supply Chain Chart

The definition of supply chain management is stated as: supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. (cscmp.org)

2.1.2 Internal supply chain

Supply chain can be separated into two parts, the dynamic supply chain and internal supply. Internal supply chain of the enterprises is only taking in consideration their own business without considering its extension. Dynamic supply chain is composed of a group of independent entities, one of the lead entity is looking for those with better-quality resources of partners, each partner contribute to the supply chain core competitiveness.

2.1.2.1 Internal supply chain concept

The concept of internal supply chain is in the production and product flow, the process of raw material suppliers, manufacturers, storage, transportation, retailers and ultimately consumers, composed of networks of supply and demand.

Internal supply chain concept confined to a single enterprise, give emphasis to internal marketing, sales, planning, manufacturing and procurement co-ordination between departments, can be seen as a reduction of external supply chain, and in the enterprises such as the procurement department can look for an external supply chain suppliers.

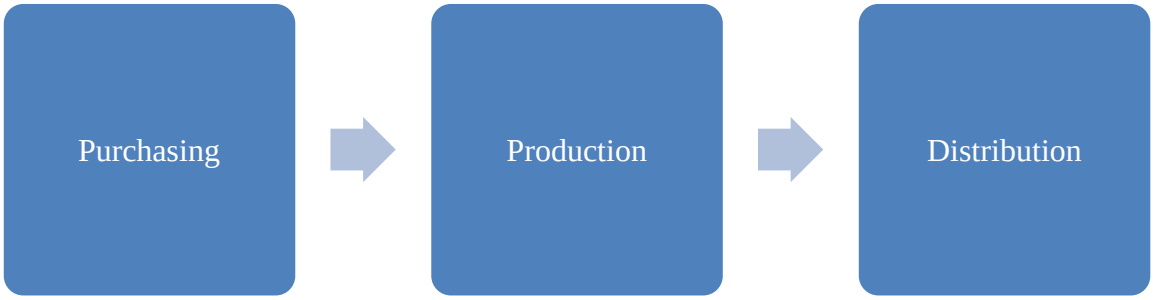


Figure 5: Internal Supply Chain Chart

2.1.2.2 Internal supply chain management

Internal supply chain management, management refers to the use of the planning, organization, command, control and coordination functions of the enterprise products in all aspects of circulation involved in logistics, capital flow, information flow and business processes to a reasonable regulation to achieve the greatest efficiency, lowest cost, and to provide maximum customer value. (Ma, Guo & Qin 2004, 70).

2.1.2.3 Supply chain integration

Supply chain integration is defined as suppliers of raw materials to finished goods to end-users the full process, including outsourcing, production, distribution, inventory, transportation, warehousing, customer service, unified coordination and restructuring in order to make this Net chain enterprises can realize maximum benefits.

Generally supply chain integration including the integration of the following elements:

- Integrated flow from raw material supply, product manufacturing, product distribution, to the end-users
- Integration of suppliers, manufacturers, distributors, retailers, customers
- Process integration of information flow, logistics, capital flow and management
- Comprehensive integration of supply chain management, organization, management technology, and management approach

Supply Chain Management emphasis includes suppliers, manufacturers, channel intermediaries and customers integration. J Stevenson proposed four stages of integration: the benchmark organizations, the functions integration, internal integration, external integration (Stevenson .G, 1998, 8).

2.1.2.4 Internal supply chain integration

Internal supply chain integration is to have the internal relations between supply and demand adjust to optimize the flow, so that products or services at a faster transmission, more flexible, more economical and effective, so that the operation of enterprises improve operational efficiency, improve business competitiveness.

Internal supply chain integration has four main areas: information integration, decision-making integration, financial integration and the operation of integration.

2.2 Logistics

2.2.1 Logistics concept

Logistics was used in a military, it mean all actions necessary to keep an army in the field, fighting a war. Years ago production and service companies did not contain a logistics function. Customer service was operating by the sales department while inventory was managed by production or sales according to location. Suppliers arranged input and output of transport which was booked by someone in the sales department.

There are a lot of Logistic definitions. Modern logistics is defined as: the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to the point of consumption for the purpose of conforming to customer requirement.

(Johnson, Wood, Wardlow & Murphy, 1998, 5)

The uniqueness of this definition is that it takes in consideration at first customer's satisfaction, than the efficient logistics activities and logistics extend from the original sale of the logistics to the supply logistics, business logistics and sales logistics.

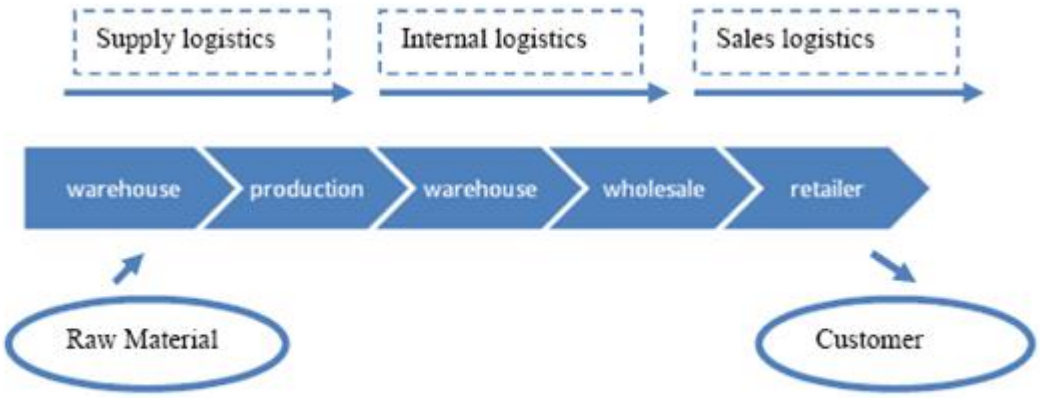


Figure 6: Extension of modern logistic concept

One simple definition is the “Seven R’s of Logistics”. The Seven R’s defines logistics as ensuring the availability of the right product, in right quantity and right condition, at the right place, at the right time, for the right consumer, at right cost.

Traditional logistics refers to actions after products manufactured, such as packaging, transport, loading, unloading and warehousing, etc. Modern logistics stated the integrated logistics management concept and implementation to combine the social logistics and internal logistics, the supply logistics from the beginning, after the production logistics, re-entering the sales logistics, at the same time, go through the packaging, handling, transportation, storage, processing, distribution and deliver to consumers, and finally have recycling logistics.

2.2.2 Logistics management

Logistics management has many names, which including:

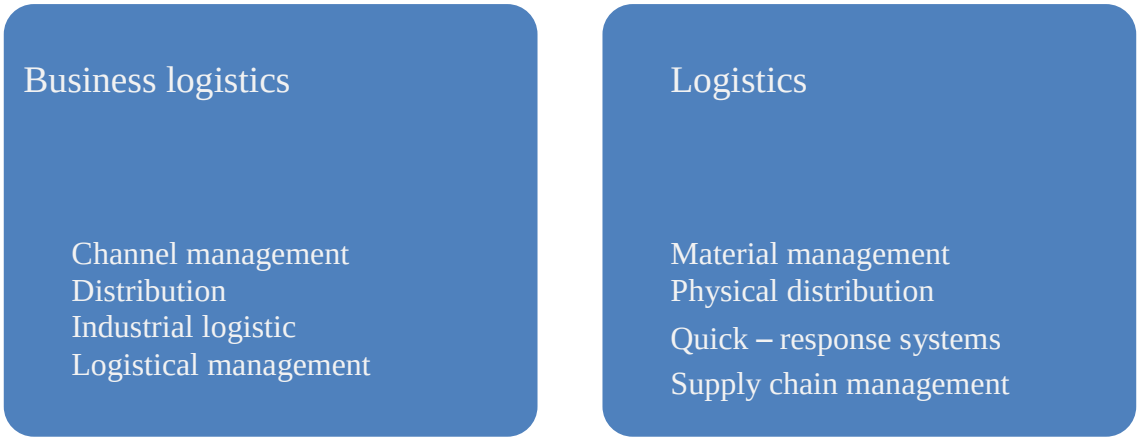


Figure 7: Names of Logistics Management (Stock & Lambert 2001)

Logistics management is accepted with those mention names.

The Council of Supply Chain Management Professionals defines logistics management as:

The part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related informational between the point of origin and the point of consumption in order to meet customers' requirements (cscmp.org).

The features of logistics management are:

- Realize customer fulfillment for the first goal
- Focus on the total logistics channel
- Optimize the overall enterprises for purpose

- Focus on information technology as the driving force, effectively relation from the supplier to the end-user.
- United management

The objective of logistics management as follows:

- Quick response
- Small variation
- Low inventory
- Transport integration
- Quality of Product

2.2.3 Logistics Integration

Integrated Logistics is mature stage of logistics industry development. Highly developed logistics Industry, improving the logistics system, the logistics industry become a leader in the production chain and coordination, and is able to provide the community with a full range of logistics services. The development of logistics integration can be further divided into three levels: self-integration, macro and micro integrated logistics (Feng 2004, 21).

Successful integrated logistics management ties all logistics activities together in a system which works to minimize total costs and maintain desired customer service level (Kenderdine & Larson 1988, 5).

It is important to mention that, the total cost includes this main cost category of logistics: customer's service levels, transportation costs, warehousing costs, lot quantity costs and inventory carrying costs.

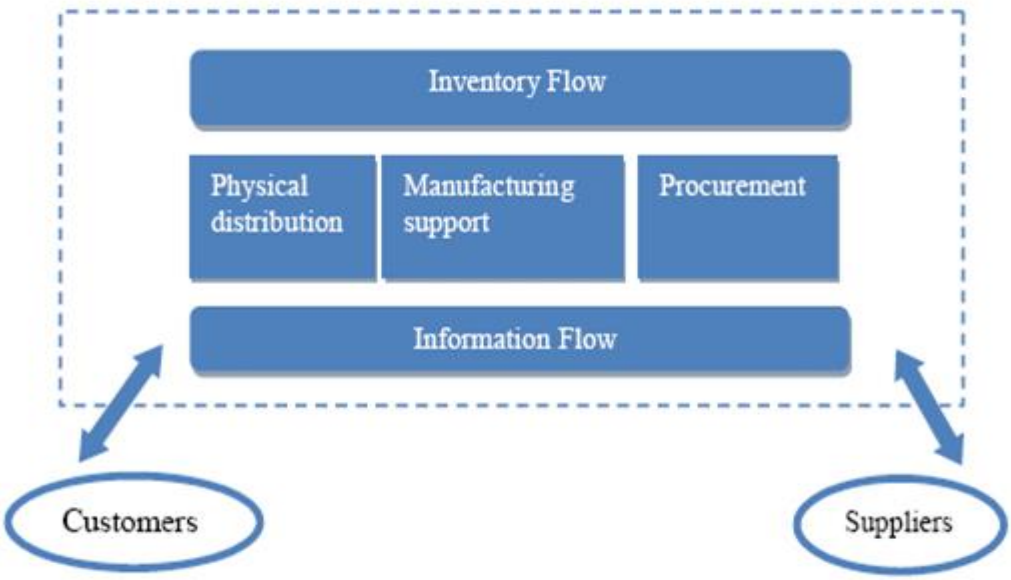


Figure 8: Logistical Integration

Information flow has an essential role in the logistics integration. The conceptualization of integrated logistics is illustrated in the shaded area of Figure 8 (Bowersox & Close 1996, 34).

2.2.4 Logistics organizations

Effective and efficient logistics organizations are vital elements of supply chain management (Stock & Lambert 2001, 582).

To understand various departments grouped in one integrated logistics organization, it is helpful to know the development of logistical organizations. (See Figure 9)

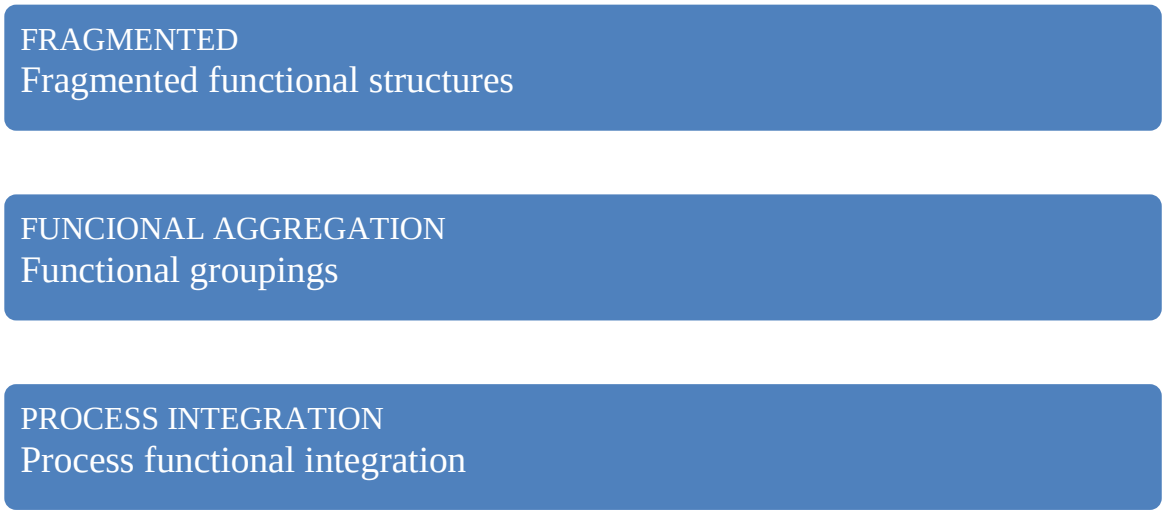


Figure 9: Logistical organization development cycle

These stages above of organizational development are based on the relative balance of functional aggregation and information integration.

2.2.5 Logistics information systems

Many logistics experts believe that the correct identification, integration, and implementation of information technology tools is the single most important issue facing logistics managers today and into the foreseeable future (Richard, Max & Bill 1995, 123), Information flow is a most important element of logistics operations. Customer orders, inventory requirements, warehouse work orders, transportation documentation, and invoices are the ordinary types of logistics information. The uses of technology logistics information systems have made the logistics information exchange more efficiently, effectively, and rapidly.

Figure 10 shows the logistics activities and decisions at each level of information functionality.

For enterprise, a logistics information system has following functions:

- Simplify management, improve the internal and the exchange of information among enterprises, and increase the work efficiency
- Improve the speed of operation of the system, in the shortest possible time goods and services provided to customers
- On staffing and resource utilization to optimize and create the largest input-output ratio;
- Achievement and analysis of suppliers, customers and partners relevant information to help businesses make better decisions.

Gartner Group who is from RR, the world's leading research consulting firm, said that, "If you stop using the SAP software, will announce the collapse of the German economy. If the United States stops using it? Many places the United States is bound to fall into darkness, such as Silicon Valley." It can be seen that the use of information systems have given businesses what foreground.

Strategic Planning	• Strategic alliance formulation • development and refinement of capabilities and opportunities • focused customer service analysis
Decision Analysis	• vehicle routing and scheduling • inventory levels and management • network location configuration • vertical integration vs. third party
Management control	• financial measurement • assets management • customer service measurement • productivity measurement • quality measurement
Transaction systems	• order entry • shipping • inventory assignment • pricing and invoicing • order selection • customer inquiry

Figure 10: Information Functionality

EDI and ERP are the best "logistics assistant" in any companies overall the world.

EDI (Electronic Data Interchange) is identified as intercompany computer-to computer exchange of business documents in stand formats. EDI describes both the capability and practice of communicating information between two organizations electronically instead of via the traditional forms of mail, courier or even fax. The capability refers to the ability of computer systems to communicate effectively (Bowersox & Close 1996, 204).

ERP is a software solution most often used inside production environment. ERP is a business tool that management uses to operate the business day-in and day-out. It is generally comprised of some modules such as a financial module, a distribution module, or a production module.

These modules shares information that is housed in the database structures on which the ERP system was coded. ERP helps or make a connection between departments in a company. For example, sales department may be selling 21% more product than the production department can produce.

By apply an ERP system, the sales department, production department, operations management, shipping, financial department, purchasing department all have access to the up-to-date information that is needed to operate in any manufacturing environment.

Generally ERP systems are justified by three major arguments:

(1) Less maintenance

(2) Cost effective

(3) Less integration

There have been notice catastrophic ERP projects that have failed resulting big losses. The situation is dynamic and evaluation between separate software and centralized ERP should be made case by case. (PETRI HELO)

2.2.6 Logistics lead to competitive advantage

Effective logistic management is the one of most important element to improve the profitability and competitive performance of enterprise. In Figure 6, state the three elements of marketing concept, customer satisfaction, integrated effort and company profit and logistics' relationship, we can conclude that logistics plays a key role in each of these elements.

Figure 11: Marketing / Logistics management concept (Lamber, Stock & Ellram 1998, 12)

2.3 PERFORMANCE MEASURMENT

Performance evaluation estimate system directly concern the target performance level of business operations and development, a good measurement system to ensure that the enterprise's short-term objectives and long-term goals.

2.3.1 Performance measurement principle

In order to set up an effective supply chain performance measurement target system, the following principles to be followed (Nie 2004, 66):

- Analysis focus on key performance indicators
- Should use the target system performance which reflect the supply chain business process
- Measurement indication should be able to reflect the operation of the whole supply chain, rather than just reflect a single node in the operations of enterprises
- Should maximize the use of real-time analysis and evaluation methods, performance metrics should be extended to reflect the supply-chain information in real –time operation , because this analysis is more valuable than after the work
- When measure the performance of the supply chain, it is necessary to use the measurement indication, which reflect the relationship of suppliers, manufacturers and users, extend the measurement objects up to relevant enterprise in supply chain.

The three objectives for developing and implementing performance measurement systems include monitoring, controlling, and directing logistics operations. (Donald & David 1996, 670).

2.3.2 Performance measurement bound

There are three aspects which should be taken in consideration in supply chain performance measurement:

1. Internal performance measurement
2. External performance measurement

2.3.3 Integrated supply chain performance measurement

2.3.3.1 KPI of performance measurement

2.3.3.2 Lummus performance measurement KPI

Lummus listed the KPI (Key Performance Indication) of supply chain performance measurements. Each target has three target values: the ideal value, target value and current value. Supply Chain Performance Management is aimed at the value set in accordance with the ideal value; subsequently improve the performance of the current situation.

Table 1: Lummus performance measurement KPI (Nie 2004, 68)

TYPE	ASSESSMENT INDICATION
Supply	Reliability: Lead Time
Transition	Process reliability, processing time, plans achievement situation
Transportation	Order completion rate, add lead – time, delivery days

Demand management	The total supply chain inventory costs, the total turnaround time

2.3.2.3 SCOR model

SCOR model states 13 supply chain KPI (key performance indication), these indications are created by delivery reliability, supply chain responsiveness, flexibility, costs and efficiency and asset management these five main aspect, which are the supply chain performance operation measurement index system. The 13 indications as following:

1. Delivery Performance
2. Fill Rate
3. Order Fulfillment Lead Time
4. Perfect Order Fulfillment
5. Supply Chain Response Time.
6. Production Flexibility
7. Total Supply Chain Management Cost
8. Cost of Goods Sold
9. Value-Added Productivity
10. Warranty Cost or Returns Processing Cost
11. Inventory Days of Supply
12. Cash-to-Cash Cycle Time
13. Asset Turns

(Nie 2004, 69)

2.4 Performance measurement implementation

First of all, put the performance level of every target is divided into five levels. According to Level 1-5, the best level of 5 points, the worst level of the industry sub-1, and so on.

Secondly, the allocation of resources based on business and strategic planning, setting the various performance indicators of achievement target level of performance over a period of time.

To put in diagram comparison of the ideal achievement level and the actual operating results chart. If the performance of enterprises set up the performance indicators as: new sales rate, information sharing rate, customer satisfaction rate, the order fulfillment rate and cash-flow period. The ideal achievement levels are (5, 4, 4, 4, 5), the actual operation result are (4, 3, 4, 5, 5), thus the comparison chart as following:

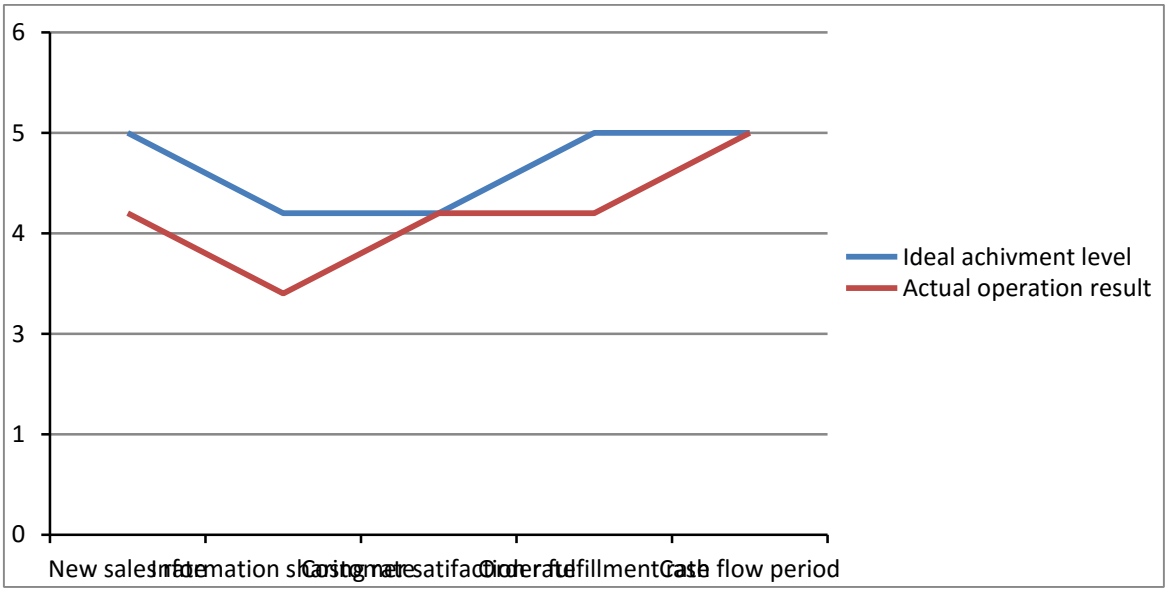


Figure 12: Comparison charts of ideal achievement level and actual result

2.5 Operations Research: Basic Concepts

Logistic systems are systems of huge dimensions that are geographically spread in space. Complexity of Logistic systems is caused by many factors, containing interactions between decision-makers, workers and clients, drivers, vehicles, transportation and warehousing processes; modern computer technologies and communication systems, which are very complex. Logistics has been defined by the Council of Logistics Management as "... the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements."

