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WAREHOUSE LOGISTICS

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This research is a review of warehouse logistics on the example of Kannustalo Oy, located in Kannus, Western region of Finland. Kannustalo is an international company of designing, manufacturing and assembling block and turn-key houses.

The research subject is logistics process in warehouse system of industrial company. In my work I discussed about theoretical aspect of logistics, logistic functions and processes. Later I considered warehouse as a part of logistics system and provided information about logistics process in the warehouse. By implementation of ABC-analyze, I analyzed the storage system in Kannustalo Oy.

As the result of the research, the suggested solutions were prepared for improving quality of warehouse system in Kannustalo.

CONTENTS

INTRODUCTION

Logistics is the science of planning, directing and controlling the movement of material and information flows in the space and time from its original source to the final consumer. Logistics has deep historical roots, but it is still a relatively young science. Rapid development it received during the Second World War, when it was used to solve the strategic problems and clear communication of the defense industry procurement facilities and transport in order to ensure timely delivery of army weapons, fuel and food. In the economy the beginning of widespread use of logistics is in 1960-1970s due to the development of communication technologies. Better communication technologies gave ability to follow all stages of movement of raw materials, semi-ready parts and ready products. It provides to see clearly huge losses which happen during using of traditional method of material management. Conclusion can be made that logistics has been known, and it has been used long time, but nevertheless it is the scientific and educational discipline of the 21st century. Domestic logistics is still in its development stage in the market economy.

Due to fast development of logistics the question about logistics in general and logistics in warehouse is relevant. In the research attention is paid to logistics as a system, to the role of warehouse and to the storage system. In Chapter 1 and Chapter 2 functions and properties of logistics are discussed. In Chapter 3 concept of material flow and inventory management is given. In addition there is a model of inventory control of distribution. Role of warehouse, their types and functions are presented in Chapter 4. In Chapter 5 discussed themes are storage system and material handling on the example of house designing and building company Kannustalo.

1. THE FUNCTIONS OF LOGISTICS

1.1 Logistics operations and functions

Logistics operation is any action within the set objectives of study or management associated with the appearing, transformation or absorption material and accompanying flows (information, financial, service). Logistics operations include activities such as loading, unloading, bagging, transfer from one mode of transport to another, sorting, labeling, etc. Logistics operations associated with the concomitant information and financial flows can be collection, storage and transmission of information to material flow, payment to suppliers by buyers of goods, cargo insurance, etc. Logistics functions are a detached set of logistic operations aimed at implementing and assigned to the logistics system and its functioning tasks. One of the main tasks of logistics is improving merchandise management, the establishment of an effective system and control of material and information flows. (Lu D 2011.)

There are two types of logistical functions:

1. Operational function relates to the direct control of material assets movement in the field of supply, production and distribution.
2. Coordination is identification and analysis of the need of material resources between different production phases; market analysis and forecasting of potential markets; data processing demands and consumers' needs. (Lu D. 2011.)

The object of logistical studies is material, financial and information flows processes of economic activities. Logistics contributes, the effectiveness of the company to the following requirements:

- Support of connection between logistics and strategy;
- Improvement of material flows movement in the organization;
- Receipt of the necessary information and its processing;
- Effective human resources management;
- Careful development of logistical operation; etc. (Nerush 2006, 23-25.)

Lack of attention to the management of logistics activities in the enterprise reduces the effectiveness of the financial and economic activity of the enterprise, and in some cases it can lead to bankruptcy of firms, because expenses of income material flows form the expenses' structure of organizations. Venture for the organization's primary Business activity requires the placement of inventory, raw materials and resources needed for the smooth production process, trade and supply activities, as well as semi-finished products in order to provide needed inventory for the enterprise inventory. That is why it is important how company establishes warehousing, fitted and equipped buildings, structures, specialized facilities, devices for receiving, loading, storage of good. Inventory depends on the quality, product specifications, safety and completeness of inventory. (Walther L. M. 2009, 16-17.)

1.2 A list of major logistics functions

Each of these functions is a fairly homogeneous (in terms of reason of using) set of actions are interrelated and they are aimed at management of material flows. Supports of the functions are the subjects involved in the logistics process.

The list of functions:

- Creation of economic ties to the supply of goods or providing of services, their development, updating and streamlining.
- Determination of the amount and direction of material flow.
- Forecasts of assessment of the transportation needs.
- Determination sequence of goods movement through storage areas.
- Development, deployment and organization of storage facilities.
- Inventory management.
- Implementation of transportation, as well as all necessary operations in transit of goods to their destinations.
- Perform of operations proceeding and trailing carriage of goods.
- Management of warehouse operations. (Learn Logistics 2009.)

The indicator of good implementation of logistics functions is achievement of the ultimate goal of logistics activities, expressed the Six rules of logistics.

1. Product- the right product.

2. Quality - the required quality.

3. The number of - in the required amounts.

4. Time - to be delivered at the right time.

5. Place - at the right place.

6. Costs - with minimal costs.

The purpose of logistics activities is considered achieved if these six conditions are met. The desired product quality, in the required quantity delivered at the right time in the right place at minimal cost. (Learn Logistics 2009.)