Logistic systems in many aspects are stochastic, dynamic, and nonlinear this parameters affect to logistic systems to be extremely sensitive even to small perturbations. Control of modern logistic systems together with management of Logistic system through this paper we will see that there are based on many distributed, hierarchically organized levels, because every single parameter which is included or is part of logistic systems, as decision-makers, dispatchers, drivers, workers, and clients have different interests and goals, different educational levels, different geographical spread and different work experience. All this parameters notice situations in different ways, and make a different decisions based on subjective perceptions and subjectively evaluated parameters. (G. Don Taylor, 2008)

Control of modern logistic systems and management and are based on:

- Management Science (MS),
- Operations Research (OR), and
- Artificiel Intelligence (AI) techniques.

Operations Research can be defined as scientific techniques which always search for the best solution of action under limited resources.

Best solution of solving problem should go through some steps. First step is verbal formulation of the problem in the problem solving scheme. Second step is to replace verbal description of the problem by corresponding mathematical formulation such as variables, objective function, and constraints, which describes the problem mathematically. Building of mathematical model requires from analysts to establish few logical and mathematical relationships between specific variables. The constraints depend from nature of problem, physical, geographical, institutional, or financial resources. The mathematical feasible solution of problem is solution that satisfies a given set of constraints. In lot of cases it is impossible to produce a mathematical model that will capture all different aspects of the problem considered. Therefore, mathematical models characterize simplified description of the real problem. Practically represent the compromise between the wish to precisely describe the real-life problem and the capability to solve the mathematical model.

Many real-life logistics problems can be formulated in words (Figure 13). Next step for engineers is to translate a verbal description of problems into a mathematical of a real-world problem which is called a mathematical model of the real-world problem.

An algorithm represents some step-by-step procedure which are used by an analyst to produces a feasible solution which is the best possible solution among all feasible solutions. Depending on a defined objective function, the optimal solution corresponds to maximum revenue, minimum cost, and maximum profit. (G. Don Taylor, 2008)

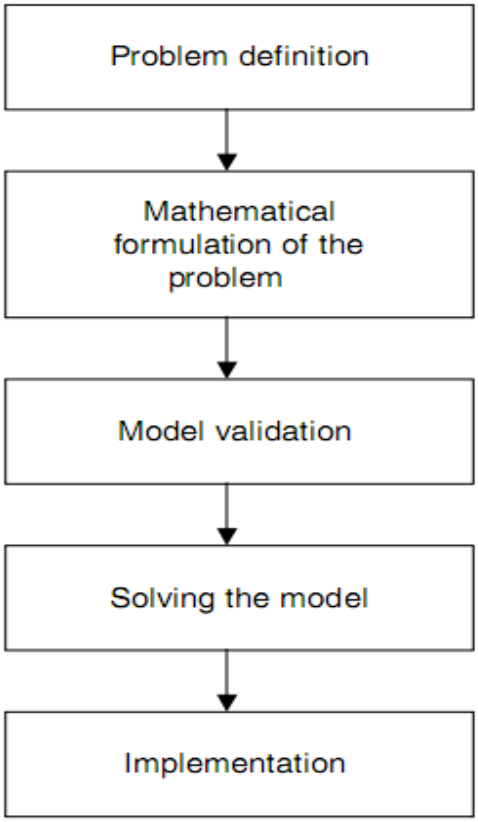


Figure 13: Problem solving steps

2.6 Mathematical Programming

Mathematical programming techniques are used to address problems which have to do with the most efficient allocation of limited resources (supplies, capital, labor, etc.). Typical problems include market maximization, production scheduling, transportation and scheduling, locating facilities in a network, planning feet development, personnel scheduling etc. Solutions can be found using one of the mathematical programming methods. (G. Don Taylor, 2008)

2.6.1 Linear Programming

To understand linear programming we will analyses a rent-a-car company's operations. The company owns 100 vehicles.

The potential clients are offered 2 tariff classes:

$150 per week and

$100 per week.

The potential client pays $100 per week if they make reservation at least 3 days in advance.

We suppose that we are able to calculate exactly the total number of requests in both client-tariff classes. We expect 70 client requests in the first class and 80 client requests in the second class during the same time period. We keep at least 10 vehicles for the clients paying higher tariffs. We have to account the total numbers of vehicles rented in different client tariff classes to reach the maximum company revenue.

Solution:

To account the total numbers of vehicles rented in different client tariff classes, the variables of this model can be defined as:

x_1 —the total number of vehicles planned to be rented in the first client-tariff class

x_2 —the total number of vehicles planned to be rented in the second client-tariff class

The total revenue from renting x_1 vehicles is $150x_1$. In the same way, the total company revenue from renting the x_2 vehicles equals $150x_2$. The total company revenue equals the sum of the two revenues, $150x_1 + 150x_2$.

The vehicle renting limits may be explained verbally in the following way:

- Total number of vehicles rented in both classes together must be less or equal to the total number of vehicles.
- Total number of vehicles rented in any class must be less or equal to the total number of client requests.
- Total number of vehicles rented in the first class must be at least 10.

Total number of vehicles rented in the second class cannot be less than zero.

Above verbal description for the rent-a-car revenue management can be presented with mathematical model in the following way:

Maximize

$$F(x) = 150x_1 + 100x_2$$

Subject to:

$x_1 + x_2 \leq 100$

$x_1 \leq 70$

$x_2 \leq 80$

$x_1 \geq 10$

$x_2 \geq 0$

In our problem, all variables are continuous variables and we have only one objective function. Our goal is to maximize the total company's revenue. Objective function and all constraints are linear, meaning that any term is also a constant or a constant multiplied by a variable. Any mathematical model that has one objective function, all continuous variables, a linear objective function and all linear constraints is called a linear program (LP), which are usually solved using a widely spread Simplex algorithm .Taking in to consideration that we have only two variables, it make possible to solve our problem graphically. The graphical method is idealistic for mathematical models with more than two variables. To solve the earlier-stated problem graphically, we plot the feasible solutions (solution space) that satisfy all constraints simultaneously.

Figure 14 shows our solution space.

All feasible values of the variables are located in the first quadrant. This is caused by the following constraints: $x_1 \geq 10$, and $x_2 \geq 0$. The straight-line equations $x_1 = 10$, $x_1 = 70$, $x_2 = 80$, $x_2 = 0$, and $x_1 + x_2 = 100$ are got by substituting "≤" by "=" for each constraint. The resulting solution space of the rent-a-car problem is shown in Figure 3.3.Workable points for the problem considered are all points inside the boundary or on the boundary of the solution space. The optimal solution depends on the direction in which the objective function $F(x) = 150x_1 + 100x_2$ rises. The optimal solution is shown in Figure 15

The parallel lines in Figure 15 represent the objective function $F(x) = 150x_1 + 100x_2$. The optimal solution happens at the connection of the following lines:

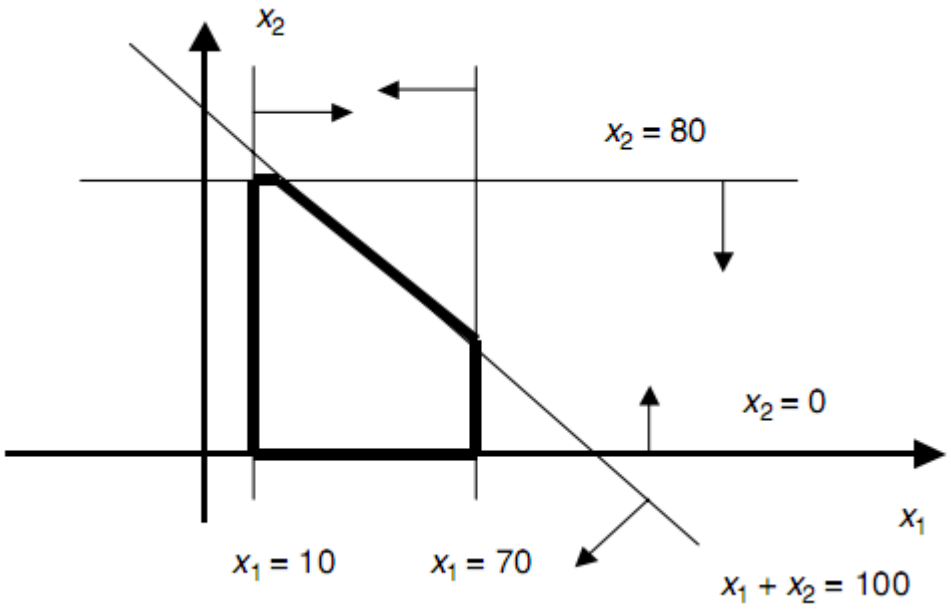


Figure 14: Solution space of the rent-a-car revenue management problem.

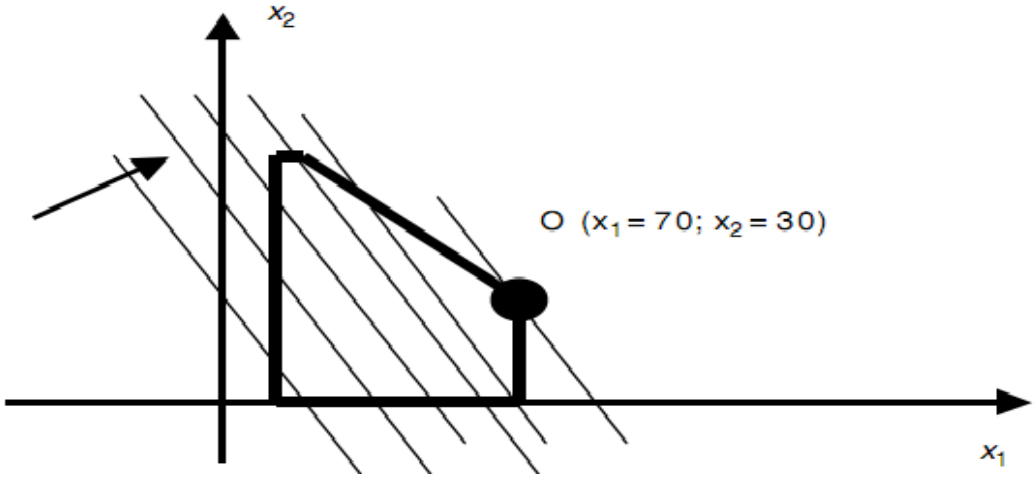


Figure 15: The optimal solution of the rent-a-car problem.

$$x_1 + x_2 = 100$$

$$x_1 = 70$$

After solving the system of equations we get:

$$x_1 = 70$$

$$x_2 = 30$$

The corresponding rent-a-car company revenue equals:

$$F(x) = 150x_1 + 100x_2 = 150(70) + 100(30) = 13,500$$

Linear Programming helps us to notice the best allocation of limited resources. The following is a Linear Programming Model:

Maximize

$$F(x) = c_1x_1 + c_2x_2 + c_3x_3 + \cdots c_nx_n$$

Subject to:

$$a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \cdots + a_{1n}x_n \leq b_1$$

$$a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + \cdots + a_{2n}x_n \leq b_2$$

(3.1)

$$a_{m1}x_1 + a_{m2}x_2 + a_{m3}x_3 + \cdots + a_{mn}x_n \leq b_m$$

$$x_1, x_2, \cdots, x_n \geq 0$$

The variables $x_1, x_2 \ldots x_n$ describe the level of various economic activities (number of cars rented to the first class of clients, number of items to be kept in the stock, etc.). (G. Don Taylor, 2008)

2.6.2 Integer Programming

Specialists realize that some or all of the variables in linear program must be integers. To make problem easier, specialists often allow these variables to take fractional values. For example, specialists know that the number of first class clients must be in the range between 40 and 50. A linear program can produce the "optimal solution" that tells us that the number of first class clients equals 47.8. In this example, we can negligence the fractional part, and we can decide to protect 47 (or 48) cars for the first class clients. But in this way, we are making a small numerical error.

In some other examples, it is not possible for experts to behave in this way. For example if we analyses and in same time have to take decision about a new warehouse layout and we must choose one out of numerous generated alternatives. This is kind of "yes/no" ("1/0") decision: "Yes" if the alternative is chosen, "No," otherwise. The value 0.7 of the variable means nothing to us. This make situation complicated because we are not able to decide about the best warehouse layout if the variables take fractional values. This mean that problems like warehouse layout we solve exclusively with integer variables. These types of problems are known as integer programs, and the area is known as Integer Programming.

Integer programs describe the problems in which one or more alternatives must be selected from set of generated alternatives. In some problems, variables can take only integer values, some other variables can take fractional are known as mixed-integer programs. It is much harder to solve Integer Programming problems then Linear Programming problems.

The following is the Integer Programming Model formulation:

Maximize

$$F(X) = \sum_{j=1}^{n} c_j \lambda$$

Subject to

$$\sum_{j=1}^{n} a_{ij} x_j \leq b_i \text{ for } i = 1, 2, \ldots n$$

$$0 \leq x_j \leq u_j \text{ integer for } j = 1, 2, \ldots n$$

There are huge number of software systems that solve linear, integer, and mixed-integer linear programs (CPLEX, Excel and Quattro Pro Solvers, LINDO, LINGO, MILP88, MINTO, OML). (G. Don Taylor, 2008)

2.7 Heuristic Algorithms

Heuristic algorithm represents a procedure used by the specialist(s) in order to search of feasible solutions. They should generate quality solutions in an acceptable computer time. Complex logistic problems are solved with the help of various heuristic algorithms. Heuristic algorithms are capable of realizing optimal solutions for some problem examples, but they do not guarantee optimal solution.

2.7.1 "Classical" Heuristic Algorithms

The easiest way to explain basic principles of these algorithms is by analyzing the traveling salesman problem (TSP) which is one of the most well-known problems in OR and computer science. The problem can be describe as follows: Find the shortest route which starts in a specific node, goes through all other nodes just once, and finishes in the starting node. In different traffic and logistic problems, the TPS can represent airplanes, boats, trucks, buses, etc. Solution process of the TSP is in the following: (a) We construct an initial tour; (b) Any remaining unvisited nodes are inserted; (c) The created tour is improved. There are many developed algorithms for each step. (G. Don Taylor, 2008)

2.7.2 Heuristic Algorithm Based on Random Choice

The TSP could be easily solved by the following simple heuristic algorithm:

Step 1: Arbitrarily choose starting node.

Step 2: Randomly choose the next node to be included in the traveling salesman tour.

Step 3: Repeat Step 2 until all nodes are chosen. Connect the frst and the last node of the tour.

2.7.3 "Greedy" Heuristic Algorithms

The Nearest Neighbor (NN) heuristic algorithm is a typical representative of "Greedy" algorithms. Tis algorithm, which is used to generate the traveling salesman tour, is composed of the following algorithmic steps:

Step 1: Arbitrarily (or randomly) choose a starting node in the traveling salesman tour.

Step 2: Find the nearest neighbor of the last node that was included in the tour. Include this nearest neighbor in the tour.

Step 3: Repeat Step 2 until all nodes are not included in the traveling salesman tour. Connect the first and the last node of the tour. (G. Don Taylor, 2008)

2.7.4 Exchange Heuristic Algorithms

Exchange heuristic algorithms are based on the idea of interchange and they are widely used. The idea of interchange is the idea to start with the existing solution and check if this solution could be improved. The exchange heuristic algorithm first creates or selects an initial feasible solution in some arbitrary way (randomly or using any other heuristic algorithm), and then tries to improve the current solution by specific exchanges within the solution.

3. SYSTEMATIC ANALYSIS OF THE CURRENT STATE OF INPUT FLOW OF MATERIAL GOODS IN THE COMPANY X- research subjects

3.1 Basic characteristics of the current situation

3.1.1 Organization of procurement processes in a Company X, Kosovo

Procurement procedure defines the activities and their executors for the purchase of raw materials used in the production process of the company (reproductive materials). The procurement process begins with reviewing the needs for raw materials and materials after obtaining a production plan.

Based on observed needs through a preliminary contact with suppliers and proceed to ordering. Preliminary contact realizes the director or the officer for procurement stepping into contact with old and new suppliers. A request is send to the supplier for the submission of bids, pursuant to which the supplier / vendor shall submit offers that identify:

- Product kind,
- Product price,
- Time for delivery, and
- Place (parity) for material delivery

Following a preliminary contact approach to select the most favorable offer. Procurement Officer, in choosing the most favorable offer, considers that whether they are old or new suppliers.

For the old supplier previous experience in terms of price or quality of the product etc., is taken into account.

In the case of new suppliers, while choosing to take into account the material quality, price, delivery time and payment terms. On this occasion it is a comparative analysis of the price

of new and old suppliers and selected tender that shall be submitted to the Assistant Director for verification and decision making.

In the next steps an approach for procurement contracting with selected suppliers.

In case there is no contract with the supplier or necessary changes in the contract approach are made to tackle the procurement conditions. Procurement Officer on the basis of the documentation request more favorable conditions, such as: shortening the period of delivery, lowering the price, arranging appropriate parity delivery and so on. Based on the signed contract and identified needs they proceed to ordering. If agreed to advance payment, the supplier sends the fax Pro-invoice if payment isn't in advance procurement officer constitutes a supplier list with a priority of payments and delivers it to the Assistant Director for approval.

Proposal for a specific month payments constitute an assistant director at the sector level and submit it to the Director for verification. Assistant Director on the proposal for payment, certified by the director, complete the form in which proposal for payment stated for the indicated day. After analyzing this document, he forwards it to the Director of Finance for further implementation.

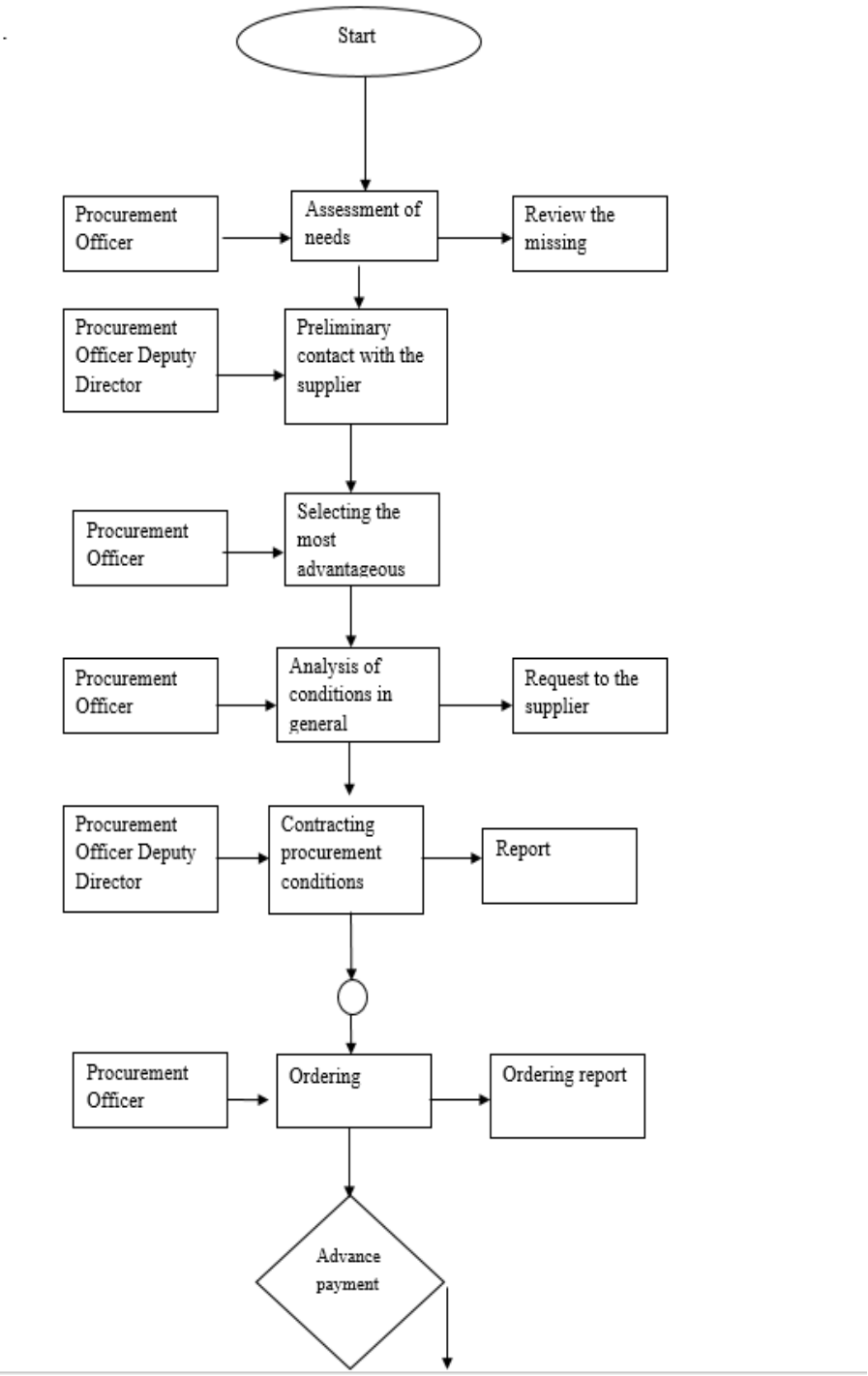
If delivery has been agreed at parety Franco supplier the procurement officer then engage the service of shipping or transportation company with whom is the contract for carriage. However, if the delivery is realized at parity Franco buyer then supplier the realizes the transport and delivery of commissioned goods on his own.