2 LOGISTIC SYSTEMS

The concept of logistics system is one of the basic concepts of logistics. Movement of material flows are performed by trained staff with using different techniques: transportation, loading and unloading devices, etc. Various buildings and structures are involved in the logistics process; the process depends strongly on the level of preparedness of moving products for it and periodically accumulated goods in stocks. Logistics solves the problem of creating harmonious, coordinated logistics systems, with the given parameters of material flows at the output. Logistics system is a complex of organized and completed economic system. The complex is composed of elements-units (subsystems), interconnected in single process control and related material flows. (Mulcahy 1993.)

2.1 Properties of logistics systems

The first property: the system has an integrated set of logistical elements that interact with each other. At the macro level, it is the passage of material flow from one company to another. These enterprises can be considered as the elements, as well as connecting them transport. Micro level of logistics can be represented by the following subsystems: Purchase is a subsystem, which provides coming in of material flow into logistics subsystem. Production planning and control receive the material flow from the subsystem procurement and manages them in the process of performing operations that make the object of labor in the product of labor. Sale is a subsystem, which provides outflow of material flow logistics system. (Gadzdinskii 2005, 52-53.)

The second property: there is a substantial connection to a legitimate need to define the integrative quality between the elements of the logistics system. In macro logistical system communication base between elements is a contract. In micro logistical systems elements are related by industrial relations. The third property: the links between elements of logistics system are in a certain order, ie, logistics system is the organization. The fourth property: logistics system has integrative qualities, not peculiar to any deliver the goods at the right

time in the right place, with required quality, with minimal cost, and ability to adapt to changing environmental conditions.(Gadzdinskii 2005, 54-58.)

Macro logistical system is a large material flow of management system that covers industrial enterprises and organizations, intermediary, trade and transport organizations of various departments located in different regions of the country or in different countries. It represents a certain infrastructure of economy of the region, country or group of countries. Creation of macro logistical systems in interstate programs requires the establishment of common economic space, a single market without internal frontiers, customs barriers for transportation of goods, capitals, information and labor resources. Micro logistical systems are subsystems and structural components of macro logistical systems. They are items of internal production of logistics systems, which include technologically related production, combined a single infrastructure. Links between micro logistical systems are set on the basis of commodity-money relations. (Keller International Publishing Corp 2014-2015.)

2.2 Types of logistics systems

There are three types of logistics systems:

- Logistics systems with direct links. Material flow passes directly from the manufacturer of products to its consumers, without intermediaries.
- Echelon logistics systems. In such systems, the way of cash flow has at least one mediator.
- Flexible logistics systems. Material flow from the manufacturer of product to the final consumers may be carried out both directly and through intermediaries. (Ivanov 2006.)

The main object of the analysis of an integrated logistics system is its logistics cycle- an intergraded set of functional time cycles. The structure of the logistics cycle is the following components:

- Cycle of order
- Cycle of creation (or maintenance) of stock;

- Cycle of processing of customer orders;

- Cycle of procurement and placement of orders;

- Production cycle;

- The acquisition cycle customer orders and documentation;

- Cycle of analysis and reporting. (Ivanov 2006.)

Logistical systems with the principle "just in time" are pulling systems in which the placement of orders of replenishment of material resources or finished products occurs when a number of certain links of the logistics system reaches a critical level. Concept RP "resource planning" often contradicts the concept of "just in time" because system is based on "push" type. Such systems are characterized by the production of parts, components, semi-finished products and assembly of these finished products.

3. MATERIAL FLOWS AND LOGISTICS OPERATIONS

3.1 The concept of material flow

Material flow is loads, parts, inventory items considered in the process of their use in various logistics operations and related to the time interval. Material flow can occur between different companied or within a single enterprise. Along the way, the movement of goods includes various operations: unloading, palletizing, moving, unpacking, packing for storage, etc. All of it is logistics operations. The scope of work for a particular operation, calculated for a certain period of time (month/year), is a material flow for the transaction. For example, the material flow for the unloading of wagons and stacking goods on pallets for wholesalers warehouse area (5 000 sq.m.) is 4383 tons/year. Let's suppose that the cost of performing an operation on the warehouse is accurately known and general storage costs can be represented as the sum of costs of performing certain operations. Then, if the route of material flow is changed inside of warehouse, costs can be minimized. (Gadzdinskii 2005.)

Inventory costs can be reduced by transportation of goods from storing area to loading area immediately. This means abandoning the selection range in the area of integration, as well as the refusal to deliver goods to customers (operations-departure of the expedition). However, refusing to provide services, the company is losing niche in market; it is accompanied by economic losses. Search of acceptable compromise is possible only if the adjusted system of accounting. It allows generate information about the most significant costs incurred in the implementation of logistics operations, as well as the nature of the interaction of these costs to each other. (Gadzdinskii 2005.)

In warehouses of wholesaler material flows are calculated, as a rule, for individual parts. For this sum the amount of work on all logistics operations is carried out in the area. The total material flow for the entire wholesale trade is determined by summing of material flows occurring in some areas.

Concerning relations to the material flow logistics systems can be:

- External – flows in the external environment for the enterprise. This is not any good moving outside the enterprise, and those to whom the company has relationships;

- Internal – formed as a result of logistical operations with goods within the logistics systems;
- Input- enters the logistics system from the external environment.
- Output- comes from the logistics system to the external environment. (Learn logistics, 2009.)

By natural composition material flows are divided into monoproduct and multiproduct. This separation is necessary because composition range of the flow significantly affects to the work with it. For example, the logistics process in wholesale food market, which sells meat, fish, vegetables, fruits will be different from the logistics process of potato storage, which works with only one shipping name. By quantity variables material flows are massive, large, medium and small.

Massive flow is a flow arising in the process of transportation not by single vehicle, but by their group, for instance, a train, a column of trucks or fairies.

Large flow is carried by several train car or few cars. Medium flows occupy the space between the large and small. These include streams that form the freight coming a single car or cars. Small streams form a number of goods that do not allow full use of the capacity of vehicles during carriage and combined with other goods. (Walter 2003, 166-173.)

3.2 Inventory management and costs in logistics systems

Inventory management has a serious impact on the activity of the enterprise in general. On the one hand, the shortage of raw materials or finished products can lead to large losses in the production or loss of market share. On the other hand, a glut of inventory in warehouse leads to obsolescence, deterioration and ineffective investment of working capital. Transportation costs are the cost of performing logistics operations. Costs to perform logistics operations include in part of distribution costs and part of the production. The main components of logistics costs are: transportation and procurement costs, the costs of maintaining of stocks. With the growth of the quality of the results of the logistics system to certain level logistics costs increase linearly, then exponentially. (Porter 2011, 57-58.)

Specificity of accounting expenses in logistics is the sum of all costs associated with the implementation process. Effective method of materials management is the analysis of total cost. Analysis of the total cost means taking into account all the economic changes arising from any changes in the logistics system. Applying of this method is the identification of all costs in the logistics system and regrouping of them, which will reduce the total cost. Using of total cost method implies the possibility of varying the price during looking for solution. Figuratively idea of the method can be represented as an iceberg. The part above water is clearly visible price solution. The total mass of the iceberg is the full costs associated with the solution. The decision made without regard to the underwater part of the iceberg is wrong. (Walther 2009, 17-22.)

When the scope of work with the material flow is changed because of variation of cost, these expenses are divided into fixed and variable. Direct costs are expenses directly related to the object of cost (content of the provision of equipment, labor power). Variable costs are expenses which can be controlled at the level of responsibility center. Fixed costs are costs cannot be influenced (regulated at the level of the company as a whole). Depending on the type of the logistic functions costs are divided into transport cost, storage costs and others. (Walther, 18.)

3.3 The nature and role of inventories in logistics

Inventories are tangible assets which takes place at a certain time in the certain place. Material flow in the path of the primary source of raw materials to the final consumer can accumulate in the form of stock by any stretch. Creation of stock is always followed by expenses. The main costs associated with the creation and maintenance of a stock are:

- Frozen funds;
- The costs of the specially equipped premises;
- Payment to special personnel;
- Constant risk of damage, theft. (Waters 2003, 251-252.)

Availability of stock means also costs. However, the absence of reserves is a cost expressed in the form of variety of losses. The main types of losses associated with the absence of reserves include:

- Losses from business interruption;
- Losses from the lack of goods in stock at the time of submission of the demand;
- Losses from the purchase of small quantities of goods at higher prices, and others. (Ivanov 2006.)

Efficient inventory management ensures smooth production and trading process at the minimum cost of maintaining inventory. The main motivation of entrepreneurs to create reserve is:

- The possibility of fluctuations in demand. The demand for goods is subject to fluctuations that are not always possible to predict accurately.
- Discounts for purchasing large quantities of goods.
- Speculation. The price of some goods may be markedly increased. The company, which has been able to anticipate this growth, creates a reserve for the purpose of generating a profit from changes on market prices.
- Reduction of costs associated with the placement of the order and delivery. The process of registration and delivery of each new order is accompanied by a number of costs; administrative costs associated with the search for supplier, negotiating with supplier, travel, long-distance call, etc. These costs can be reduced by the number or orders, which is equivalent to an increase in sufficient quantities and increase the size of the reserve.
- The probability of violation of delivery schedule. In this case, the stock is needed for non-stop the trading process, which is especially important for products that play a significant role in shaping the company's profit. In production processes, unplanned stop is the most dangerous for companies with continuous production cycle.
- The possibility of uniform operations of production and distribution. These two activities are closely linked; distributed what is produced. In the absence of inventory of material flow rate in the distribution system varies in accordance with changes in the intensity of production, Availability inventory distribution system allows implementation process more uniformly, regardless of the situation in production.

Availability of stocks of raw materials and semi-finished products provides uniformity of production process.

- The possibility of immediate customer service. The latter method is the most expensive, because it requires maintenance of a stock. However, in a competitive opportunity to order immediate gratification can be decisive in the fight for the consumer.

- Minimizing downtime due to lack of spare parts. Damage to equipment, a variety of accidents can follow result in the absence of spare parts to stop the production process.

- Simplification of the process of production management. It is about creating of semis-finished goods at different stages of production within the enterprise. (Ivanov 2006.)

These reasons suggest that entrepreneurs, both in trade and industry, are forced to create reserves, as otherwise increased costs, otherwise expenses will reduce profit. At the same time, the stock should not exceed a certain optimal value.

3.4 Inventory management company

The main goal of inventory management is to prevent deficiency of production.