After the arrival of the goods material is received in the warehouse of the company.

Storekeeper, immediately after the arrival of the goods, notify the clerk of procurement in order to perform quantitative and qualitative tests (control) of material or goods. Under the quantitative examination of the goods means, whether the goods arrived at the agreed quantities and whether the goods arrived corresponds to the type, number or amount compared to the ordered.

We compare the itemized data with dispatch and purchase order or other document and perform their visual control. If the goods are liable under these parameters, then move on to the next step and that is a qualitative control of the goods supplied.

Under the qualitative control of the goods means check its condition in terms of quality and other characteristics of the goods, such as: whether the goods are damaged, if there is confirmation of the quality of the supplier (if there isn't then sent to an authorized lab for testing) and the like.



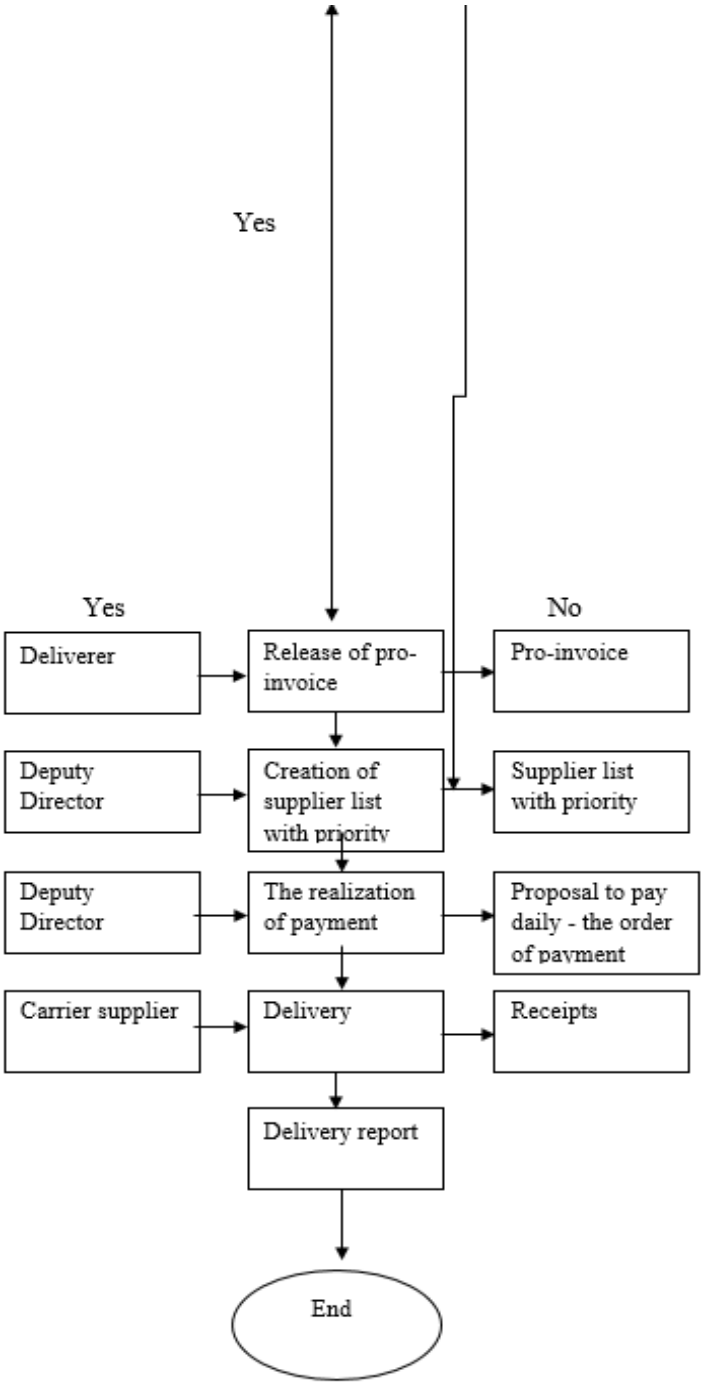


Figure 16: Flow diagram of the procurement process

for the whole process to be implemented without hindrance it is necessary to do the division of tasks and responsibilities. Service procurement is an evolving business located within the manufacturing sector. Organizational chart of services procurement is shown in Figure 17.

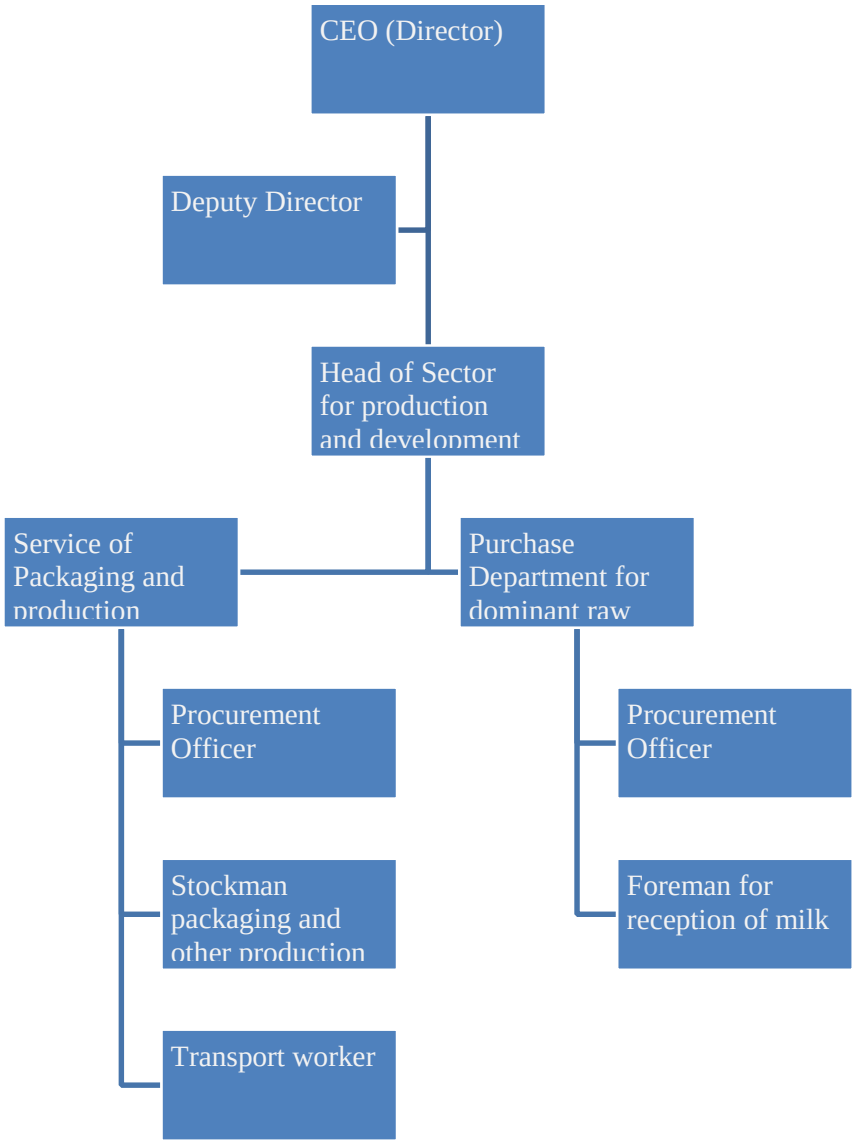


Figure 17: Organizational chart of services procurement

Company X has quality systems such as ISO 9001: 2000, on the basis of which the procurement process is precisely defined from the initiation of the initial procurement to receipt of goods in warehouses, its storage (whether it be on the packaging, auxiliary raw materials for production or dominant raw material for the production) and its involvement in the process of production and exploitation.

This system of organization is achieved by clearly defining responsibilities and tasks .All employees must fulfill their obligations. This system allows the identification of non-fulfillment of obligations and accountability for employed persons for any omissions. Processes and packaging materials are procured from internal and external supplier. Under the internal imply domestic suppliers / vendors (locals), and under external foreign suppliers / vendors (abroad).

The expectations of the company regarding the implementation of the procurement process are to be timely (in terms of time) in qualitative and quantitative terms to be correct (or within certain limits), servicing the production process with the necessary raw materials, packing materials, auxiliary materials and the like. And in addition to the specific process information (related to the definition of orders, contracts, income, etc.).

Below we will give overview of some basic characteristics of logistics procurement.

For the purchase of packaging and other materials the company uses products of six partner companies (supplier) as follows:

- Farm “DD”
- Farm “AA”
- Farm “BB”
- Farm “CC”
- Farm “EE”
- Farm “FF”

Average (mean) distance of a Procurement: 158.66 [km]

Getting the dominant raw material for the production is carried out, in spatial terms, the areas closer to the location in which the Company X. Milk is supplied from 19 (nineteen) different locations, mostly rural and suburban areas as follows: Farm “1”, Farm “2”, Farm “3”, Farm “4”, Farm “5”, Farm “6”, Farm “7”, Farm “8”, Farm “9”, Farm “10”, Farm “11”, Farm “12”, Farm “13”, Farm “14”, Farm “15”, Farm “16”, Farm “17”, Farm “18”, Farm “19”. Average (mean) distance of a Procurement: 25.52 [km].

3.1.2 Strategy and Competitive Advantage

The business strategy of the company aims to establish new, or retain already acquired, competitive advantages and thereby permanently securing adequate ability of company to survive in the market.

Objective strategic planning at the level of the business areas are:

- Your own company,
- Customers and,
- Competitors.

These three areas of strategic planning together to form a triangle.

The company cannot survive on the market only if it has good knowledge of the objects in observation and master the relationships that exist between them. Compared to its competitors strategic competitive advantage is the result of focus of the enterprise, as well as the system as a whole, and it should meet the following section focuses:

- To provide appropriate effects that are important to customers,
- Provide that customers perceive effects,
- That the gained advantages are of a permanent character and that they cannot be quickly removed - annulled by the competition.

It should be noted that the company engaged in the distribution of goods in the international market.

3.1.3 The process of entry of raw materials, packaging and other materials

The entry procedure of raw materials, packaging and other materials is explained in above section.

Received the goods can be found in three states:

- Goods without objection;
- Goods certain inaccuracies;

1. By quantity,
2. In terms of quality,
3. By arrived documentation and
4. Goods with hidden defects;

- Goods with complaint. Flow of receipt and control of raw materials, packaging and other materials is shown in Figure 18.

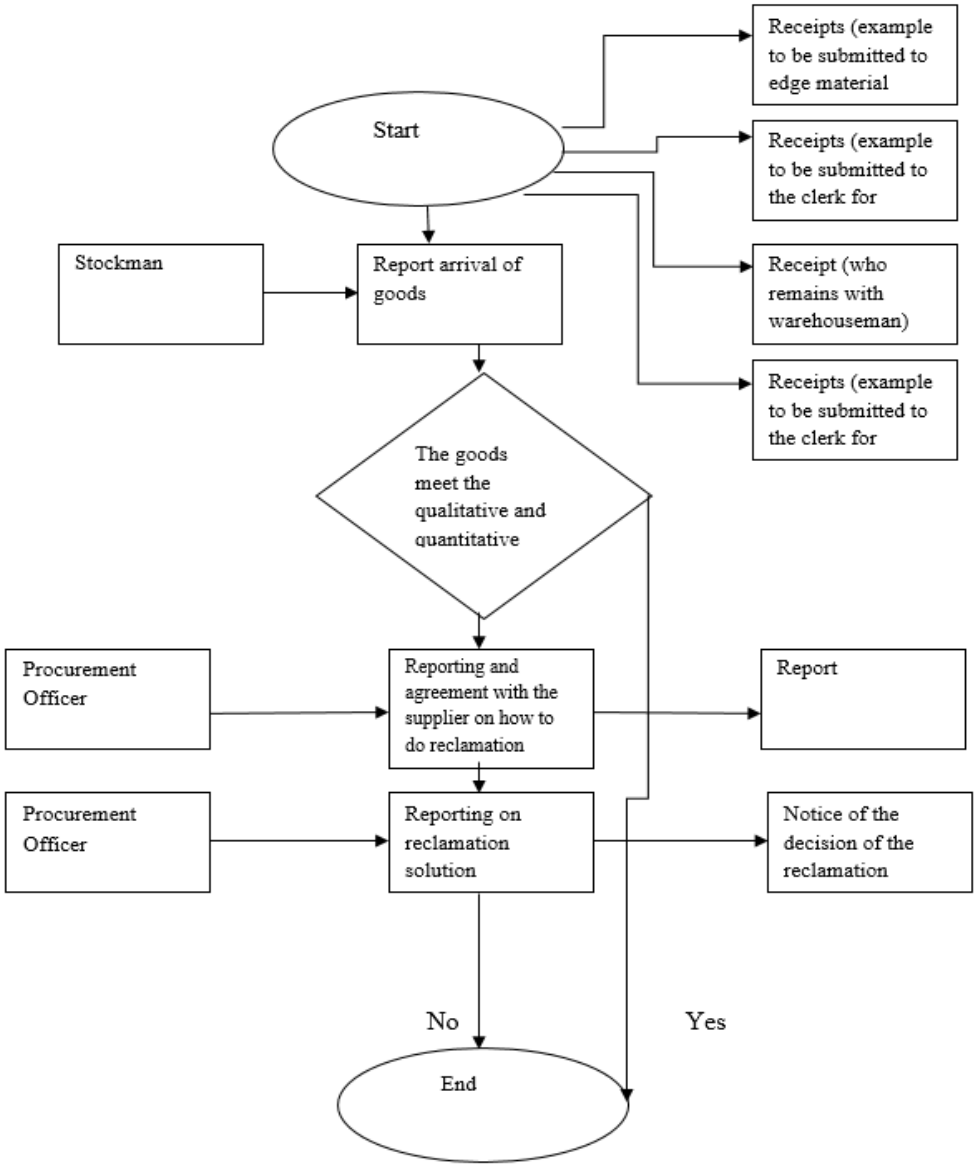


Figure 18: Flow of receipt and control of raw materials, packaging and other materials

3.1.4 The process of storing material goods

At the outset it should be noted that there are certain differences with regard to storage or warehousing, storage and storage of dominant raw materials for the production of milk and other material goods. Storage technology itself differs. Basic raw- material milk is transported and stored in special refrigerated tanks, while other material goods such as packaging and the like is stored in conventional warehouses for unit materials. The basic raw milk after delivery, with trucks, and setting in place for dispensing located next to the tanks sent to the qualitative control in the companies laboratory.

After quality control, and confirmation of meeting quality requirements, follows a quantitative control. After that, the storekeeper prepares receipts, which contains information on the quantity and quality of raw materials received which are summarized at the end of working hours, with the other receipts delivered to the clerk for procurement.

After making the receipt of raw materials are they are pumped into reservoirs from which, when needed, the system of pipes transports them to the production process itself.

Activities undertaken with regard to the storage of other material goods will be displayed below. Activities related to storage is a process that involves receiving, storing and issuing of goods for the purposes of following instances of companies and their respective information.

The main tasks of storing goods are system tasks and they are done, according to the applied technology, according to certain chronological order and include the following processes:

- Vehicle admission and material examination, should be made immediately upon receipt of vehicles and notification of the procurement clerk in about the same, the check is performed by the warehouseman for packaging and materials, visually counting and controlling arrived material in the vehicle. About this labor activity a record shall be made. One copy remains the stockholder and the other is submitted to the clerk for purchase upon arrival;

- Founded and received quantity is compared with the shipping documentation of the supplier or suppliers;
- In case of disagreement about controlled amount recount in the presence of the driver and note the lack of it;
- Unloading and storage carries a warehouseman or transport worker, and that depending on the type and amount of material goods unloaded at the intended place in the warehouse;
- Storekeeper unloaded and uncontrolled material marks the status card with "Attention goods are not received for trial";
- Then they wait for the Procurement Officer unless unless his there and in his presence make quantitative and qualitative control of the goods received;
- If the goods have passed the control, material is marked as "Receiving materials", where the data on the number of the warehouse, suppliers or vendor code, carrier name, number of vehicles, purchase order number, name quantity and price of materials. Receipt for material is printed in four copies, one remains warehouseman, two go to Procurement Officer and a copy shall be forwarded to accounting;
- Marking material shall be made on the basis of the results of control and on that basis it assigns the appropriate status card;
- Issuing the material is performed by a warehouseman in a way that is based on request for production or any other part of the company issued dispatch and perform a physical relocation of material by the means of transport (In case of receiving warehouses outside the factory) or perform the abstraction of the adjuvant and its shipping (if the warehouse is within the factory). Storekeeper perform commissioning of the goods required;
- Checks the condition of materials (primarily packaging and chemical products) at the request or by order of certain functions of the company. If there are changes to the material notify the competent instances of the company.

Damage Assessment and labeling of material shall be carried out after the deposition of materials in the warehouse. First, it is evaluated whether certain material may be used or are unusable. In accordance with the procedure mark his status card and make a record of the cause of the damage. Process Flow of storing is shown in Figure 19.

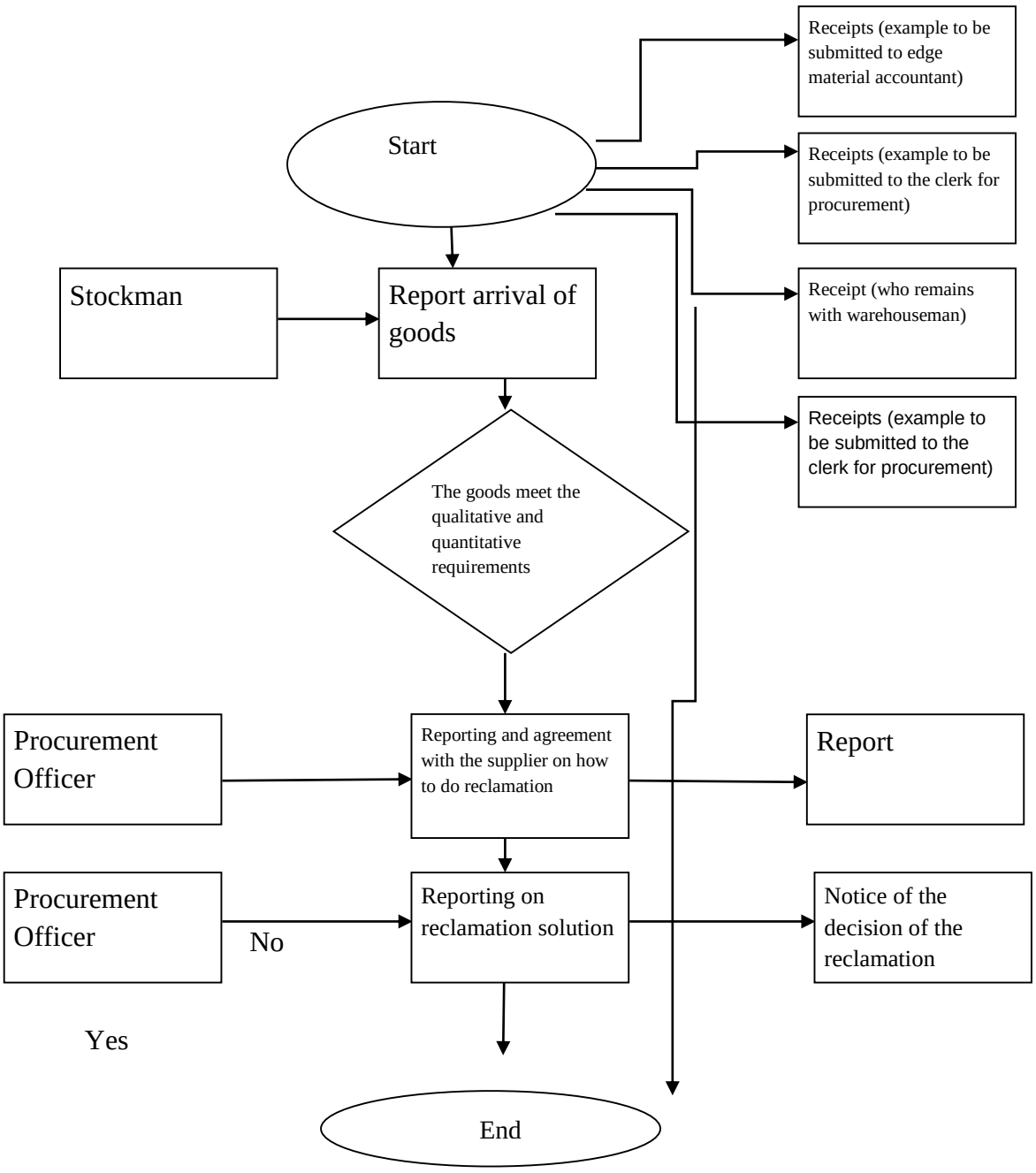


Figure 19: Process Flow of storing

3.2 Identification of key activator of commodity flows

High ability to respond to customer needs, to some extent depends on the supply of the following enterprise functions, which come after the procurement process, certain goods, raw materials, packaging, or in a word raw materials. This material goods must arrive at the right time, in the required amount and be available for the appropriate corresponding company functions (mainly manufacturing).

It is well known that not all the material goods that are purchased for the needs of the company are of the same importance. Certain material goods have a greater importance for the company. This greater importance for the company is reflected through some criteria, it is mostly the amount of funds necessary for the purchase, which is of particular importance for the company.

In addition to the funds other criteria may include the: the so-called "critical importance" for the company, various restrictions regarding the implementation of procurement, procurement quantities and the like.

One of the main tasks is to monitor the procurement and implementation of procurement of material goods, taking into account all the specifics for a specific company.

One of the most important tasks to fulfill in this paper is to study and analyses procurement flows to come by certain data that is needed to optimize procurement.

The Company X is purchasing: the basic raw material (milk), different types of packaging, parts for manufacturing, chemicals, energy, etc. All together within the procurement they orders over ninety different positions of material goods. The large number of items to be procured indicate the complexity of performing the analysis. Heterogeneity of items are reflected in the following: the purpose of the manufacturing process of physical-chemical properties, the physical condition, size and price, and the like.

Due to the large heterogeneity of material goods which are the subject of this analysis as the main criteria for comparison used will be the funds that are spent for the purchase. The data

used in the analysis were obtained from the purchasing department in 2013, which can taken as reference period. Sources of data on procurement are: data from the service procurement, procurement contracts, the data obtained from personal contact or conversation with some participants in the implementation of procurement, and the recording of certain processes spatio-temporal transformation of material goods.

The number and heterogeneity of material goods to be supplied, as well as a multitude of data related to the purchase, according to the procedure of selecting a representative group of material goods. In a representative group there a more detailed analysis will be made on the process of material goods from the supplier to the destination warehouse of the company, and with them the costs associated with procurement. The procedure on the basis of which this research will be conducted consists of several steps;

- Collecting data from the data source and classifying the groups: raw materials for production, fuel and energy, tools and inventory and spare parts for production;
- Extracting representative groups based on the percentage of participation in segregated funds for procurement;
- Extracting dominant subgroup of representative groups via ABC analysis with the help of the selected criteria (expended funds for procurement);
- A more detailed analysis of the procurement process of representative material goods

3.2.1 Separation of material goods via ABC analysis

- Separation of representative material goods of the highest percentage of group raw materials for manufacturing (see Table 2) will be done using the ABC analysis and the creation of Pareto diagram. Pareto or ABC chart is a graphical method that is characterized by simplicity and applicability in various fields. ABC analysis involves the differentiation of certain elements of the dataset (products, suppliers) into three groups based on specific criteria.

- The criteria can be a classification of elements according to the quantity, value, etc.).
- This analysis is based on the fact that a relatively small number of elements of the dataset has extensive participation in the selected criteria.
- For the application often used is the so-called rule of "80/20", which means that twenty percent of elements in a given set of accounts for eighty percent share in certain selected criteria.

This rule is broadly found to be true at most manufacturing companies.

There are two limits to create pareto chart as follows:

- When all of the elements of the dataset have the same share in the criteria and
- When an element has an extremely dominant share in the criteria for differentiation.

Pareto diagram can be used for classification of material goods (which are sold, supplied,

unloaded and the like) and rank them based on certain criteria (participation in the procurement, sales, stocks, etc.).

On this basis, the observed elements are classified in descending order in a particular criteria, then perform their accumulation and the results of this analysis are drawn in particular chart. They are trained three classes A, B and C, and the boundaries between them are withdrawn in each case (the delimitation of influence: firm size, characteristics procurement, production or sales, etc.). Based on this selection, elaborate procedures of work which enable different

treatment of certain elements in the dataset of procurement, production, sales and inventory of materials. In making ABC analysis in this master thesis certain rules will be subject to adjustment to the specific situation in the company X.

Method for preparation will not be called into question. The process of performing ABC analysis is performed in several steps:

Step one-make a selection problem to be solved, specify the time period for which the data are analyzed, prepare the required data.

Step Two-shape Pareto diagram and diagram of the relative share of each element in the selected criteria and the cumulative line.

Step Three-determination of the degree of significance .On the appearance of cumulative line performs the separation of three distinctive areas:

- A –group, area with the highest share in the observed size, mainly composed of a small number of elements,
- B -group with significant participation,
- C -group with low participation.

Due to the large number of items (elements) that are purchased there will be made grouping of material goods in four major groups:

- Raw materials for production,
- Fuel and energy,
- Tools and inventory and
- Spare parts for production.

3.2.2 Structure of material goods in procurement

Based on the available data tangible clustering of goods to the already mentioned groups. Information on funds allocated for the purchase and percentage share are presented in Table 2.

Table 2: Information on funds allocated for the purchase

No.	Name of Group	Value of Procurement (euro)	Percentage (%)
1.	Raw materials for production	4.347.786.91	92,65
2.	Fuel and Energy	260.897.48	5,56
3.	Tools and inventory	51.822.05	1,11
4.	Spar parts for production	31781.65	0,68
Total:		4.692.288.09	100,00

From the data presented in Table 2 it can be seen that in the framework of the total supply of raw materials for manufacturing has a dominant effect with even 92.65 [%] participation.

On the basis of allocated funds within the overall procurement can be seen that the specified group has the greatest impact and is the focus of the analysis down the final paper.

In Figure 20 graphically participation of certain groups within procurement is shown.

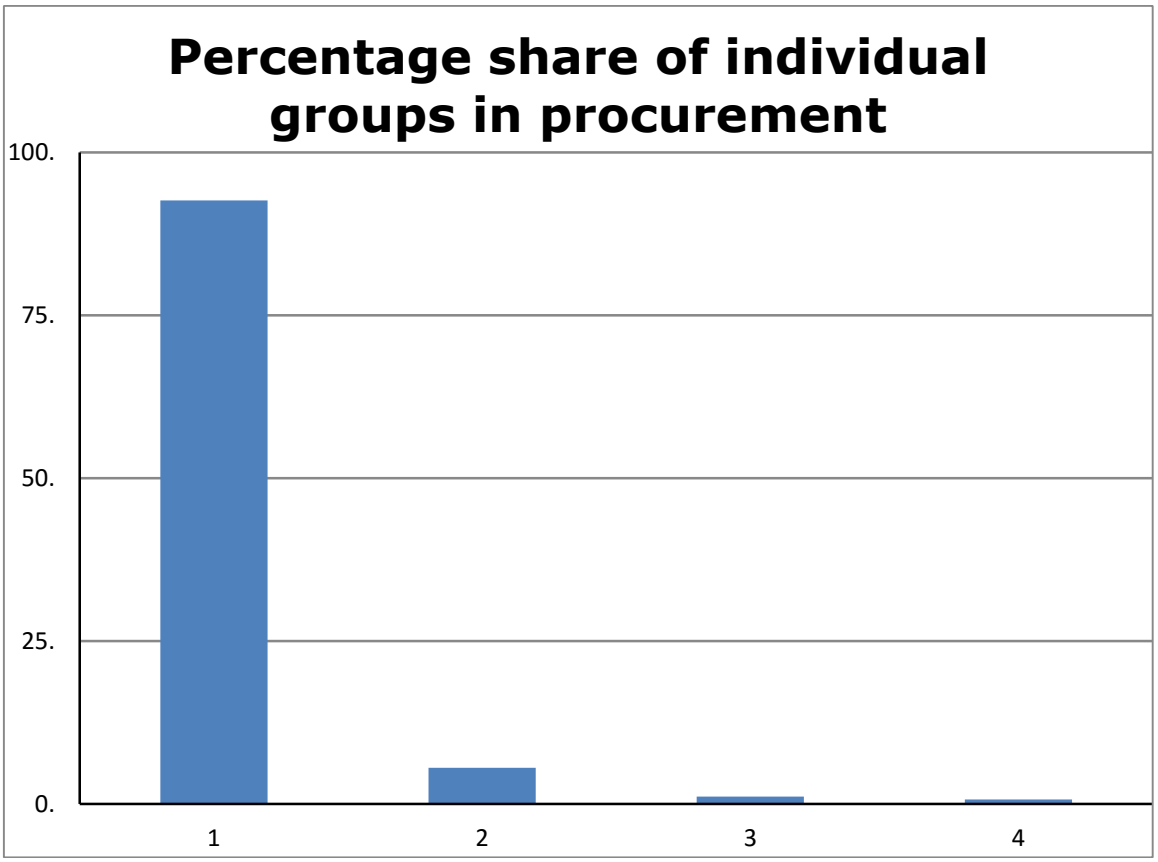


Figure 20: Graphically participation of certain groups within procurement

The number of the group: 1 - Raw materials for production, 2 - Fuel and Energy, 3 - Tools and inventory, 4 - Spar parts for production

3.2.3 Structure of material goods in the group of raw materials for the production

A closer view of allocated funds for procurement within the group services are shown in Table 3.

Table 3: Closer views of groups of raw materials for the production

No.	Name of Group	Value of Procurement (euro)	Percentage (%)
1.	The dominant raw material (milk)	3.920.372.18	90,16
2.	Packaging	371.414.16	8,54
3.	Chemical products	56.000.58	1,30
Total:		4.347.786.91	100,00

As can be seen from Table 3 the dominant role in the acquisition, by expenditure funds (value), occupies the dominant raw material (milk) to 90.16 [%], while the rest is packaging and chemical products with 9.84 [%]. For the purposes of this detailed analysis a number of elements within a group packaging, which has 47, classified according to certain criteria and classified them into subgroups. For the classification into subgroups primarily similarities in purpose packaging for a certain group of final products were taken into account.

The following is observed volume of packaging, vendors and value at acquisition. The above classification into subgroups is necessary for adjusting the data for the performance of ABC

analysis and their ease of processing. The main motive is the fact that there is a huge disproportion in the procurement value of individual elements. The above disproportion refers to a group of elements - packaging and chemical products and the group - the dominant raw material for the production (milk). The differences in the acquisition of the dominant raw material and packaging and chemical products is mirrored in technology and the dynamics of supply. So the mentioned analysis to be all encompassing there must be an accessed classification into subgroups. Subgroups with the elements they contain will be presented in tables, as follows:

Table 4: Allocated funds for procurement of elements of Subgroup 1

No.	Name of elements	Value of procurement (euro)
1.	Cup of yogurt 0,2 liter – 0,5 % mm (milk fat)	48851.57
2.	Cup of yogurt 0,2 l – 3,2 % mm	42745.12
3.	Cup of sour milk 0,2 l	12212.89
4.	Cup of extra sour milk 0,2 l	732.77
5.	Cup for fermented cream 0,2 l – 12% mm	2978.75
6.	Cup for fermented cream 0,2 l – 20% mm	9770.31
Total:		117365.89

Table 5: Allocated funds for procurement of elements of Subgroup 2

No.	Name of elements	Value of procurement (euro)
7.	Five bottles of yogurt 1l – 0,5 mm (milk fat)	31455.64
8.	Five bottles of milk 1l – 2,8 mm	18349.12
9.	Five bottles of milk 1l – 3,2 mm	34601.21
Total:		49804.77

Table 6: Allocated funds for procurement of elements of Subgroup 3 (Chemical products)

No.	Name of elements	Value of procurement (euro)
10.	Hemo 64	39319.55
11.	Hemo 55	16681.02
Total:		56000.58

Table 7: Allocated funds for procurement of elements of Subgroup 4

No.	Name of elements	Value of procurement (euro)
12.	Cover of yogurt 0,2 liter – 0,5 % mm (milk fat)	2534400
13.	Cover of yogurt 0,2 l – 3,2 % mm	2217600
14.	Cover of sour milk 0,2 l	633600
15.	Cover of extra sour milk	38016
16.	Cover for fermented cream 0,2 l – 20% mm	506880
17.	Cover for fermented cream 0,2 l – 12% mm	158400
Total:		6088896

Table 8: Allocated funds for procurement of elements of Subgroup 5

No.	Name of elements	Value (euro)
18.	Plastic cup 1 kg (kilogram)	3149.53
19.	Plastic cup 0.5 kg	1640.38
20.	Plastic cup 5 liters	3411.99
21.	Plastic cup 6.4 l	504.84
22.	Cannikin 1 kg	3254.51
23.	Cannikin 1/2 kg	1859.10
24.	Snap Cover fi 95 mm (millimeters)	14435.35
Total:		28255.70

Table 9: Allocated funds for procurement of elements of Subgroup 6

No.	Name of elements	Value (euro)
25.	Cork for pink bottle	9615.61
26.	Cork for green bottle	8598.58
27.	Cork for blue bottle	3236.02
Total:		21444.91

Table 10: Allocated funds for procurement of elements of Subgroup 7

No.	Name of elements	Value (euro)
28.	Five bottles for yogurt 0,5 liters – 0,5 % mm	9022.09
29.	Five bottles for yogurt 0,5 liters – 3,2 % mm	10389.08
Total:		19411.17

Table 11: Allocated funds for procurement of elements of Subgroup 8

No.	Name of elements	Value (euro)
30.	Cup for sour milk 0,5 liters	3554.16
31.	Cup 0,5 l	5467.94
32.	Cup for mileram 0,5 l	3280.76
33.	Cup for fermented cream 0,5 l	6834.92
Total:		19137.77

Table 12: Allocated funds for procurement of elements of Subgroup 9

No.	Name of elements	Value (euro)
34.	Cup for cream 0,25 liters	7515.93
35.	Cup 0,25 l	5010.62
Total:		12526.54

Table 13: Allocated funds for procurement of elements of Subgroup 10

No.	Name of elements	Value (euro)
36.	Lid for cup 0,5 liters – sour milk	1052.03
37.	Lid for cup 0,5 l	1618.51
38.	Lid for cup 0,5 l – mileram	971.11
39.	Lid for cup 0,5 l – fermented cream	2023.14
40.	Lid for cup 0,25 l – cream	1574.77
41.	Lid for cup 0,25 l	1049.68
42.	Lid for cup 0,1 l – cream	1574.77
43.	Lid for cup 0,1 l – cream	1574.77
44.	Lid for cup 0,1 l – cream 24% mm	157.48
Total:		11596.40

Table 14: Allocated funds for procurement of elements of Subgroup 11

No.	Name of elements	Value (euro)
45.	Cup for cream 0,1 liter	3514.02
46.	Cup for cream 0,1 l	3514.02
Total:		7028.04

Based on the data from Table 4 to 14 and the values of the dominant raw material procurement for production, the participation of individual subgroups will be graphically shown, based on selected criteria values of procurement. See Figure 21.

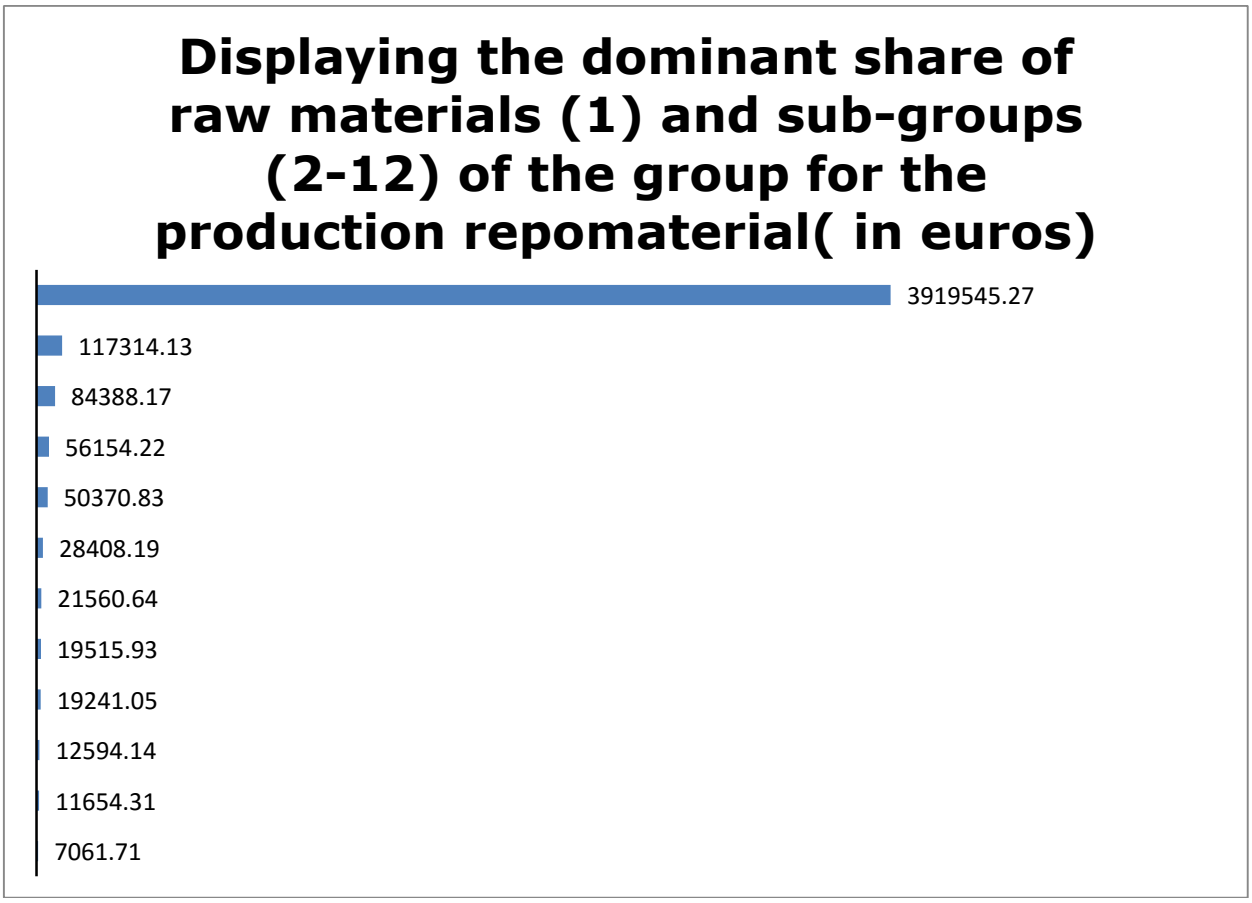


Figure 21: Graphical representation of participating subgroups (containers and chemical products) and the dominant raw material for the production of the raw materials group for the production.

3.2.4 The process of determining the most important set of material goods within the group with materials for production

Choosing the most significant set of material goods from the group with materials for production shall be done on basis of selected criteria (allocated funds for the purchase and the value of purchases). From the above mention leads us to the necessity of determining the boundaries of groups A, B and C (wholesale, retail and significant participation in the criteria).

From process execution ABC analysis follows several ways of determining the limit values for certain groups (A, B or C). This analysis indicated the rules needed to be adapted, primarily concrete participation of material goods (elements) in the chosen criteria. As starting point for determining the threshold values a modified rule "80/20" is used in favor of the most influential element that is the dominant raw material for the production (milk) .In Table 15 shows the boundaries between the groups.

Table 15: Allocated funds for procurement of elements of Subgroup 11

Group mark	Participation in criterion	Boundaries between groups
A	Big (very important)	≥ 124082.62
B	Medium (important)	$41360.87 \leq X \leq 124082.62$
C	Small (important)	$0 \leq X \leq 41360.87$

In Table 16 shows the data related to the value of the goods to be supplied within the group of raw materials for the production.

Table 16: Allocated funds for procurement of the goods to be supplied within the group of the raw materials for production.

No.	Name	Allocated cash for procurement (euro)
1.	Basic raw material (milk)	3919357.12
2.	Subgroup 1. (Cup 0,2 liters for yogurt, sour milk, fermented cream, 0,5 % mm; 3,2 % mm etc.	117335.50
3.	Subgroup 2. (Five bottle 1 liters for yogurt 0,5% mm, milk 2,8 % mm and 3,2 % mm etc.)	84384.12
4.	Subgroup 3. (Chemical products (Hemo 64, Hemo 55)	55986.08
5.	Subgroup 4. (Lid for cup 0,2 liters for yogurt, sour milk, fermented cream, 0,5 % mm; 3,2 % mm etc.	50368.41
6.	Subgroup 5. (Plastic vessel 1 kg, 0,5 kg, 5 l, 6,4 l)	28208.11

7.	Subgroup 6. (Cork for five bottles in rose, green, and blue color)	21412.36
8.	Subgroup 7. (Five bottles 0,5 l for yogurt, milk, 0,5% mm, 3,2% mm)	19381.70
9.	Subgroup 8. (Cup 0,5 l for yogurt, mileram, fermented cream)	19108.72
10.	Subgroup 9. (Cup 0,25 l for cream)	12507.53
11.	Subgroup 10. (Lid for cup 0,5 l for sour milk, mileram, fermented cream; Lid for cup 0,25 l for cream; Lid for cup 0,1 l, cream 24%)	11578.79
12.	Subgroup 11. (Cup 0,1 l for cream)	7028.04
Total:		4346661.18

According to Table 17, which shows the expended funds in the group with materials, it can be seen that the largest funds are expended for the purchase of the dominant raw material for the production of even 3919357.12 [euro] or 90.16 [%], followed by sub-packaging and chemical products with a total of 55986.08 [euro] or 9.84 [%]. In the Table 17 there will be shown a classification, sub merged number of elements, based on the defined limit values given in Table 15. Classes (A, B or C) are the result of such a classification where it was shown with their percentage share in both the group materials, as well as the total value of

purchases for the reference period of one year. Based on the data (shown in Table 17) Pareto diagram ABC diagrams shall be design.

Table 17: Classification of the material goods in class (A, B or C) based on the defined limit values given in Table 15

Mark of class	Serial number	Participation in range of procurement [%]		Participation in separate funds for procurement [%]		Participation in the average inventory [%]	
		Group	Cumulative	Group	Cumulative	Group	Cumulative
A	1	6,66	6,66	83,55	83,55		
B	2, 3, 4, 5, 6	26,66	33,32	6,57	90,12		
C	7, 8, 9, 10, 11, 12	66,68	100,00	9,88	100,00		

Based on the data presented in Table 17 it can be seen that within the class A (large participation in the criteria), there is only one element, the dominant raw material for the production (milk), and that his participation in the assortment for purchase only 6.66 [%] and to the chosen criterion (funds allocated for the purchase) it participates with 83.55 [%]. Within the class B (significant share in the criteria) there are four subgroups of elements that

participate in the assortment for purchase in 26.66 [%] in separate funds for the purchase of 6.57 [%]. Within the class C (small participation in the criteria) is located six sub-elements with 66.68 [%] share in the range of procurement and 9.88 [%] in segregated funds for the purchase. In Figure 22 shows the Pareto diagram (ABC diagram).