There are many models of stock management the companies. The main models are:

- Inventory model with a fixed size of the order (the order size is calculated once and no longer changed):
- Inventory model with a fixed interval of time between orders (delivery interval may be adjusted to reflect the features of logistics system);
- Inventory model with fixed periodicity of replenishment stocks to a constant level;
- Inventory control model to a minimum, maximum and the constant replenishment intervals (orders made under the condition that reserves were equal to or less than the set level). (Learn Logistic 2009.)

3.5 The application of models of inventory control distribution by using ABC

ABC-analyze is used in logistics. The purpose of the applying is to reduce the amount of inventories, to cut the number of movements in the warehouse, reducing the theft of tangible assets as well as pursuing other goals. Practice of different companies shows that reserves can be divided into three groups, with the following tendency: The items the most expensive group is much smaller than the medium group and the medium group is much less than cheaper group.

The idea of ABC-analysis is that the entire set of similar objects highlights the most significant objects in terms of the designated target. These objects are usually a small, and that they are needed to pay attention and effort. ABC method is widely used in logistics. It provides for the division of the set of managed objects into three parts. At the same time average statistical distribution is as follows: (See Table 1)

TABLE 1: The percentage of groups in the ABC method (adapted from Walther 2009.)

Group	Part in managed objects, %	Part in result, %
A	20	80
B	30	15
C	50	5

The first key step in the analysis is to determine the purpose of the ABC analysis. One and the same set of objects is divided into subset A, B and C in different ways, depending on the purpose of analysis. The second step is the identification of objects of management, analyzed by ABC. Feature extraction on the basis of which will be implemented classification of management object (the third stage). Once defined attribute classification, each of the objects (position range, vendor, etc.) is estimated on the planned basis. Then carry out the grouping of objects of management in the order of decreasing feature extraction. Small part of the list will play a key role in terms of the target. (Walther 2009, 115-122)

Material flow is the important part of warehouse logistics. The information about material flow and inventory is needed for successful warehouse logistics management. There are few method of analyzes of material flow. The ABC analysis and XYZ analysis are the most used in the logistics. ABC analysis was overviewed in the research.

4. WAREHOUSES, THEIR CONCEPT AND ROLE IN LOGISTICS

4.1 Theoretical aspects of the organization of storage

In most cases the design of lean manufacturing processes gives the optimal solution gives the accumulation of raw materials, semi-finished products in a particular part of the supply chain for time period. Holistic project shows what must be done with the load in the place of accumulation. Perhaps received cargo units must be disbanded, the goods must be repacked, and then to create new loading units and at the right time to deliver them to the consumer. For this purpose warehouses are organized in the logistics system. Warehouse is a building, structure, and variety of devices for receiving, distribution and storage of goods, preparing them for the consumption and sending to the consumer. Manufacturer needs warehouses of raw materials and required starting materials which are provided for non-stop production process. Storage with finished goods allows keeping the stock, ensuring the continuity of distribution. Good organized logistics system cannot exist without warehouses. Harmony in logistics is achieved by the right mix of storage and right methods of transportation of goods from the primary source of raw materials to the final consumer. (Mulcahy 1993.)

Warehouse logistics is used only when it helps to improve performance of transverse processes. Thus, the role of the warehouse is to create the conditions for optimization of material flow. Logistics poses the problem of well-organized processes inside of warehouse, as well as the task of technical, technological and organizational planning of warehouse's processes with processes which have affect on the economic environment. Warehouse logistics is considered as elements of physical distribution system and as an independent system at the same time. Accordingly, there are two groups of tasks:

1) The tasks associated with warehouses that appear when systems of product distribution is planned;
2) The task of warehouses as an independent system;

Thus, the main purpose of the warehouse is concentration of stocks, storage and to ensure the smooth and rhythmic execution of customer orders. It is necessary to consider the

characteristics of warehouses for getting an idea about the types and functions of warehouses.

4.2 Types of warehouses

Warehouses are one of the most important elements of logistics systems. The need in specially equipped areas for holding stocks exits during all stages of the material flow, ranging from the primary source of raw materials to the final consumer. It explains existence of a large number of different types of warehouses. Size of warehouses varies in wide range from small premises with total area of several tens of square meters to giant warehouses covering area of hundreds of thousands of square meters. Warehouses are distinguished by height of cargo stowage. In some warehouses cargo is stored not taller than human's high, when in others special devices are used for pick up or just put the good in a shelf at a height of 24 meters and more. Warehouses can have different design: placed in separate rooms (closed), had only a roof or a roof and one, two or three walls (semi-closed). Some loads are kept outdoors in specially equipped areas which are called as open warehouses. In warehouse special mode, for instance temperature and humidity, can be created and maintained. (Frazelle 2001.)

Warehouses can be allocated by level of mechanization and automation of warehouse operations; non-motorized, mechanized complex, automated and automatic. The essential feature to classify warehouses is the ability to deliver and send cargo by railway or water transport. In accordance of this feature, people distinguish next to station or port warehouses (located on the territory of the railway station or port), a railroad warehouses (with decal railway line for coming and leaving train cars) and deep. In order to deliver the cargo to the station or port jetty, road transport must be used. Depending on the range of stored cargos warehouses can be divided to the following groups: specialized warehouses, warehouses mixed variety. Such a way as the benefits of different types of storage are considered: a high level of use of area and volume, easy access to product, control of structural changes in inventories, the possibility of a high-rise storage, ease of maintenance, low investment and construction costs, low operating costs and maintenance costs. (Frazelle 2001.)