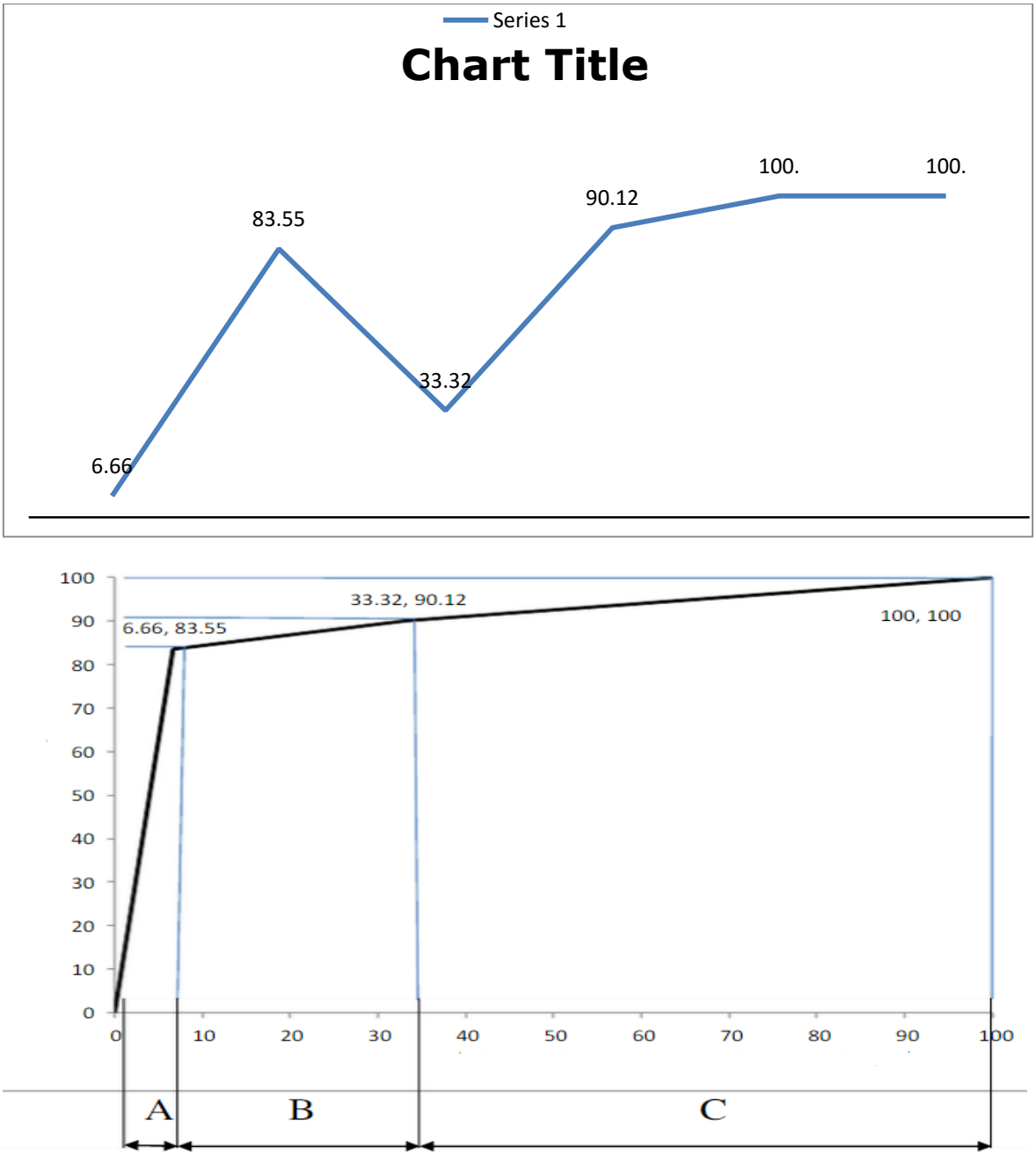


Figure 22: Pareto diagram (ABC diagram) for group raw materials for production

Arranged data in table or graphical representation of the diagram, allows the procurement function, and other functions of the company to make certain conclusions important for planning future operations. Namely:

- The element of class A (area, no. 1) accounts for 6.66 [%] of the total range for procurement of annual consumption in the purchase of even 83.55 [%]
- Elements of class A and B (area, no. 1, 2, 3, 4.5) accounted for 33.32 [%] of the range for the acquisition of a 90.12 [%]
- In spending for procurement, means that in the coming period, the elements of class A and B should be given special attention.

The remainder of this paper will discuss and analyze all processes involving the said material goods in detail. The table 18 shows a classification of material goods by ABC Pareto-analysis basis of a study results.

Table 18: Classification of material goods on the basis of the results of Pareto-ABC analysis

Mark of Class	Name	Participation in the criterion
A	Basic raw material (milk)	Big (Very important)
B	Subgroup 1. (Cup 0,2 liters for yogurt, sour milk, fermented cream, 0,5 % mm; 3,2 % mm etc.	

	Subgroup 2. (Five bottle 1 liters for yogurt 0,5% mm, milk 2,8 % mm and 3,2 % mm etc.)	Medium (Important)
	Subgroup 3. (Chemical products (Hemo 64, Hemo 55)	
	Subgroup 4. (Lid for cup 0,2 liters for yogurt, sour milk, fermented cream, 0,5 % mm; 3,2 % mm etc.	
C	Subgroup 5. (Plastic vessel 1 kg, 0,5 kg, 5 l, 6,4 l)	Small (Important)
	Subgroup 6. (Cork for five bottles in pink, green, and blue color)	
	Subgroup 7. (Five bottles 0,5 l for yogurt, milk, 0,5% mm, 3,2% mm)	
	Subgroup 8. (Cup 0,5 l for yogurt, mileram, fermented cream)	
	Subgroup 9. (Cup 0,25 l for cream)	

	Subgroup 10. (Lid for cup 0,5 l for sour milk, mileram, fermented cream; Lid for cup 0,25 l for cream; Lid for cup 0,1 l, cream 24%)	
	Subgroup 11. (Cup 0,1 l for cream)	

3.3 Critical analysis of the process of material goods of class A and B

Based on the results of the ABC analysis it was found what groups of material goods to the fullest extent affect the volume of total procurement costs. In order to provide insight into business processes and highlight the gaps in this chapter processes that occur during procurement shall be processed. Special attention will be paid on logistics costs, which are actually the subject of the overall research of this master thesis.

The logistics processes and the costs associated with them will be analyzed through:

- Initiation of cargo flows (ordering)
- Organization and implementation of material good flows from the supplier (vendor) to the destination warehouse companies,
- Arrival (reception) input flows in companies and
- The structure of total logistics costs

3.3.1 Initiating the flow of material goods (ordering)

Ordering material goods performs the purchase department headed by an officer of purchase. Based on consideration of need ordering is performed. Ordering is done with the help of corresponding document: Purchase Order (acquisition) for the material goods which are in class B, while the main raw material (milk) uses a continuous contract for daily supply to be signed for the corresponding period. Input material goods begin the process of ordering. Data related to this process are shown in Table 19.

Table 19: Order (acquisition) for the material goods which are in class A and B

Mark of class	Name of cargo	Specific initial activities				Transport unit means	
		Name of activity (doc.)	Supplementary unit	Earlier date issuing	Delivery deadline	Type of unit	Capacity in units
1.	Dominant raw (milk)	Contract	46185,00 [l]	1 day	1 day	Tank	2600,00 [l]
2.	Subgroup 1. (Cup 0,2 liters for yogurt, sour milk, fermented cream, 0,5 % mm; 3,2 % mm etc.	Order	516440,00 [pieces]	16 day	15 day	Truck	Till 55 m^3

3.	Subgroup 2. (Five bottle 1 liters for yogurt 0,5% mm, milk 2,8 % mm and 3,2 % mm etc.)	Order	20160,00 [pieces]	4 day	2 day	Tractor with semitrailer	Till 96 m^3
4.	Subgroup 3. (Chemical products (Hemo 64, Hemo 55)	Order	5600,00 [kg]	11 day	5 day	Truck	7000 [kg]
5.	Subgroup 4. (Lid for cup 0,2 liters for yogurt, sour milk, fermented cream, 0,5 % mm; 3,2 % mm etc.	Order	3225600 [pieces]	92 day	15 day	Truck	Till 55 m^3

The data in the table shows that the company will be regularly supplied to the dominant raw material for the production on an average amount of 46185.00 [l]. From the data presented in the table dynamics and order quantities of other material goods. The longest period of time between the two procurement for the group of material goods under no. 5 and is 92 days.

3.3.2 Organization and implementation of material goods (freight) flows from the supplier to the recipient

Data related to the process itself that flows the load will be shown:

- Limits of liability and risk,
- Modes of transport and
- Total transport costs.

Table 20 shows the limits of liability and risk parity delivery.

Table 20: Limits of liability and risk

No.	Name of cargo	Suppliers	Daily amount in a unit of measure	Annual quantity in the unit of measure	The total value of annual quantities (euro)	Contracted and Parity of delivery	Type of transport [road]
1.	Raw material (milk)	Farm "1"	6285	2294025 l	522629.24	EXW	R
		Farm "2"	4503	1643595 l	374447.01	EXW	R
		Farm "3"	3548	1295020 l	295033.98	EXW	R
		Farm "4"	2979	1452335 l	330873.78	EXW	R

		Farm “5”	2581	942065 l	214623.08	EXW	R
		Farm “6”	2578	940970 l	214373.62	EXW	R
		Farm “7”	2254	822710 l	187431.39	EXW	R
		Farm “8”	2453	895345 l	203979.24	EXW	R
		Farm “9”	2475	903375 l	205808.65	EXW	R
		Farm “10”	2582	942430 l	214706.24	EXW	R
		Farm “11”	1891	690215 l	157246.12	EXW	R
		Farm “12”	2450	894250 l	203729.78	EXW	R
		Farm “13”	1989	725985 l	165395.31	EXW	R
		Farm “14”	1691	617215 l	140615.12	EXW	R

		Farm “15”	1278	466470 l	106272.10	EXW	R
		Farm “16”	1590	580350 l	132216.47	EXW	R
		Farm “17”	960	350400 l	79828.81	EXW	R
		Farm “18”	1048	382520 l	8714.65	EXW	R
		Farm “19”	1068	389820 l	88809.55	EXW	R
2.	Subgroup 1. (cup 0,2 l liters...	Company “AA”	-	11532000 [pieces]	117509.40	DDP	R
3.	Subgroup 2. (five bottles 1l...)	Company “BB”	-	1932000 [pieces]	84509.18	DDP	R
4.	Subgroup 3. (Chemical products...)	Company “CC”	-	192000 kg	56069.05	DDP	R

5.	Subgroup 4. (Lid for cup 0,2 l...)	Company "DD"	-	11532000 [pieces]	50443.06	DDP	R
Total:					4353103.31		

From the table it can be seen that within the dominant procurement of raw materials for production, there are 19 smaller suppliers. The largest quantity of milk purchased from a farm "1" and then from a series of rural settlements. Quantities from individual farms are ranging on average, from 6285 l (Farm "1") to 1068 l (Farm "1"). Deliveries of goods, in other sub-groups, are with significantly larger distances (Farm "AA"). Complete delivery of milk using trucks with over walled tanks with capacities of 2600 l, while other material goods transported by trucks of various types but useful volume (cargo space) up to 55 m3. There are two parity deliveries EXW and DDP. The first parity refers to the delivery of milk (minimum obligations of the supplier) and other packaging products and chemicals (maximum liability of the supplier).

Table 21: Mode of transportation

No.	Name of cargo	Suppliers	Transport Unit			Realize of transport	Contracted annual dynamics of transport		Transport prices (euro/transport)
			Type	Capacity	Dimension		No. of delivery	The average time interval between two delivery [days]	
	Raw material (milk)	Farm "1"	Truck - cistern	2600 l	7 x 2,47 x 2,4	Company "X"	1095	1/3	20.02
		Farm "2"	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	730	½	42.23
		Farm "3"	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	730	½	31.99
		Farm "4"	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	69.12

		Farm “5”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	74.24
		Farm “6”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	76.80
		Farm “7”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	43.52
		Farm “8”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	125.43
		Farm “9”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	38.40
		Farm “10”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	94.72
		Farm “11”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	51.20
		Farm “12”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	25.60
		Farm “13”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	81.92

		Farm “14”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	64.00
		Farm “15”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	38.40
		Farm “16”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	38.40
		Farm “17”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	20.48
		Farm “18”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	71.68
		Farm “19”	Truck - cistern	2600 l	7 x 2,47 x 2,4	Transporter	365	1	81.92
2.	Subgroup 1. (Cup 0,2 l liters...	Company “AA”	Truck	55 m³	9 x 2,47 x 2,4	Company “AA”	23	16	180.93
3.	Subgroup 2. (Five bottles 92001l...)	Company “BB”	Truck	96 m³	13,7 x 2,47 x 2,45	Company “BB”	96	4	35.79

4.	Subgroup 3. (Chemical products. ..)	Company "CC"	Truck	55 m³	9 x 2,47 x 2,4	Company "CC"	35	13	76.22
5.	Subgroup 4. (Lid for cup 0,2 l...)	Company "DD"	Truck	55 m³	9 x 2,47 x 2,4	Company "DD"	4	92	208.77

Based on the data from the table it can be seen that most funds for transportation are for delivery of milk and least for the delivery of material goods under number 5 (a glass lid for 0.2 l).

For transportation of milk we distinguish two modes of transport:

- With company's own fleet (from the Farm "1") and
- Transport on the basis of contracts with transporters (for the other 18 suppliers).

For the transport of material goods (subgroup 1, 2, 3, 4) fleet from the supplier is used (settled delivery). For the use its own fleet there is no exact cost records. Determination of transport costs for its own car park was based on the basic characteristics of transport costs as follows:

- The cost of employees' salaries (Ces) - gross personal income of employees,
- Material costs (C_m) -Costs consumption of fuels and
- Other costs (Co) - related costs (change of the technical condition of the vehicle, amortization and other periodic expenses incurred by the use of vehicles).

Total cost of delivery for the Self neither fleet are given pattern:

$C_t = C_{es} + C_m + Co$ (Euro)

(1.1)

$$\Rightarrow C_t = [(N_{ad} x C_{dc}) + (2xDx\frac{C_f}{100}xP_f)xN_{tt}]xCo = 60.41(euro/daily)$$

(1.2)

N_{ad} - Number of arrange drivers N_{ad} =2 (drivers/transporters)

C_{dc} - Daily Costs for arrangement of one driver $C_{dc} = \frac{GPI}{30} = 12.49$ (euro)

GPI – Gross Personal Income

D- Distance between Company and Farm "1", D=76 km

N_{tt} - Number of turn needed for transport N_{tt} =3 (turns)

C_f - Consumption of fuel on 100 km C_f =18 liters

P_f - Price of fuel P_f = 0.87 (euro/liter)

C_o -Other costs, due to the inability to be identified, are estimated at approximately 10%, compared to the rest of the total cost of delivery C_o =1, 1.

The form (1.2) is used for calculating of the costs for not keeping records of expenses incurred transport.

For calculation of the costs of engagement with the transportation company used a simple model costing as follows:

$C_t = 2xD_i xC_{km}(euro)$

(1.3)

And

D_i - Distance between Company and Farm "i". Data about distance are shown in Table 22

Table 22: Distance between Company and Farm "i" for production of milk

No	Name of the place	Distance [km]	No.	Name of the place	Distance [km]
1.	Farm "2"	33	10.	Farm "11"	20
2.	Farm "3"	25	11.	Farm "12"	10
3.	Farm "4"	27	12.	Farm "13"	32
4.	Farm "5"	29	13.	Farm "14"	25
5.	Farm "6"	30	14.	Farm "15"	15
6.	Farm "7"	17	15.	Farm "16"	15
7.	Farm "8"	49	16.	Farm "17"	8

8.	Farm “9”	15	17.	Farm “18”	28
9.	Farm “10”	37	18.	Farm “19”	32

For the calculation of transport costs for goods from group packaging and chemical products (subgroup 1, 2, 3, 4) form (1.2) is used with some adjustments because of the lack of relevant information. Distance between companies and suppliers (supplier Farm “AA”) are, respectively, (273km, 54km, 115km and 315km).

After determination of all relevant costs and their running in Table 20 in the next step, the data will be presented on a daily and annual basis. Table 23 will show the total costs of transporting cargo from individual suppliers.

Table 23: Total costs of transporting cargo

No.	Name of cargo	Suppliers	Transportation costs			Percentage participation in the value of the cargo [%]
			Transport costs (for transport) [euro]	Transport costs (per day) [euro]	Transport costs (per year) [euro]	
	Raw material (milk)	Farm “1”	20.14	60.43	22058.83	4,19

		Farm "2"	42.47	84.96	62019.40	16,46
		Farm "3"	32.18	64.36	46984.39	15,83
		Farm "4"	69.51	69.51	25371.57	7,62
		Farm "5"	74.66	74.66	27250.95	12,62
		Farm "6"	77.23	77.23	28190.64	13,07
		Farm "7"	43.77	43.77	15974.69	8,47
		Farm "8"	126.15	126.15	46044.70	22,44
		Farm "9"	38.62	38.62	14095.32	6,80

		Farm “10”	95.26	95.26	34768.45	16,10
		Farm “11”	51.49	51.49	18793.76	11,88
		Farm “12”	25.74	25.74	9396.88	4,58
		Farm “13”	82.38	82.38	30070.01	18,07
		Farm “14”	64.36	64.36	23492.20	16,61
		Farm “15”	38.62	38.62	14095.32	13,18
		Farm “16”	38.62	38.62	14095.32	10,60
		Farm “17”	20.60	20.60	6364.13	7,92

		Farm “18”	72.09	72.09	26311.26	30,02
		Farm “19”	82.38	82.38	30070.01	33,66
2.	Subgroup 1. (Cup 0,2 l liters...	Company “AA”	181.96	-	4185.17	3,54
3.	Subgroup 2. (Five bottles 92001l...)	Company “BB”	35.99	-	886.86	4,05
4.	Subgroup 3. (Chemical products...)	Company “CC”	76.65	-	2682.80	4,56

5.	Subgroup 4. (Lid for cup 0,2 l...)	Company “DD”	209.96	-	839.83	14,82

The table below shows the price of cargo transport, namely: to transport, on a daily basis (for the transport of milk) and on an annual basis.

Most funds are spent on transport milk from Farm “2” 62019.40 [euro / year] and least for a Farm “17” 6364.13 [euro / year]. The indicator, which gives a more comprehensive picture of the cost-effectiveness of procurement of milk from specific farms which takes into account the volumes purchased, the percentage share of transport costs in the amount of cargo for transport. On the basis of this indicator from the point of procurement best relationship: the quantity to be transported, the distance from the company and spent funds to purchase milk at the Farm “1” 4.19 [%] and the most favorable relationship with the Farm “19” 33.66 [%].

Transport costs of milk per annum are 495446.16 [Euro].

Total cost of transporting milk to the value of the quantity of milk procured 12.55 [%].

Transport costs for material goods of class A and B, on an annual basis are 504040.81 [euro].

The total transport costs involved in the total value of purchases from 11.51 [%].

Based on the analysis of transport costs noticed a big difference in cost between using its own fleet and leased fleet-truck operators.

The cost of transporting its own fleet is 0.27 [euro / km] a leased fleet is 0.65 [euro / km]. Given the above, the difference in the cost of transport per kilometer between own and leased fleet is 243 [%]. Table 24 shows the transport costs per unit (unit costs) and total cost of supply (per unit).

Table 24: Total cost of delivery per unit

No.	Name of cargo	Unit of measurement	The unit cost of delivery		Total cost of delivery (euro/unit of measure)
			Amount (euro)/ unit of measure	The percentage participation in the unit value of cargo [%]	
1.	Milk	Liters	0.03	13.27	0.03
2.	Subgroup 1. (Cup 0,2 l...)	Pieces	0.001	3.25	0.001
3.	Subgroup 2. (five bottles 1 l ...)	Pieces	0.002	3.97	0.002
4.	Subgroup 3. (Chemical products...)	Kg	0.003	1.66	0.003
5.	Subgroup 4. (Lid for cup 0,2 l...)	Pieces	0,0001	1.48	0,0001

From the data in the table we see that for the delivery of one liter of milk 0.03 [euro] is spent and that the costs of delivery to the value of one liter of milk accounts for 13.27 [%]. The minimum expenditure of funds per unit delivered for a glass of 0.2 l with the cover is 0.0001 [euro / piece] and that the costs of delivery to the value of one piece are 1.48 [%].

3.3.3 Receiving incoming flow of material goods (freight)

Tangible goods that are observed in this study are delivered by road. Transportation equipment's are tankers for transportation of milk and trucks for transportation of containers and chemical products. The dynamics of supply and technology, and the process of storing differs from the dominant raw material (milk), and other material goods. It should be noted that the central warehouse located at a distance of 8 [km] of the parent company.

Within the dairy is located in another warehouse for unit loads and two reservoirs - refrigerators that are used for storing milk From the aspect of movement of material flows there are restrictions on access to the warehouse for general cargo located within the dairy or its physically not possible to accommodate larger vehicles and payload. The reason is that adequate roads have not been provided (radius of curves inappropriate and inadequate width of roads). For this reason, material goods from group packaging and chemicals are completely transported in the warehouses outside the company's perimeters, and after that is done in the transport warehouse within the company's perimeters. Receiving warehouse is owned by the Company. Goods that are transported in containers within the group arrive on pallets measuring 1200 x 1000 mm and packed in bags and packed in cartons.