4.3 Functions of warehouse

Traditionally warehouses were regarded as places for long-term storage of goods, and their main function was considered as warehousing, consisting in the maintenance and preservation of stocks. Currently, the role of warehouses has changed, they are now considered more as an intermediary through which the material flow is converted and moved as quickly as possible, that justifies expansion of the operations in the warehouse activities.

Thus, the basic functions of the warehouses are:

- Concentration and storage of stock to ensure the implementation of continuous production or supply under the constraint associated with the sources of resources and fluctuations in consumer demand;

- Cargo consolidation means the union of goods in larger mixed batch sent to consumers, geographically located in one area of the marketing;

- Unbundling of goods is sorting goods into smaller parties intended to several customers;

- Accumulation and formation of the range of products in anticipation of customer orders and their subsequent sorting according to orders;

- Equipment consignment- rearrangement of goods received from the supplier, and the consolidation of the party to send to consumers;

- Provision of services, such as shipping, packaging, labeling (material); reception for temporary storage of material assets, leasing storage facilities; contracts with transportation companies, preparation and delivery of shipping documents, etc.(Gadzdinskii 2006, 47-49.)

There are different types of warehouses relatively warehouse process which they do:

- Raw material storage

- Intermediate, postponement, customization or sub-assembly facilities

- Finished goods storage

- Consolidation centers and transit warehouses

- Transshipment or break-bulk centers

- Cross-dock centers

- Sorting centers

- Fulfilment centers
- Reverse logistics centers
- Public sector warehousing (Richards 2011, 9-12)

It is needed to consider the functions of the various warehouses encountered in the material flow from primary source of raw materials to the final consumer. In the warehouses of finished goods of manufacturer there are such activities as storage, sorting, further processing of product before sending it, marking, preparation for loading and loading operations are performed. Storage of raw materials and raw materials consumption enterprises takes products unloaded, sorted, stored and prepares it for industrial consumption. Warehouses of wholesale intermediary firms in the field of products for industrial purposes perform the following functions: provide a concentration of goods, packaging it in the desired range, arrange delivery of goods in the small batches, as end-users, and on the other warehouses wholesale intermediary firms, implementing storage backup parties. Trade warehouses are located in place of concentration of production, taking goods from manufacturing plants in large quantities, complete and send large quantities of goods to wholesalers who are in the places of consumption. Warehouses located in places of consumption goods get the produced product range. (Gadzdinskii 2005.)

4.4 Warehouses as part of the logistics system

Warehouse network is a significant element of the logistics system. The construction of this network has a significant impact on the costs involved in the process of bringing products to consumers, and through them – and on the final cost of the sold product. Logistics process in the warehouse is very complicated because it requires full coordination functions of supply inventory, processing and distribution of the load order. Logistics process in the warehouse is a much broader process and includes: supply of inventory; control transfers; unloading and receipt of goods; transportation inside warehouse; collection and delivery of pallets; information service of warehouse; providing customer service. The functioning of all components of the logistics process should be considered in the relationship and interdependence. This approach does not only allows to coordinate warehouse services

clearly, but it is the basis for planning and control of the movement of goods in stock with minimal costs. Conventionally, the entire process can be divided into three parts:

- Operations aimed at coordinating services procurement;
- Transactions directly related to processing of cargo and its documentation;
- Operations aimed at coordination services sales. (Richards 2011, 9-14.)

The general concept of storage system solution in the first place should be cost-effective. Economic success is ensured in the event, that planning and implementation of storage systems is considered from the point of view of the interests of the whole company, as a part of the overall concept of the warehouse, and the profitability of the warehouse and will ultimately. List of problems is often encountered in the design of logistics systems and is directly related to the stock:

- How many warehouses in the logistics system?
- Where to place them?
- To have own warehouse or to rent it?
- What functions are assigned to the warehouse in the projected logistics system?

Along with listed problems in the organization of storage subsystem packing, loading, unloading , transport and warehouse equipment is selected (Frazwlle 2001.)

5 STORAGE SYSTEM IN KANNUSTALO OY

Kannustalo OY is a Finnish house designing and house-building Company. The ompany slogans are "Rakennemme taloja, mutta ensisijaisesti me teemme Koteja" and "Home is the most important thing in life. For over two decades professionals of Kannustalo have worked for Your family to get that kind of home which you have always wanted." (Company web-site 2015)

The history of the company started in 1968 when recently graduated engineer Raimo Uusimäki opened a house designed and building company in his hometown in Kannus. First test house was done 1978. The house production started and runs till nowadays. Kannustalo-company's value strongly increased during in 90s economic slump when Ainola (one of the house models) was chosen overwhelmingly best house of Asuntomessut (Finnish biggest housebuilding exibition) at Pietarsaari in 1994. (See Table 2) Recent decades of work have pointed to the company small, but important key factors to success: skilled professionals' commitment to principles and investing in quality. For the company it is not enough just to use best materials. The quality of Kannustalo comes from small acts: how attentively salesman and designer listens to customers wishes, how fine is the quality of wall elements or erection of the house, or how fast answer to phone when questions appear in construction site. Caring about every step of house making is the quality. Customers wishes are realized like house would be built by themselves. (Company web-site)