Packaging is irreversible and transportable in terms of packaging functions. For chemical product goods arrive packaged in sacks on pallets 1200 x 1000 [mm].

Milk is transported by lorries and transferred into temperature controlled tanks with capacity of 2 x 25000 [l] from where they are transported by the need to manufacture site.

The packaging in which milk is supplied is metal, with 2600 l capacity, and packaging functions for transport. Manifestations of cargo and their characteristics are given in Table 25.

Table 25: Manifestations of cargo

No.	Name	Unit of measure	Annual amount of cargo			Physical condition	
			Mass	Dimensions	No.	Cargo in the solid state	Cargo in the liquid state
1.	Milk	Liters	16288135,00	-	-	-	-
2.	Subgroup 1. (Cup 0,2 l...)	Pieces	-	-	11532000,00	Palettes/ boxes	-
3.	Subgroup 2. (five bottles 1 l ...)	Pieces	-	-	1932000,00	Palettes/ boxes	-
4.	Subgroup 3. (Chemical products...)	Kg	192000,00	-	-	Palettes/ boxes	-
5.	Subgroup 4. (Lid for cup 0,2 l...)	Pieces	-	-	11532000,00	Palettes/ boxes	-

Table 26: Delivery of cargo to the place of unloading

No.	Name	Cargo is transported to the place unloading
1.	Milk	Road
2.	Subgroup 1. (Cup 0,2 l...)	Road
3.	Subgroup 2. (five bottles 1 l ...)	Road
4.	Subgroup 3. (Chemical products...)	Road
5.	Subgroup 4. (lid for cup 0,2 l...)	Road

For reasons of lack of adequate roads, only the dominant raw material for the production is delivered to the storage (tank -freezers) within the company, while the delivery of other material goods of Class A and B is carried to the receiving warehouse outside the company. In the warehouse, within the company, delivered goods are arriving in smaller amounts and smaller road transport. The above mentioned material goods are not subject to detailed analysis. The table 27 below provides an overview of unloading places for material goods which are the subject of detailed analysis.

Table 27: Place of unloading

No.	Name	Warehouse outside the company	Warehouse inside the company	Warehouse for milk / storage tank – refrigerator
1.	Milk	-	-	100%
2.	Subgroup 1 (cup 0,2 l...)	100%	-	-
3.	Subgroup 2 (five bottles 1 l...)	100%	-	-
4.	Subgroup 3 Chemical products...)	100%	-	-
5.	Subgroup 4 (lid for cup 0,2 l...)	100%	-	-

The table 27 below provides an overview of unloading places for material goods which are the subject of detailed analysis. Table 27 in the data shown in the table about the place of unloading it can be seen that the first unloading and storage of material goods in a warehouse outside the company. From that follows that the flows of material goods is doubled. With the storage in warehouse outside the company, that the limitations has been already explained of the previous part of the paper, performs additional manipulation and transport and storage again but this time in the warehouse within the company. When the need arises picking and dispatch is done from the destination warehouse within the company to the place of processing in the production process. This way of manipulating and duplication is not

economical but at the same time it's coerced because the existing restrictions. Table 28 shows the costs of unloading.

Table 28: Type, time and costs of unloading

Degree of unloading mechanization, the average duration and unit costs						Total costs of unloading per unit[euro/u. m]
No.	Name	Unit of measure	Mechanized unloading			
			Average duration[min/u. m]	Cost for lowest u. m	Costs [euro/ u. m]	
1	Milk	Metal bucket with capacity2600l	20	0.0020 [euro/l]	0.52	0.52
2	Subgroup 1 (cup 0,2l)	Pallet 1200x1000 mm(39960 piece)	4	0.000026 [euro/piece]	0.10	0.10
3	Subgroup 2 (five bottle 1 l)	Pallet 1200x1000 mm(700 piece)	4	0.0014 [euro/piece]	0.10	0.10
4	Subgroup 3 (chemic product)	Pallet 1200x1000 mm(400kg)	6	0.0047 [euro/piece]	0.16	0.16
5	Subgroup 4 (cover glass 0,2l)	Pallet 1200x1000 mm(230400 piece)	4	0.0000004 [euro/piece]	0.10	0.10

The table shows data manipulation with a cargo or material goods with reference to the applied method of loading and the overall time and cost required to perform this process. Cost data are based primarily on the basis of time and, in this regard, financial resources needed to engage their workforce.

Table 29: Technical base of unloading

No.	Type of type of cargo agents	No. pieces	Nominal capacity		Manufacturer	Year built	Annual (daily) time balance		Participation in the annual (daily) time balance [%]	
			No. value	u. m			Planed-possible working hours	Realized work in hours	1	2
1	Hand pallet truck (Linde)	1	2	t	-	2001	2920	146	3,42	1,57

Unloading is done by placing the truck sideways (parallel) with a front unloading.

3.3.4 Receipt of cargo in warehouse

For floor storage, input-output zone, linking production and storage areas etc., we require a mobile conveyor transfer agent (with or without storage pallets). These means of transport are divided into:

- Pallet trucks or vehicles that have the lift height sufficient to separate the range of substrates (about 100 [mm]) and a smooth transfer to the next destination:

  -Hand pull carts on the substrate and

  -Electric motor-driven for horizontal movement.

- Forklifts to lift range eg. 1m or more for composition with the options:

  - Hand drawing of such a forklift (rarely) and

  - Motorized horizontal movement.

Hand pallet trucks are the simplest means to transport pallets inside the warehouse, as a means of transport in the input, and output area for smaller storage as a means of internal transport in the production processes at short distances and occasional use, etc. Dimensions of hand pallet trolley depends on the capacity of the cargo, and this type is used for the transfer of cargo that weights up to 2 [t].

Hand forklifts are easiest of cranes forklifts categories. There is a lifting device as with all forklift, but the operator is walking on the floor and pulls (rarely) or guides, an electric motor driven device for horizontal movement. Manually pulled forklifts, with capacity up to 750 [kg], a stroke is between 90 and 1600 [mm] height. For greater lift heights they use cranes with telescopic guides. By adding an electric motor with planetary gears on a wheel, we obtained manually guided hand truck with electric drive engine. This design is intended for smaller capacity (eg. 500 kg). Crane with a telescopic runner raises range of up to 4m, the boot speed about 0.1 m / s (with load).

Greater lifting height or requirements for commissioning caused the need for raising the cab with the operator. If forklifts are used for commissioning, then the handlers have only front fork, or to have counterbalanced forklifts. It should be noted that within the sector procurement are not used forklifts, so they will not be subject to further examination.

Technical base for company destination warehouse are: hand pallet trucks.

Based on these technical base warehouse, company's warehouse is low mechanized warehouse.

For the use of hand pallet trolley it's necessary to emphasize that the floor should be ideally flat, since hand pallet trucks do not have electric drive, but his handler walks on the floor and lifting weight is achieved with hydraulic cylinder. This means of reloading, no matter that they are not automated, they are mostly used in the receiving warehouse (with block storage system) in support loading and unloading of goods from pallets, as well as in substation of goods. Utilization of dock is about 5 [%] during working hours. At its utilization a favorable impact has the fact that hand pallet trucks do not require daily charging the battery. Flaw of these devices is that they are a difficult to use device for the one who handles it.

As a conclusion, we can say that the hand pallet trucks in a warehouse are used to move cargo within the warehouse, unloading cargo means of transport, and open the cargo (if applicable). It is necessary to point out that in the context of procurement generally a small cargo weight and dimensions are delivered and that the need for equipment in the warehouse are at the minimum. The structure of the material goods that are purchased mainly in terms of plastic products of small weight and dimensions (packaging) .Turn pallet trucks are used behind the tangible goods such as table salt (which is packaged in bags) or bags of chemical products, which are larger weight and dimensions. For the purposes of the proceedings the physical transfer of goods is largely performed manually. In the process of making this final paper interviewing the officer for procurement was done in order to determine the basic goals of the organization storage

Basic main organization objectives of storage

Optimization of work items stock 1, 2, **3**, 4

Efficient production supply..... 1, 2, 3, **4**

Minimum losses of wastage and fracture..... 1, 2, 3, **4**

Preparation (finishing, processing, packaging) of materials for production.... **1**, 2, 3, 4

When evaluating the importance of individual goals many symbols have the following meanings:

1-not important, 2-bit important, 3-important, 4 - very important. The shaded part is the answer.

Based on state of the enterprise it has two receiving warehouses. To receive the milk reefer tanks are used that are located next to the building for production. Type and capacity of storage are shown in Table 30.

Table 30: Type and capacity of storage

No.	Name of cargo	Warehouse type	Warehouse equipment	Technological level of realization of warehouse operations	Operational storage area	Warehouse capacity		[%]
						Designed	Exploitation	
1.	Milk	Refrigerator	Tank / Refrigerator	Highly mechanized	50000 [l]	50000 [l]	4621 [l]	92.42
2.	Subgroup 1 (cup 0,2 l...)	Closed	On a floor without racking	Medium mechanized	200 [m²]	144 [pallet unites]	13 [pallets]	9.02
3.	Subgroup 2 (five bottles 1 l...)	Closed	On a floor without racking	Medium mechanized	200 [m²]	144 [pallet unites]	17 [pallets]	11.80
4.	Subgroup 3 Chemical	Closed	On a floor without racking	Medium mechanized	200 [m²]	144 [pallet unites]	10 [pallets]	6.94

	products ...)							
5.	Subgroup 4 (lid for cup 0,2 l...)	Closed	On a floor without racking	Medium mechanized	200 [m²]	144 [pallet unites]	3 [pallets]	2.08

Middle technological level of warehouse operations performance involve approximately the same ratio of manual and mechanized work. Based on the data from the Table 30, we can conclude that the utilization of the storage capacity for unit charged with low 29.84 [%]. Storage capacity for milk is used with even 92.42 [%].

Table 31: Technical Maintenance Storage

No.	Type of type of cargo agents	Nr pieces	Nominal capacity		Manufacturer	Year built	Annual (daily) time balance		Participation in the annual (daily) time balance [%]				
			No. value	u. m			Planed-possible working hours	Realized working hours	1	2	3	4	5

1	Hand pallet truck (Linde)	1	2	t	-	2001	2920	146	15	55	8	5	3

* Data percentage in the period of balance, on the realization of certain warehouse operations should be taken with some reserve due to limitations in data collection. It should be borne in mind that: 1-qualitatively and quantitatively load transfer, 2-shift the cargo from place of delivery to the place of storage, 3-transfer of cargo from the place of storage to the place picking, 4- move cargo within the warehouse, 5-delivery of cargo to shipping

Information transport and storage support of process for receiving the cargo:

- Information about transportation of cargo (type and amount of cargo, delivery methods, condition of the cargo, transport costs, etc.).....1, 2, 3, **4**, 5
- Information about the quantitative and qualitative receipt (type and amount of cargo, range and quality of cargo, complaints, etc.)..... 1, 2, 3, **4**, 5
- Information on the disposal and handling of cargo in the warehouse (the position of stored cargo, manner and handling charge, the degree of utilization of storage space and handling agents etc.) 1, **2**, 3, 4, 5
- Information about the commissioning, publication, packaging and shipping (preparation of goods for the issuance, packaging and packaging, shipping costs, etc.)..... 1, 2, **3**, 4, 5
- Information on stocks of goods (volume, structure, actual and average stock, safety stock, coefficient crafts, craft time, etc.) 1, 2, 3, **4**, 5
- Information on keeping, maintaining, protecting and securing of cargo (measures and solutions for maintenance of physical and chemical properties of the cargo) ... ……..…1, **2**, 3, 4, 5

- Information about the organization of work of storage service (labor, working process, the method of distribution of cargo at the warehouse, storage, etc.) ……1, **2**, 3, 4, 5

The level of information about the storage process is indicated: 1-no data, 2-partly available information manually available, 3- completely available information available manually,4-partly available information available through the AOP (Automatic Data Processing) and manually 5-fully available information carried over AOP.

Table 32 shows the time flow for selected groups of goods through the warehouse, starting from the introduction and control, storage, waiting until the issuance of the load following operation of the company.

Table 32: The average time the flow of material through the warehouse and storage costs

* Details about the flow of milk through a warehouse or cold storage tank should be taken with caution due to the limitations in collecting data. Data in the table is the framework character. A record for cost of storing milk does not exist.

Based on the data from the table we can see that the biggest timed cycle for pallet units storage is determined for material goods subgroup 4 (cover glass 0.2 l) of up to 47 [day] and the smallest pallet unit for 2 subgroups (five bottles of 1 liter) of only 3.68 [h]. If we look at storage costs they are the largest for pallet unit 4 subgroup (cover glass 0.2 l) with 2.90 [euro] and the smallest for the subgroup 2 (five bottles of 1 liter) of 0.01 [euro].

3.3.5 Storage costs

Storage costs represent costs incurred due to operation and maintenance of storage space. By talking with authorities we determined that there are no records of expenses incurred. The procedure that follows is to determine their approximate value. Storage costs will be tentatively assigned to the warehouse outside the factory (warehouse for piece goods), the reason is that the material goods that are the subject of the warehouse just at that location. From insights into existing storage costs form:

- Costs of gross wages of workers,
- Energy costs and
- Maintenance costs.

The cost of storage is determined according to the following formula:

$C_s = C_e + C_E + C_o = 0.05$ [euro per day/ m²]

(1.4)

and

C_e - Labor costs per day per square meter

C_e - (GWPI/30)/Sa = (277.03/30)/200 = 0.05 [euro/m²]

GWPI-Gross workers personal income

Number of workers = 1

Sa - Storage area, Sa = 200 [m²]

C_E - Daily energy cost per square meter $C_E = 0.001$ [euro]

C_o - Other costs are estimated on [10%] of employers cost and energy cost.

C_o = 0.01 [euro per day/m²]

On a monthly basis storage costs per square meter is 10.28 [euro]. On an annual basis the storage costs are 3749.80 [euro].

Table 33: Cost of storage per unit

No.	Name of cargo	Unit of measure	Cost of daily held inventory [euro/u. m]	Total cost of annually held inventory [euro/u. m]	The average monthly stocks of material goods[u. m]
1.	Milk	-	-	-	-
2.	Subgroup 1 (cup 0,2l)	Pallets (39960 pieces)	0.06	22.51	7
3.	Subgroup 2 (five bottle 1 l)	Pallets (720 pieces)	0.06	22.51	13
4.	Subgroup 3 (chemical product)	Pallets (400 kg)	0.06	22.51	12
5.	Subgroup 4 (cover glass 0,2l)	Pallets (230400 pieces)	0.06	22.51	7

3.3.6 The costs of owning stocks

Costs related to assets in stocks represent costs incurred due to the possession of a certain level of inventories in the reporting period. Anyone owning stocks requires certain funds that are trapped in the stocks.

Costs related to assets in stocks represent the amount of money that can be obtained when put in a savings bank.

Costs incurred by linking funds in stocks of goods shall be determined form (1.5):

$$C_i = T_{i.g} x P_{i.g} x I_{n.d}$$

(1.5)

and

$T_{i.g}$ - Total average stocks of the i-group [unite measurement – u. m.]

$P_{i.g}$ - Price of i-group of material goods [euro/ u. m.]

$I_{n.d}$ - Interest rate on non-term deposits within a year [%]

Table 34: Costs related assets in stocks

No.	Name of cargo	Unit of measure	Total average stocks of the i - group [u. m.]	Price of i-group of material goods [Euro/u. m.]	Interest rate on non-term deposits within a year [%]	Costs of holding inventory [euro/u. m]	Total cost of daily held inventory	Total cost of annually held inventory
1.	Milk	-	-	-	-	-	-	-
2.	Subgroup 1 (cup 0,2l)	Pallets (39960 pieces)	7	2865.03	3	421.57	8.08	2950.98
3.	Subgroup 2 (five bottle 1 l)	Pallets (720 pieces)	13	411.54	3	32.61	1.16	423.88
4.	Subgroup 3 (chemic-al product)	Pallets (400 kg)	12	1438.94	3	123.51	4.06	1482.11
5.	Subgroup 4 (cover glass 0,2l)	Pallets (230400 pieces)	7	7091.11	3	1043.41	20.01	7303.84

Costs related assets in stocks were the highest for a subset of products 4 (cover glass 0.2 l) with 7307.75 [euro] and the lowest for subgroup 2 (five bottles of 1 liter) with 424.11 [euro].

3.3.7 Structure of total logistics costs

Based on the analysis of individual logistics costs we can provide insight into the structure of total cost of logistics procurement for selected material goods. Based on the identification of these costs better business results and a "more comprehensive" logistical competence can be achieved, cost analysis as one of the criteria of logistics competencies achieved a high degree of implementation of logistics system in the company.

Based on the research presented in this paper the total logistics costs of procurement for the selected material goods for the reference period of one year.

The total cost of procurement logistics consist of:

- Transportation costs (C_t)
- Costs of unloading (C_{ul})
- Costs of storage (C_s)
- Costs of inventories (C_i)

The total cost of procurement logistics shall be determined form (1.6):

$$C_{\log.} = C_t + C_{u.l} + C_s + C_i \text{ [Euro]}$$

(1.6)

Table 35: Total cost of procurement logistics

No.	Name of cargo	Transportation costs [euro]	Costs of unloading [euro]	Costs of storage [euro]	Costs of inventories [euro]	Total cost of procurement logistics [euro]
1.	Milk	495446.16	3261.04	-	-	498707.20
2.	Subgroup 1 (cup 0,2l)	4185.17	29.79	157.53	2952.55	7325.04
3.	Subgroup 2 (five bottle 1 l)	886.86	279.44	292.55	424.11	1882.96
4.	Subgroup 3 (chemic-al product)	2682.80	754.45	270.05	1482.90	5190.10
5.	Subgroup 4 (cover glass 0,2l)	839.83	4.80	157.53	7307.75	8309.91

The total logistics costs of procurement are: 521415.32 [euro].

The total funds allocated for the purchase amount: 4257838.01 [euro].

The total logistics costs involved in the funds earmarked for the purchase of: 12.24 [%].

The data in Table 34 were obtained on the basis of company's business enterprises in the reference period of one year. According to data from the table it can be concluded that as the largest logistics cost are the costs of transport of material goods to be procured. The minimum logistic cost in the process of implementation of the procurement warehousing or storage and manipulation of selected material goods. Figure 23 graphically presents the relationship of logistics costs.

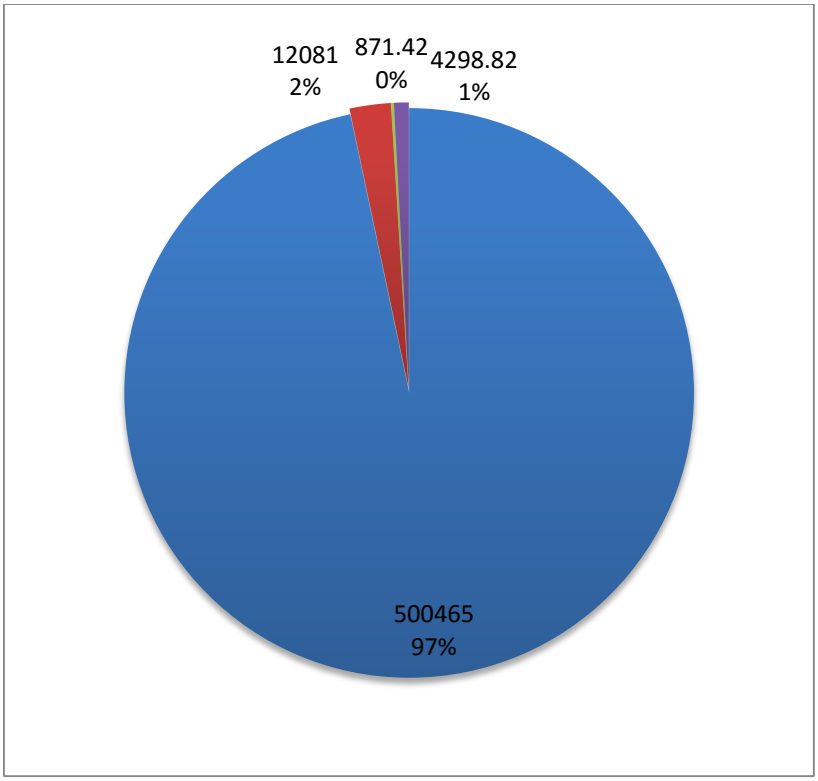


Figure 23: The graphical representation of individual logistics costs (transport-1, 2-unloading, 3-storage, 4- stock)

As previously stated, comparing the costs of logistics, we come to the conclusion that the highest percentage of expenses is for transportation at even 96.66 [%]. The relationship of logistics costs as determined was created as a result of the research.

At the start of the study we did not theorized that this relationship between logistics procurement costs but considering the activity and organizing activities within the procurement process this result is not surprising.

Within the company there isn't an adequate interest or otherwise, we can say that there isn't implemented an adequate logistical competence in the enterprise system.

The largest reserves for optimization at first glance can be found within the transportation costs. For confirmation of such claim we must perform a detailed analysis and answer these questions:

Does the introduction of its own fleet leads to a reduction in logistics costs?

To answer this question, we'll come to the end of the research. Prior to that single out all the problem points encountered while performing system analysis of the process of procurement in the company logistics.

3.4 Identification of problem points in the relevant flows of material goods

- The low level of logistics competence. We conclude that based on the classification of logistics competence in the Company X, logistics, purchasing logistics, is on a pre-Logistics level. Tasks for purchases are mostly made uncoordinated and servicing without company's orientation in the freight flows.

- Organizational scheme of business acquisition is at relatively low organizational level. The function of logistics procurement services has the status of a subordinate unit within the organizational unit (sector) production. The responsible person is an officer for the purchase.

- High cost of deployment foreign (leased) transport means for conveying the dominant raw material for the production (milk) in relation to its own car park. For its own fleet of vehicles, which are used for the delivery of milk, their cost of shipping is 0.27 [euro / Km]. The cost of the rental fleet (Companies) is 0.65 [euro/km]. It appears the difference in the cost of as much as 243 [%].

- The share of transport costs, for the supply of milk, in some cases is up to 30 [%] of the value of raw materials (cargo).

- Low capacity utilization destination warehouse for piece goods. The average utilization of Stock 29, 84 [%].

- Lack of systematic monitoring of stocks, rather it's done on a case-by-case .Automatic data processing is not used.

- The impossibility of direct access to the receiving warehouse for general cargo located within the company for road transport vehicles of large dimensions. This is due to inadequate access roads for receiving warehouses (small radius of curvature, inadequate width of roads ...).

- Destination distance of warehouse for piece goods from the company's 8 [km]. Increasing the number of manipulations with load and thus increase the cost of delivery.

- Failure to maintain accurate records of the costs of transport vehicle fleet.

- Failure to maintain accurate records of costs for stock

4. The possibility of improving the current situation in the procurement processes

Based on the facts and considerations above that are research confirmed, as well as a proposed measures to optimize procurement costs and improve the current condition, we will try to find out: can we reach the required rationalization within the transport costs?

As a possible or potential, measure of improvement we will take the opportunity of introducing company own fleet during transport or delivery of milk. Company own fleet will be introduced into service with the delivery in those places, where the dominant raw material is for the production, in which highest transport costs occurs. A possible solution for optimization is selected because within it there are potentially the largest reserves for savings, taking into account that transport costs make up 96.66 [%] of the total logistics costs of procurement.

The introduction of company own fleet and cost incurred by using the same are a complex topic, below it will be displayed and analyzed only the basic elements needed to create the necessary image for the mentioned measure and can it lead to the required solution of problems or to reduce the cost of logistics procurement in relation to the existing situation. The introduction of the fleet will be carried out gradually and in the first phase company own car park will be introduced in those directions where it appears to have higher transport costs. What the directions of delivery are will be determined using the ABC method. As a basic parameter for ABC analysis will serve appropriated funds for transportation.

After completion of the introduction of the fleet and the associated costs determined by comparative analysis it will give the answer to the previous question. Before performing the analysis it is good to provide an insight into the basic theoretical assumptions for the improvement of the current situation in the procurement processes.

4.1 The basic theoretical settings to improve the existing situation

4.1.1 Operating costs of road transport equipment (basic notes)

Transport costs as for all modes of transport as well as in road transport are the most important indicators of labor for the fleet. The basic condition is a rational use of road transport means a precise knowledge on the level of transport costs and the price per unit. The financial result of work of any fleet is influenced by many factors from exploitation, organizational, technical and technological nature.

Reducing costs is extremely important from a social point of view, and since they all influence branches of the economy it affects production costs and therefore the final price products. Meanwhile the reporting period for price of transport services is defined by the total operating costs for the execution of a unit of the transport operation.

It is customary for transport services that transportation of goods is expressed in the form of cash generated per unit of transport work (tons, liters, kg, m^3, etc...), for unit of actual transport work it's usually kilometer.

Determination of transport costs for each fleet is a complex problem, since the level of operations is affects by number of factors such as number of employees, technical equipment, composition and degree of technical fleet accuracy, vehicle quality, vehicle age structure, composition and extent of the roadworthiness of the vehicle parks, technology of vehicle maintenance, vehicle operation, expertise and training of personnel, equipment repair garage, supply materials and raw materials and spare parts, the condition of the road network, the quality of roads, weather conditions, etc.

The task of monitoring the methodology for calculating costs is reduced to finding a general and practical methods for determining the costs generated as a function of the intensity of exploitation of the fleet. Based on the analysis above, the cost of transport must be considered as a synthetic indicator that expresses the complex impact: the scope of work performed,

utilization of working time, labor productivity, utilization of road transport means, material and technical supply and a number of other factors.

Constant monitoring and analysis of the costs which initiates the possession and exploitation of the fleet is a necessity for every entity that owns a fleet because in this way can timely notice causes and ways of eliminating them, i.e. reducing transport costs.

4.1.2 Classification of costs in companies that own fleet

In the scientific literature, but in practice also there is no universal classification of costs in the exploitation of road transport vehicles. This is due to the different ways of formation expenses.

The most commonly used next distribution costs:

- Classification of costs by economic characteristics,
- Classification of costs per production features,
- Classification of costs according to the method of formation,
- Classification of costs to cost holders and
- Classification of costs according to the method of determination.

Further research will use the classification of costs per production characteristics.

The costs per production marks are divided into:

- Constant (fixed) costs and
- The variable (variable) costs.

The recurring costs are formed by time and are independent of the intensity of exploitation of road transport vehicles and the extent of such transport work. Variable costs are those costs that just depend on the intensity of exploitation and extent of such transport work and grow with the number of kilometers of vehicles.

The fixed costs include:

- Labor costs (relatively constant costs)
- Depreciation of vehicles,
- Calculated investment in vehicle maintenance,
- Fees for the use of public roads,
- Vehicle insurance costs,
- Costs of vehicle inspection,
- Interest on loans for vehicles and

- Other contractual and legal obligations.

All mentioned costs are constant for the same number of inventory vehicles.

If you change the number of vehicles than these costs are changing to. Acquisition and disposal or write-off of certain vehicles as a rule occurs after a certain period of time and then comes to the change in the number of inventory vehicles, and the reasons may be twofold, be it for the need to maintain simple reproduction fleet or for the purpose of capacity expansion or expanded reproduction.

The recurring costs of road transport have a characteristic that reduced to a transport unit of production they are so much smaller if the transport production increased. This leads to the fact that at the same total cost, the cost per unit of production decrease with increasing intensity of work and increasing the employment rate of the transport capacity of the fleet.

Variable costs change in the total sum and depend on traversed road. Variable costs are directly dependent on changes in the intensity of use of the vehicle fleet and the resulting transport work.

In the variable costs include:

- Diem staff,
- The cost of tires,
- Cost of lubricants,
- Cost of fuel,
- Parts and supplies for basic maintenance and
- Travel and other expenses.

The total cost of forming the sum or the sum total of permanent and total cost variables.

4.1.3 Assessment of the quality of road transport means

The quality of road transport is part of the overall quality in every mode of transport together with the quality of roads and transport nodes, terminal or places change mode of transport. For the purpose of assessing the quality of road transport means it is necessary to use methods qualimetrics. Qualimetrics deals with the study of new models or models during the course of construction and operation of road transport vehicles.

The technical level of road transportation means, as an element of its quality, is defined as a function of the parameters T criteria rating:

$$T = f(G, V_p, H, G, L, V, G_{p.m}, N, V_{\max})$$

(1.7)

Where:

Q - Maximum load capacity for which it paid the fare, [t];

V_p - Travel speed (exploitation) [km / h];

H - Distance transportation or autonomous movement distance [km];

G - Total mass transportation or means of transport in loaded condition [t];

L - Length road section under special conditions, for example: big ups, limits the profile of roads and the like.

V - Outer volume of the means of transport in the regime of movement, [m³];

$G_{p.m}$ -Total consumption drive and other materials (fuels, working liquids and gases, oil, grease, spare parts, components and auxiliary generators, etc., [t];

T - Total time the means of transport to the capital repair and other guarantees as an indicator of the reliability of the means of transport, [h];

N - Power engine [kW];

V_{max} - Maximum speed [km / h].

Qualimetrics of transport means for new models or models in building are based on the following criteria:

- Useful effect of the means of transport,
- Utilization of the transport operation,
- Evaluation of the technical quality of the means of transport,
- General reliability of the means of transport,
- Competitive ability and the means of transport
- Overall technical level of the means of transport.

4.1.4 Quality Management of techno- exploitation state of road transport means

Information integration in transport-level business system enables top management, among other things, to make timely business decisions which realizes the target function of the transport system. At this level subsystem technical exploitation (TE) are defined:

- Requirements necessary for levels of performance, transport capacity and availability of, or approved cost levels, and possibly workshop capacities, inventories of spare parts, frames and the like;
- Performs balancing for planned and realized value of TE subsystem performance, characteristics exploitation reliability, maintenance costs, achieved quality of means of transport, etc.:
- Undertake corrective measures.

The main activities at the level of management subsystem technical exploitation are:

- Design and development of program for preventive maintenance of vehicles of all constructional - technological exploitation group (TEG);
- Design work organization, technology, periodic repair and repair services;
- Optimization of inventory, workshops and eventual capacity of the drive.

All the necessary resources with technical and technological base are projected on the basis of information on the number of transport means, their TEG properties, operating conditions and chosen strategy of preventive maintenance and repair services. Design and development of a program for preventive maintenance is one of the most important processes. It should provide maximum application of preventive measures in the process of exploitation of transport means. With the possible need for the construction of technical maintenance and repairs, information's on the conditions of use are needed (load, travel, climatic topographic conditions and the quality of driver), the intensity of exploitation, technology maintenance and repair, and the like. It is important to note that all activities at the level of technical

exploitation must be time synchronized with the time function basic process of a whole transport system.

The activities above are based on integration of business and engineering activities, based on information support and knowledge base application (expert systems), communication and the like. At this performance level detailed planning of all tasks, comparative analysis of the planned and executed tasks on the basis of relevant information to bring corrective measures.

Indicators of quality of service, exploitation and reliability (availability, failure-free operation, convenience for maintenance and logistics support) are defined by the International Standards.

They enable reliable monitoring of the quality of the process, timely corrective measures without prejudice to the basic (transportation) process, identifying weaknesses in the process of searching for the most appropriate solutions, etc., Or continuous improvement of the process.

The main problem of the current system is that it does not have the majority of the required data, which means that no indicators are currently in use and cannot be quantified in a timely manner. This further causes late or incorrect adoption of business-management.

4.1.5 Determination of the transport path (routing)

In order to reduce transport costs often we are meet with the decisions and the problem of finding the best path for the vehicle through a network of roads, in order to minimize the distance traveled, and therefore in most cases the time required to perform transport activities.

In other words it is necessary to physically relocate some cargo hypothetically say from point A to point B through a proper network of roads at an optimal way and minimize transportation costs. At the outset it should be noted that when choosing a haul road comes to a large number of solutions from which only one, from the standpoint of transportation costs is optimal.

The simplest method of determining the transport path of the direct method or the shortest transportation times, when it comes to transportation with only one point (node) on the network and when the same starting and arrival point.

The problem arises with the collection or distribution of transport routes, then there are several nodes on the network

In such cases we encounter a large number of iterations in finding solutions. In practice, the routing code, finds a number of caps and facts, such as:

- Each stop should have a quantity which can be loaded or unloaded,
- Can we use multiple vehicles that have different permitted volumes, and weights or have a different capacity,
- It is allowed, for one the driver to operate the vehicle in a total daily duration of eight hours,
- Transshipment, loading or unloading can be done only in a certain period of time (time of day), the so-called "time window",
- Drivers are allowed to drive during the breaks for rest and
- Other limitations and assumptions.

These limits are increased efforts to find the best solution. Good solutions possible to find if the application of the principles of good routing and making timetables.

There are several methods of routing, for purposes of this study we will use a simpler method of routing. In summary will be displayed:

4.1.5.1 Method "Pendulum" (eng. The Sweep Method)

Method for determining the pendulum motion of the vehicle is simple enough that it can be performed without the use of a computer program, even when it comes to large-scale problems. If you enter it into a computer program, this method gives fast results without taking up much memory space. For different problems accuracy is projected at ten percent. This level of calculation errors may be acceptable in relation to the optimal solution, especially if you are seeking a quick and relatively good solution.

For the purposes of this survey we will be using a computer program because of the relatively small scale of the problem.

A disadvantage of this method lies in the way in which paths are formed. The process consists of two parts, with the provision that the first stopping point awarded a vehicle, and then determines the order of stopping. Because this is a two-stage model, time data, such as the total length of time and working time, has not been paid much attention.

Method pendulum can be described differently, as follows:

(1) Locate it (mark) on the map or network, including all stops and a depot.

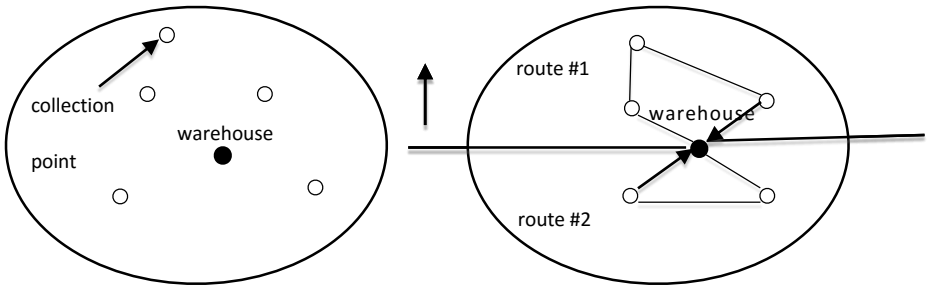
(2) Draw a straight line in any direction. The line is rotated clockwise or counterclockwise, until it encounters a stop. This raises the question: If given stop is to be entered in a path (route) the movement of vehicles, will it exceeded vehicle capacity? If the answer is no, continue with the rotation of the line until it encounters the next point of stopping.

Ask the question: Will the total amount exceed the capacity of the vehicle? First vehicles maximum capacity is used. If the answer is "Yes" terminate the last stop and define the path (route). For the rest of the process, begin a new path from the last point which is excluded from the previous trajectory.

The process continues until a routing for all transport tasks.

(3) Within each path a sequence of stops is determined to minimize the distance. In determining the order of stopping the principle of good routing is used. In Figure 24 gives a simplified graphical representation methods "pendulum".

Figure 24: Simplified graphical representation of the methods "pendulum"



4.2 Proposed measures and solutions to improve the existing situation

4.2.1 Isolation of reference directions of delivery for introduction of Company own fleet, based on costs by using ABC analysis

As mentioned in the previous sections the need for gradual introduction of the fleet is necessary on the basis of transport costs to make a selection by directions of delivery.

This will be done using the ABC analysis. Theoretical basis for the process of performing ABC analysis is given in section (3.2.1). Based on the review of the transportation costs allocated to material goods A and B class, shown in part (3.3) and examining the data assessed the cost of transport to certain areas of delivery shown in the Table 22, we can do the division into two groups:

- Group 1-Delivery of basic raw material (milk) and
- Group 2-Delivery packaging and chemical products

From the data in the Table 22 it is clear that the cost of transport for Group 2 (packaging and chemical products) several times lower than the cost of transport in Group 1 (Milk).

Taking into regard given ABC analysis of procurement within the dominant raw material for the production (dairy). Table 36 presents the price of transport for individual courses delivered milk.

Table 36: Cost of milk per directions of delivery

Name of cargo	No.	Suppliers	Transportation costs		
			Transport costs (for transport) [euro]	Transport costs (per day) [euro]	Transport costs (per year) [euro]
Raw material (milk)	1.	Farm "1"	20.14	60.43	22058.83
	2.	Farm "2"	42.47	84.96	62019.40
	3.	Farm "3"	32.18	64.36	46984.39
	4.	Farm "4"	69.51	69.51	25371.57
	5.	Farm "5"	74.66	74.66	27250.95
	6.	Farm "6"	77.23	77.23	28190.64
	7.	Farm "7"	43.77	43.77	15974.69
	8.		126.15	126.15	46044.70

		Farm “8”			
	9.	Farm “9”	38.62	38.62	14095.32
	10.	Farm “10”	95.26	95.26	34768.45
	11.	Farm “11”	51.49	51.49	18793.76
	12.	Farm “12”	25.74	25.74	9396.88
	13.	Farm “13”	82.38	82.38	30070.01
	14.	Farm “14”	64.36	64.36	23492.20
	15.	Farm “15”	38.62	38.62	14095.32
	16.		38.62	38.62	14095.32

		Farm "16"			
	17.	Farm "17"	20.60	20.60	6364.13
	18.	Farm "18"	72.09	72.09	26311.26
	19.	Farm "19"	82.38	82.38	30070.01

These data in the table represent a collection in which the analysis will be performed. It will use the data on annual price of transport. For the width of the field, ie defining the boundaries between the individual groups the following form will be used:

Width of the area = $\frac{X_{\max}}{3} = \frac{62019.40}{3} = 20673.13$ [euro]

Where: $X_{\max}$ - is maximum value of the observed size

Table 37: Boundaries between individual groups

Group mark	Participation in criterion	Boundaries between groups
A	Big (very important)	≥ 41346.27
B	Medium (important)	$20673.13 \leq X \leq 41346.27$
C	Small (important)	$0 \leq X \leq 20673.13$

Table 38 shows the classification according to the established limits for individual classes

Table 38: Sorting direction delivered in class (A, B or C) on basis of certain limits of individual classes presented in Table 37

Mark of class	No.	Participation in transport [%]					
		Group	Cumulatively	Group	Cumulatively	Group	Cumulatively
A	2, 3, 8	15,78	15,78	31,29	31,29	-	-
B	1, 4, 5, 6, 10, 13, 14, 18, 19	47,36	63,14	49,97	81,26	-	-
C	7, 9, 11, 12, 15, 16, 17	36,86	100,00	18,97	100,00	-	-

Based on the data from Table 38 ABC or Pareto diagram shall be designed

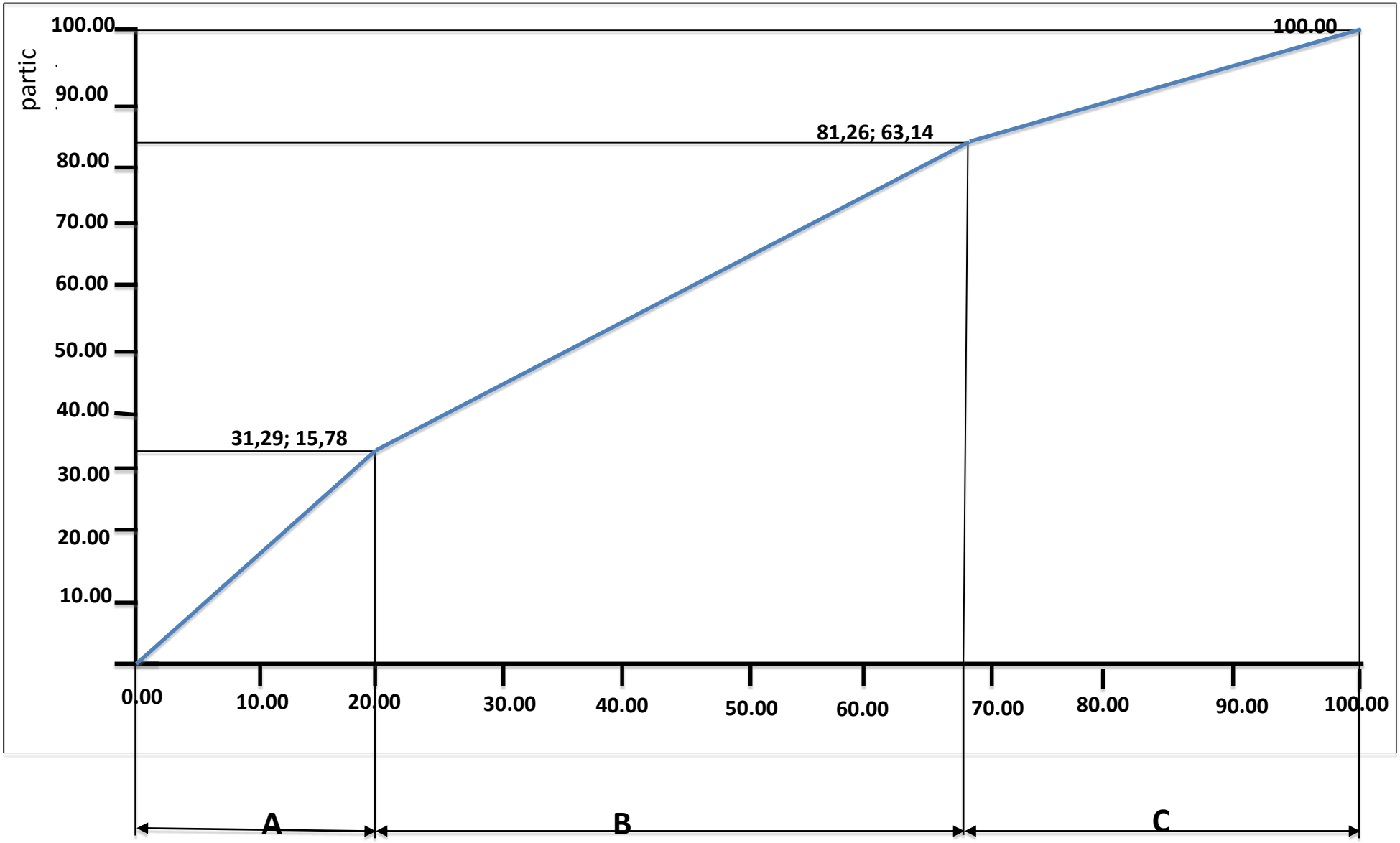


Figure 25: Pareto -ABC diagram for transportation costs for dominant raw material for production

Fixed data in Table 38 and graphically displayed diagram shown in Figure 25, allows us to reach some conclusions that are important to select delivery routes where usage of company own fleet will be implemented. Based on the data from Table 38 it can be seen that in delivery routes within the class "A" there are three elements (number 2, 3, 8 in Table 36) that range for transport participation with 15,78 [%] while their share in segregated funds for transport are 31,29 [%] and there participation is great (very important). Within the class "B" there are nine elements (number: 1,4,5,6,10,13,14,18,19) whose share are in the range of 47.36 [%] and participation in transport costs is 49, 97 [%] and their impact on transport costs are significant.