Kannustalo does everything, that every family gets exactly that home, which they have always wanted. This has been Kannustalo's secret for success past twenty years. The company has two factories. The first and main factory is located in Kannus. The main office is also there. The second factory is in Oravainen, on the Western coast of Finland. Kannustalo produces two groups of house: block and turn-key houses. The turn-key house is fully ready for houses with all systems such as electric, water, heating systems, etc. The production time of the turn-key house is 23 weeks. Oravainen factory manufactures this group. Block house is half ready house. Inside part of the house will be done by customer. This group is produced in Kannus. The production time of the house is 14 weeks. (based on interview)

TABLE 2: Customer satisfaction (adapted from Company official presentation)

	Place given by customers	
	1993 year	2013 year
Look of house	16	1
Quality	25	1
Total	15	1

In 2014 Kannustalo produced and delivered 280 house packages around Finland. Net sales are approximately 32 million euros. (See Graph 1)
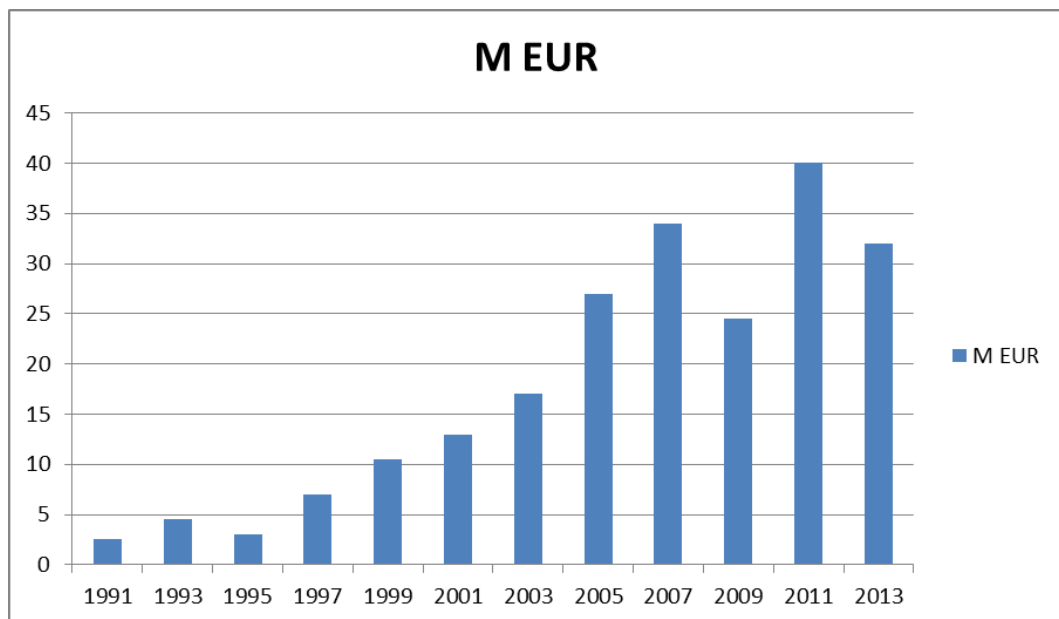
GRAPH 1: Net sales of Kannustalo (adapted from company official presentation)

The storage system is definitely an organized set of interrelated elements, providing the optimal allocation of material flow in the warehouse and rational management. Storage

system (SS) suggests optimal placement of cargo in a warehouse and rational management. In the development of the storage system must take into account all the relationships and interdependencies between external (incoming to the warehouse) and internal (storage) object flows and related factors (parameters warehouse, facilities, particularly cargo, etc.) The choice of the rational system of storage system should be carried out in the following order:

- It is determined by the place of storage in the supply chain and its functions;
- Set the overall thrust of the technical equipment storage system (mechanized, automated, automatic);
- It is determined by the task, which is subject to development of storage systems;
- Elements of each storage system are selected;
- Combination is created from all selected elements of all subsystems;
- Pre-selection of competitive options is carried out from all technically feasible;
- Technical and economic assessment of each competitive option is made;
- Choice of rational option is done;

Selection of items of storage subsystems is conducted by using charts and diagrams. Development of storage system is based on the selection of the optimal system predetermines the rationality of the logistics process in warehouse. (Gadzdinskii 2005.)

The set of operations performed at different warehouses is relatively the same. This is due to the fact that in different logistics processes warehouses perform the following functions:

- Temporary accommodation and storage inventories;
- Conversion of material flows;
- Providing logistics services in a service systems.

There are three types of material flow in any storage processes:

➢ Input;
➢ Output;
➢ Internal;

The presence of the input stream means the need to unload transport, checking quantity and quality of arrived goods. Output stream needs loading transport, internal is the need to move cargo inside the warehouse. Implementation of the temporal storage of inventory means the

need to work on placing goods in storage, providing the necessary storage conditions, removal of the goods from storage. Converting material flow occurs by dissolution of some shipments or cargo units and the creation of others. This is a need of goods unpacking, acquisition of new cargo units, their packaging, bagging. (Mulcahy 1993.)