Table 39 shows the classification according to the directions of delivery based on the obtained results of ABC analysis.

Table 39: Classification according to the directions of delivery based on the results of Pareto-ABC analysis.

Mark of Class	Name (directions of delivery)	Participation in the criterion
A	Farm "2"	Big (Very important)
	Farm "3"	
	Farm "8"	
B	Farm "1"	Medium (Important)
	Farm "4"	
	Farm "5"	
	Farm "6"	
	Farm "10"	
	Farm "13"	
	Farm "18"	
	Farm "19"	
C	Farm "7"	Small (Important)
	Farm "9"	
	Farm "11"	
	Farm "12"	
	Farm "15"	

	Farm “16”	
	Farm “17”	

Based on the analysis company own car park will be introduced on routes of delivery which are located within the class A and B.

4.2.2 Sizing transport capacity

The transport capacity is dimensioned based on the amount of cargo that can be transported (Q) and the full productivity of the fleet (WQ). Table 40 presents the average daily volume which is delivered from individual places of delivery.

Table 40: Showing average daily quantity of milk delivered

No	Name of the place	Average daily amount for transport [l]
1.	Farm “1”	6285
2.	Farm “2”	4503
3.	Farm “8”	2453
4.	Farm “4”	2979
5.	Farm “5”	2581
6.	Farm “6”	2578
7.	Farm “10”	2582
8.	Farm “14”	1691
9.	Farm “18”	1048
10.	Farm “19”	1068
11.	Farm “3”	3548

Total:	31316

On a daily basis it is necessary to transport an average of 31316.00 liters.

The model used to determine the number of inventory vehicles is produced by transforming the following expression:

$$W_Q = \frac{Q_i}{24AD_i}[t/hi]$$

(1.8)

Where is:

$A_{i1} + A_{i2} + ... + A_{in} = A_i$ - Inventory number of vehicles of the same group (the same payload)

$Q_{i1} + Q_{i2} + ... + Q_{in} = Q_i$ - - quantity of transported cargo from the same group of vehicles

$D_{i1} + D_{i2} + ... + D_{in} = D_i$ -the observed period of time (inventory days for units of fleet)

Replacing the previous express and rearranging follows:

$$A_{iQ} = \frac{Q}{24D_iW_q}$$ [Vehicle]

(1.9)

A_{iQ}

- Inventory number of vehicles calculated on the basis of full productivity

The required amount of load known to transport (Q) in the reporting period (d) the transport requirements can be considered constant in this case is:

$$C_1 = \frac{Q}{D_i} = const.$$

Q=31316 [l]; D_i =1 [day]; C_1 =31316 [l]; W_q =2600 [l]

$$A_{iQ} = \frac{C_1}{W_q} = 12,04 \approx 13 \quad \text{[Vehicle]}$$

(1.10)

Vehicle number calculated on the basis of transport requirements (C1) and the ability of the transport fleet (W_q) represents the average inventory fleet in the period. The required number of vehicles working is allotted by defined condition that during the day all technically correct vehicles are at work. In that case the coefficient of utilization of the fleet is α '= 1 , $\alpha = \alpha' \alpha_t = \alpha_t \; H_f = H_w + H_d = 1,57 + 2 = 3,57[h]$ (α_t - average value of the quotient technical accuracy in the reporting period) as the working day coefficient of utilization $(\alpha)\alpha = \frac{A_r}{A_i}$ of the fleet by replacing α_t in transient expression obtained in connection required number of vehicles in operation (ARQ) with the inventory fleet (AIQ).

The general expression for the calculation of inventory fleet and the average number of vehicles in operation depending on the exploitation measurers were obtained by substituting the expression for the full and labor productivity.

$$A_{iQ} = \frac{QKst\lambda}{24 D_i \alpha\varphi\rho\delta\beta V_s} \quad \text{[Vehicle]}$$

(1.11)

$$A_{rQ} = \frac{QKst\lambda}{24 D_i \alpha\varphi\rho\delta\beta V_s} \alpha_t \quad \text{[Vehicle]}$$

(1.12)

Where is:

$Kst\lambda$ - A middle-length drive with cargo

φ - weight characteristics for the total volume of goods transported

ρ -coefficient utilization time during 24 h

δ -coefficient utilization of working time

β - Coefficient of utilization route

V_s - Traffic speed vehicles

Forms (1.11) and (1.12) can be considered as starting, since the coefficient of work time is expressed in a basic form, rather than depending on exploitation measurers fleet.

4.2.3 Determination of the transport times – Routing

Based on theoretical assumptions presented in section (4.1.5.1) and dimensioning of transport capacity on the basis of the form (1.10) we conduct a procedure for determining the routes of each vehicle from company fleet.

It should be emphasized that this is the basis for determining the number of vehicles required to perform transport tasks. The final number of vehicles needed for the transport will come along exploitation performance indicators fleet.

When routing we should take into account the real constraints in transporting the milk. And in terms of the capacity of vehicles (each vehicle has two metal tank capacity of one thousand and three hundred liters) and delivery technology. Any quantity of milk that is loaded in the transport unit (metal tank) must be from the same manufacturer (because laboratory testing on admission of the milk in company).

4.2.4 Sequencing driving and exploitation parameters of a vehicle fleet

Paths (itineraries) obtained using the method for determining the haul road, described above, represent the path of motion that is assigned to a particular vehicle. If the travel time is relatively short, it is possible that the vehicle was not used for rest of the working hours.

In practice, if one ride starts after the previous completed, the vehicle is available for the execution of a new transportation task. When determining the sequence of driving, but on certain routes, it was taken into account that:

- Transport vehicle speed Vs = 45 km / h,
- Time demurrage per craft Hd = 2 h (during loading and unloading, during flushing cisterns water, during breaks, etc.)
- All transport tasks must be carried up to 15 h (time window)
- Must respect legal duration of driving a motor vehicle.

Based on the assumptions given in Table 41 it is establish that for the pursuit of transport tasks with the existing two vehicles is require to provide six new vehicles.

Table 41: Schematic representation of driving order

Vehicle	Working hours of the fleet [h] (working hours of vehicle) 7 8 9 10 11 12 13 14 15
Vehicle -1-	Rout -1-
Vehicle -2-	Rout -2- Rout -3-
Vehicle -3-	Rout -3- Rout -4-
Vehicle -4-	Rout -5- Rout -5-
Vehicle -5-	Rout -6- Rout -7-
Vehicle -6-	Rout -8- Rout -8-
Vehicle -7-	Rout -8- Rout -11-
Vehicle -8-	Rout -9- Rout -10-

Below in the paper there will be presented an itinerary of driving on selected routes and exploitation measurers for fleet work. All data presented are related to the operation of the fleet within one working day.

Route 1

(Garage – Farm "18" – Depot) Transport time, while driving gradual loading of goods in Farm "18" and Farm "3" and unloading at the depot in the company. The number of driving Z λ =1.

$$H_f = H_w + H_d = 1,57 + 2 = 3,57[h]$$

$$K = K_o + K_{t1} + K_{t2} = 28 + 18 + 25 = 71[km]$$

Where is:

H_f

- Work hours on the route

H_w -Driving hours

$$H_w = \frac{K}{V_s} = \frac{71}{45} = 1,57$$

$$T_g = AK * C_{g1} * \frac{N_{g1}}{V_{g1}} + AK * C_{g2} * \frac{N_{g2}}{V_{g2}} = 61135.65\ [euro]$$ -

K - Complete time on the route

K_o - Null path traveled (path from the garage to the first place of loading)

K_t - Path traveled with cargo

$$K = K_o + K_{t1} + K_{t2} = 28 + 18 + 25 = 71[km]$$

$$\gamma = \frac{q}{q_{\max}} = \frac{2348}{2600} = 0,903$$

γ

- Coefficient of capacity utilization

$$\beta = \frac{K_t}{K} = \frac{43}{71} = 0,605$$

β

- Coefficient of utilization of routes

Route 2

(Garage – Farm "3" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "3". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 1,11 + 2 = 3,11[h]$$

$$K = K_o + K_{t1} = 25 + 25 = 50[km]$$

$$\gamma = \frac{q}{q_{\max}} = \frac{2248}{2600} = 0,864$$

$$\beta = \frac{K_t}{K} = \frac{25}{50} = 0,500$$

Route3

(Garage – Farm "2" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "2". The number of driving Z λ= 2.

$$H_f = H_w + H_d = 1,46 + 2 = 3,46[h]$$

$$K = K_o + K_{t1} = 33 + 33 = 66[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2600}{2600} = 1$$

$$\gamma_2 = \frac{q}{q_{\max}} = \frac{1903}{2600} = 0,731$$

$$\beta = \frac{K_t}{K} = \frac{33}{66} = 0,500$$

Route 4

(Garage – Farm "14" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "14". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 1,11 + 2 = 3,11[h]$$

$$K = K_o + K_{t1} = 25 + 25 = 50[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{1691}{2600} = 0,650$$

$$\beta = \frac{K_t}{K} = \frac{25}{50} = 0,500$$

Route 5

(Garage – Farm "4" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "4". The number of driving Z λ= 2.

$$H_f = H_w + H_d = 1,2 + 2 = 3,2[h]$$

$$K = K_o + K_{t1} = 27 + 27 = 54[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2600}{2600} = 1$$

$$\gamma_2 = \frac{q}{q_{\max}} = \frac{379}{2600} = 0,145$$

$$\beta = \frac{K_t}{K} = \frac{27}{54} = 0,500$$

Route 6

(Garage – Farm "6" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "6". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 1,33 + 2 = 3,33[h]$$

$$K = K_o + K_{t1} = 30 + 30 = 60[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2578}{2600} = 0,991$$

$$\beta = \frac{K_t}{K} = \frac{30}{60} = 0,500$$

Route 7

(Garage – Farm "19" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "19". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 1,42 + 2 = 3,42[h]$$

$$K = K_o + K_{t1} = 32 + 32 = 64[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{1068}{2600} = 0,410$$

$$\beta = \frac{K_t}{K} = \frac{32}{64} = 0,500$$

Route 8

(Garage – Farm "1" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "1". The number of driving Z λ= 3.

$$H_f = H_w + H_d = 1,68 + 2 = 3,68[h]$$

$$K = K_o + K_{t1} = 32 + 32 = 64[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2600}{2600} = 1$$

$$\gamma_2 = \frac{q}{q_{\max}} = \frac{2600}{2600} = 1$$

$$\gamma_3 = \frac{q}{q_{\max}} = \frac{1085}{2600} = 0,417$$

$$\beta = \frac{K_t}{K} = \frac{32}{64} = 0,500$$

Route 9

(Garage – Farm "8" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "8". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 2,17 + 2 = 4,17[h]$$

$$K = K_o + K_{t1} = 49 + 49 = 98[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2453}{2600} = 0,943$$

$$\beta = \frac{K_t}{K} = \frac{49}{98} = 0,500$$

Route 10

(Garage – Farm "8" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "5". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 1,28 + 2 = 3,28[h]$$

$$K = K_o + K_{t1} = 29 + 29 = 58[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2581}{2600} = 0,992$$

$$\beta = \frac{K_t}{K} = \frac{29}{58} = 0,500$$

Route 11

(Garage – Farm "10" – Depot) Transport time: Repeating with an empty drive, shipping goods in Farm "10". The number of driving Z λ= 1.

$$H_f = H_w + H_d = 1,28 + 2 = 3,28[h]$$

$$K = K_o + K_{t1} = 37 + 37 = 74[km]$$

$$\gamma_1 = \frac{q}{q_{\max}} = \frac{2582}{2600} = 0,993$$

$$\beta = \frac{K_t}{K} = \frac{37}{74} = 0,500$$

From an established measure the work fleet we can determine the following:

$$K_{st\chi} = \frac{AK_t}{AZ_\lambda} = \frac{18 + 25 + 25 + 33 + 25 + 27 + 30 + 32 + 38 + 49 + 29 + 37}{15} = 22,72[km]$$

$K_{st\chi}$

- The mean length of driving with a load

AK_t - The number of driving with cargo fleet

AZ_λ - The number of kilometers with cargo fleet

$t_{d\chi} = 2[h]$

$t_{d\chi}$ - Time losses realized by driving with load

$q = 2,6[t]$

q - Useful payload

$$\varepsilon = \frac{\sum_1^{Z\lambda}(q\lambda Kt\lambda)i}{q\sum_1^{Z\lambda} Kt\lambda i} = \frac{1022,777}{1310,4} = 0,780$$

ε - Coefficient of dynamic utilization of payload

$Kt\lambda$ - Distance traveled freight vehicles in certain rides

$q\lambda$ - The quantity of cargo transported in individual rides

$Z\lambda$ - Number of driving with a load in the reporting period

$$\gamma = \frac{Q}{qAz\lambda} = \frac{31,316}{39} = 0,802$$

γ - Coefficient of static load capacity utilization of fleet

Q - The total amount of transported cargo

$$\beta = \frac{AKt}{AK} = \frac{504}{965} = 0,522$$

β - The coefficients of utilization of the transport fleet

AKt - Kilometers with cargo of the fleet

AK - Total kilometers covered by the fleet

From certain measured work fleet we can get the value of work productivity clearly:

-Working productivity expressed through realized transport work:

$$W_u^{'} = \frac{\varepsilon q}{\frac{1}{\beta Vs} + \frac{td\lambda}{Kst\lambda}} = \frac{2,028}{0,129} = 15,720[\frac{tkm}{hr}]$$

-Work productivity depending on the amount of goods transported:

$$W_u^{'} = \frac{\gamma q}{\frac{Kst\lambda}{\beta Vs} + td\lambda} = \frac{2,085}{45,544} = 0,045[\frac{t}{hr}]$$

In the organizational part of work of the fleet it is necessary to establish traffic, dispatching service and preventive maintenance service.

4.3 Costs of fleet

It should be noted that the determination of the cost of labor for the fleet is very complex endeavor. In continuation of work certain basic costs of operation of the fleet in accordance with the theoretical principles outlined in section (4.1.2) and taking into account the limitations in data collection. The cost of purchasing new vehicles based on the above analysis , was found that for the purposes of execution of transport tasks in transporting the milk it is needed to procure six new trucks with superstructure for transport of raw milk tanks with capacities of 2600 [l], i.e, two tanks on one vehicle of 1300 [l]. The choice fell on domestic producers of "Zastava Trucks" due to the load on the vehicle EUROZETA 85.14

The purchase price of a vehicle: 39754.20 [euro],

The costs of purchase of six vehicles using bank loans to domestic vehicles: 274330.04 [euro]

Depreciation expense of vehicle: 274330.04 [euro]

The cost of vehicle insurance: 14690.41 [euro]

The cost of vehicle inspection 2666.14 [euro]

The cost of vehicle registration -fond for environmental protection: 5949.48 [euro]

The cost of vehicle registration - public roads: 286.61 [euro].

The cost of vehicle registration - utility fee: 1199.76 [euro]

Cost of registration of the vehicle - an administrative fee: 1866.29 [euro]

First registration vehicles registration label: 20.00 [euro]

First registration Vehicle-traffic permit: 79.98 [euro]

First registration Vehicle-traffic table: 133.31 [euro]

Estimating the cost of fuel:

$$P_{year} = \frac{AkpPp + AKtPt}{100} = \frac{168265*18 + 183960*20}{100} = 67078,7[l]$$

P_{year} - The annual consumption of fuel for that brand vehicles

Akp -Total annual distance traveled number kilometers without load

Pp -Average fuel consumption for miles and miles without cargo

AKt -Total number of annual spun kilometer with cargo

Pt - Average fuel consumption for kilometers without cargo

Yearly costs for fuel:

$$\nu_{year} = P_{year} * C_f = 558.88*1.12 = 625,95$$

ν_{year} Yearly costs for fuel

P_{year} Yearly consumption of fuel

C_f Price of fuel

Costs for fuel for 20 years:

$\nu_{20\,year}$ = 1507874.93 [euro]

Cost of Non-freezing oil and engine coolant:

Volume crankcase (motor housing): 10 [l],

The volume of the cooling system capacity: 12 [l],

Oil change interval: 10000 km,

Distance traveled mileage per vehicle inventory for the year: 44028.125 [km]

The cost of oil for a period of one year: 1293.08 [euro]

The cost of oil for a period of 20 years: 25864.85 [euro]

Replacement interval Non-freezing liquid in the cooling system 1 year. ,

Cost of Non-freezing liquid cooling engine period of 20 years: 2355.21 [euro]

The cost of tires:

Interval replacement tires on the front axle: 40000 [km]

Interval replacement tires on the rear axle: 60000 [km]

Price tires on the front axle: 182.00 [euro]

Number of car tires on the front axle (for the whole fleet): 16 [pcs.]

Price tires on the rear axle: 188.95 [euro]

Number of car tires on the rear axle (for the whole fleet): 32 [pcs.]

The cost of tires, for a period of one year, calculated according to the following formula:

$$T_g = AK * C_{g1} * \frac{N_{g1}}{V_{g1}} + AK * C_{g2} * \frac{N_{g2}}{V_{g2}} = 61135.65\ [euro]$$

T_g

-The cost of tires for a period of one year

C_{g1} - Cost of tires

N_{g1} -Number of tiers in front of the vehicle

V_{g1} -Longevity of tiers in front of the vehicle

C_{g2} -Cost of tires

N_{g2} -Number of tiers in back of the vehicle

V_{g2} -Longevity of tiers in back of the vehicle

Labor costs:

Number of working days per year: 365 (truck crew) and 261 (for other employees).

The number of required workers in the framework of the traffic and dispatching service: 2

The number of required workers within the service preventive maintenance: 1

The number of workers needed at the site of drivers: 12

Issuance of gross personal income for a year for workforce: 4499.10 [euro]

Issuance of gross personal income for a period of years for workforce: 67486.56 [euro]

Issuance of gross personal income for a period of 20 years for workforce: 1349731.18 [euro]

Cost of repairs and the conducting industrial overhaul: 91351.90 [euro]

Total cost of fleet: 4775443.12 [euro]

Total cost of the fleet annually: 238772.15 [euro]

5. Concluding Remarks

Bearing in mind that in a market economy a great competitive "game" takes place to reach out to the customer, which is important to finalize those actions that preceded so that an item produced at the right time is made available, but at the right price and adequate quality. Particularly important is the optimization of the company business. In order to evaluate overall performance, both in terms of organization and in economics of the company a special area for optimization offers exactly the area "Logistics ", which is being studied at the University for Business and Technology, Prishtine.

Possibility, which provides us with logistics, through certain scientific methods and primarily through systematic consideration of connections and relationships in spatial - temporal transformation of material goods from suppliers to users of a particular product we used to primarily:

- Comprehend the whole process of procurement of material goods necessary for the functioning of the company;
- Make a selection on what material goods should be noted (based on selected criteria);
- Record the process of spatial - temporal transformation of material goods from the supplier to the manufacturing process and the associated information with them;
- Established through which instances of the company that process takes place;
- Determine responsibility and responsibilities of entities involved in the activity;
- Determine the costs generated by material goods in spatial – temporal transformation of the entire procurement system;
- Make a selection of the dominant group of material goods (on the basis of specific criteria);
- Determined in detail the costs and expenses are incurred places for the observed dominant group;
- Critically analyze the current situation;
- Singled problematic points observed during the study;

- Make a selection of problem points as a place of potential reserves for optimization;
- Select a specific area within the logistics costs where they will attempt to execute the optimization;
- Give a theoretical "way" to improve the existing situation;
- Perform the improvement of the current situation and
- Gave final opinion and show the comparison of the current and the improved condition.

5.1 Assessment of the entire research

The complete survey of the procurement process of goods, for the functioning needs of Company X, was performed on the basis already determined, steps that are shown in the previous section. This approach has enabled a comprehensive and detailed view of the logistical costs for the selected dominant group of material goods (packaging and chemical products) and the dominant raw material for the production (dairy).

It was found that transport costs involved predominantly in the structure of logistics costs and joined the search for measures to improve the current situation. As a measure that was assumed to give the expected rationalization process inbound logistics is introducing company own fleet of delivery of raw milk from farms, which are located in the region around their headquarters.

After ABC analysis is conducted for the purpose of gradual introduction of company own fleet, in those directions where delivery is generating the highest transport costs and determine the costs that would occur during the formation and operation of company own fleet for a period of twenty years has led to the following conclusions:

- Distinguished funds to transport milk by someone else (leased) fleet annually: 403465.58 [euro]
- Distinguished funds to transport milk using company own fleet at annual level: 238772.15 [euro].

The difference in segregated funds before and after implementation of the proposed measures, on an annual basis, is 164693.42 [euro] or 40.81 [%]. The total logistics costs before the intervention were: 521415.32 [euro], and then after the intervention they are:

356721.89 [euro], representing a decrease of 31.59 [%].

It may be noted that it has been the rationalization process for transport of milk, and therefore the entire process of procurement logistics companies.

5.2 Directions for further research

Directions for further research are:

- Monitoring and analysis of the cost of ownership and exploitation of companys own fleet,
- Giving of proposals for possible correction during the mining fleet and
- Increasing the level of logistics competence
- Introduction of quality indicators of logistics and monitoring and analyzing and taking corrective measures, namely:

Logistics procurement:

- retention time on exit of goods
- the percentage of bad delivery
- the percentage of complaints
- percentage of rejected delivery
- percentage of deferred delivery

Transportation and material flows:

- Quality of transport services and the percentage of realized transport tasks
- Timely accuracy of delivery
- Frequency of damage

Storage and order commissioning:

- The percentage of error in commissioning goods
- Warehouse service quality and the percentage of executed tasks and
- Inventory turnover

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*FOOTNOTE:

Information in this Master Thesis was provided from the owner of the analyzed Company X, who asked that His name, His Company name and names of his suppliers not to be disclosed.