Addressable system of storage is used in Kannustalo warehouse. It is the most optimal type of organization of goods storage. The use of address system of stock allows: make warehouse system "visible" for all employees; to perform the alignment of incoming goods quickly and accurately; to simplify the process of general and selective inventory; to improve control of storage of goods requiring special storage conditions; to reduce of risk of lack materials for production (when the goods are simply not found in the warehouse); to increase the speed of picking; reduce the number of errors in the assembly and control orders.

Address storage system allows to optimize the placement of stock on hand, taking into account the characteristics of the warehouse. Each rack is assigned its own number and letter code indicating the serial number of the rack, the serial number of the shelves, as well as additional control address for separation.

The warehouse system of Kannustalo consists of two types of warehouses. (See 4.2) They are the company's warehouse in the factory area. Usually they are used for storing of raw material. (see 4.3) But sometimes, if house was produced earlier that it was needed, it can be put in warehouse, where it will stay till dispatch. (based on interview). Inside warehouse is located in production building. The warehouse is around 8 meters high, total area is 100 sq. meters. Raw materials (windows, doors, joining elements), which are stored in the warehouse, need special storage conditions (temperature is aprox. +18 degrees, humidityis aprox 60%). (See Picture 1 on the next page)

Raw materials without special temperature requires are used for production of houses. The raw materials are steel, wood and etc. They are stored in outside warehouses. The company has 3 warehouses of that kind. They are arranged around factory building. Those warehouse building do not have doors. They are three wall constructions; instead of fourth wall is sheets. The fabric protects from getting inside big amount of snow or rain. The height of warehouse is 6 meters.
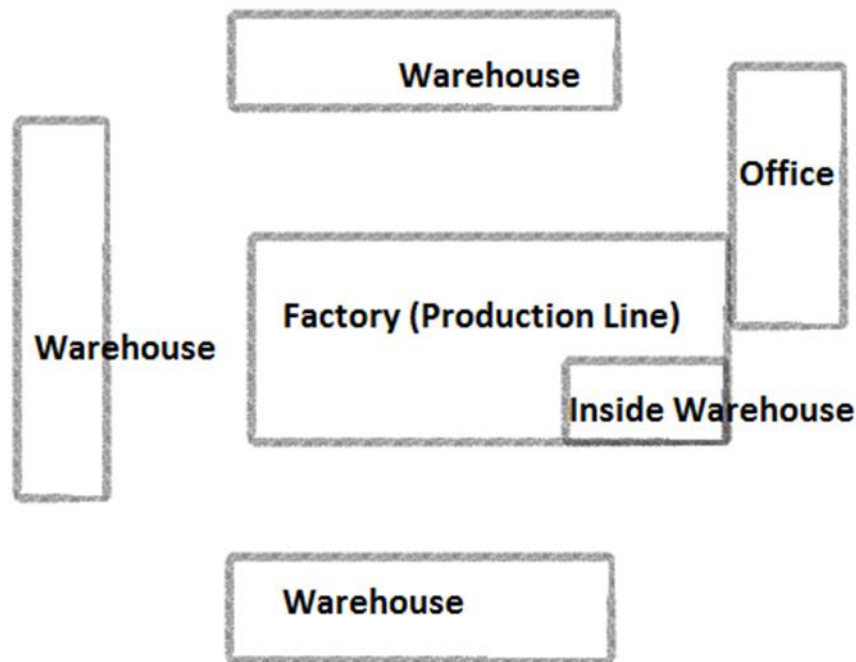
PICTURE 1: Location of warehouses in Kannustalo factory area (based on interview)

5.1 Technical equipment in warehouse

Correct chosen warehouse equipment helps to improve productivity in the warehouse, increase the speed of handling cargos and improve quality of work. In turn, development of quality level of logistics in warehouse helps to increase work efficiency, accelerate order processing and delivery to customer, expanding the customer base and, as a consequence, increase of profit. It is therefore important question how properly to organize warehouse and to get good warehouse equipment. A warehouse needs several kinds of storage equipment for providing comfortable operations of warehouse:

- Equipment for goods storage (shelves and cabinets);
- Lifting equipment (stackers, forklifts, hoists, winches);
- Transportation equipment (trolls); (Vogler equipment Inc. 2005.)

Reliability, comfort, safety storage are the first requirements for modern warehouse complex. So first of all shelving equipment is chosen (of course, if it is possible). Usually storage systems are developed on an individual project and all the features of the room (the height of the celling, uneven floors, etc.) and load (size, weight, storage requirements) are taken into account. Further, lifting and transportation equipment are selected according characteristics of shelving the height of the racks, max height of cargo, width of rack passes and other important factors that affect to the speed and quality of load process. The main principle of warehouse equipment selection is comparability. It is needed to understand which kind of equipment is planned to be used according suitable characteristics for the racking system. If the height of warehouse is 3-4 meters, then high lifting equipment is definitely not needed. For choosing of equipment it is necessary to know such important parameter as the size of cargo. A large warehouse, where loading and unloading operations are carried out non-stop needs one type of equipment. Different type of equipment is needed in a small bakery utility-warehouse. (Richards 2011, 73-98.)

There are many types of racks, and in order to select the ideal option, it is necessary to answer a few questions:

- Which kind of package do stored goods have? This is the first thing which has to be determined. For instance, one design is needed for boxes, other is for pallet.
- What is the area and height of the room, does it have architectural features?
- What would be the maximum size and weight of the load? These parameters are needed to determine the carrying capacity of the rack level and as whole system too, as well as the distance between the level and the depth of the rack. It is recommended, to determine the expected characteristics of cargo, to add 3-5% of the size and capacity to "reserve" even if the reserve is not supposed for usage, shelves will last longer).
- What speed of movement is required?
- Does the load require any special storage conditions? Shelves with galvanized studs should be used in refrigerated warehouse. They are more resistant to low temperatures. Loads with limited shelf life should be located of the front shelves, suitable long-term load can be in bad place. There are so many nuances, and they play significant role in choice of rack equipment. (Richards 2011, 90-97.)

As it was mentioned before Kannustalo has 2 types of warehouse: warehouse with special conditions and warehouse without special conditions. Pallet storage racks are used in the warehouse with special conditions. (See Picture 1) It is the most popular and economical way of storing. Products, even non-standard and specific, easily and simply placed on pallets in several tiers. These racks are ideal for industrial warehouses with a wide range and high turnover. (See Picture 2)

PICTURE 2: Example of warehouse with racks (based on interview, Google picture search)

There are no racks in the outside warehouse; the properties of the raw material allow storing it on the floor. One package can be put on the top of other. (See Picture 3 on the next page)

PICTURE 3: Example of warehouse with wooden materials (Based on interview, Google picture search)

In any warehouse goods can't be like "dead weight" on the shelves. There is a continuous work: laying on storage, lifting, lowering, transportation to another location, shipment of new customers, and the collection of customer orders. For all of these operations special storage equipment is required. Carts take the second place after the racks in the ranking of the most popular types of warehouse equipment. There is a very small warehouse where the good are stored at light shelves and loaded/unloaded by hands, but it is hardly possible to find at least one warehouse where no one would have to transport goods from one point to another. Therefore, a warehouse is unthinkable without bogies. During a selection of transportation specificity of goods has to be considered. For example, for relatively light loads manual two-wheeled carts are suitable; items that are not packaged on pallets (boxes, various packaging, etc.) can be conveniently carried on platform trucks, and hydraulic or motorized pallet fork lifter trucks are suitable for transporting pallets. (Gadzdinkii 2005.)

Stackers and forklifts are needed in any warehouse where the goods are stored on pallets. But before choosing loading equipment, the manager must estimate the size of turnover, the height of the racking system, the expected load and the distance between the shelving units. For a small warehouse a convenient and cost-effective option would be a manual hydraulic stacker- it is compact, affordable and durable. Medium and large amount of traffic, as well as high altitude racking system it is better to prefer electrolifter driven or self-propelled, with

footrest or operator cab. Storage equipment manufactures offer a variety of interesting options, one of which is for sure a suite perfect for taken warehouse. Also a loader should be selected based on the volume of traffic and necessarily features of racking system are taken into account. For tall shelving high lifting powerful machines (reach trucks) are indispensable; and average warehouse can use a compact and economical version of "two in one": a compact loader stacker with increased ground clearance and maneuverability.

Hoists and winches are types of lifting devices are not very popular as storage equipment, but often they are irreplaceable helpers at the modern warehouse. Electro hoists are comfortable to use as the lift on the mezzanine rack, manual and electric hoists- an inexpensive, compact device for not only raising a heavy load from the bottom to up, but also for its horizontal transportation from one corner of the warehouse to another. Rigging is very convenient as auxiliary storage equipment, and it will be very useful for heavy loads in warehouse. (Gadzdinskii 2005.)

Availability of warehouse equipment depends on the size of the warehouse and stored products in the warehouse. Sometimes widely used pallet jack is the best choice. Sometimes a dozen forklift trucks is not enough for handling of warehouse processes. So the simplest and most common technique is a pallet jack or professional language "deadhead". Deadhead is designed for manual loading and unloading operations, the load placed on the tray, and then transported to deadhead. Duty is 2 tons, the height at which it can lift a load of 200 mm. Stackers is a more advanced kind of warehouse equipment. They are used in the case where the load must be raised to a second tier of shelves. Stackers can be both manual and electric. The use of one or another depends on the intensity of the warehouse. Capacity can be from 0.5 to 1.5 tons. A maximum height is 1.5 meters. Fork-lift truck is a serious technique for the management of which a license is required. Truck is a self-propelled vehicle equipped with a lifting mechanism. Depending on the make and model varies in speed, load capacity, size and price.

In Kannustalo Oy all those types of equipment are used. (See Picture 4) Pallet jack is used for transportation of not so heavy pallet inside of warehouse; stacker is for moving and lifting material inside in warehouse. The fork-lift truck has functions such as: moving raw material inside of warehouse, lifting, unloading raw material and loading ready blocks of houses before despatcher. For safety issues, the area inside of warehouse allowed to drive fork lift

truck is marked. Workers should be careful in this area. Working uniform has bright color with reflectors for the same reason.


PICTURE 4: Warehouse equipment used by the company (based on interview, Google picture search)

5.2 The logistic process in stock

Logistics process in the warehouse is a time-ordered sequence of logistics operations, integrating the functions of supply inventory, cargo handling and physical distribution of the order. The main objective of supply inventory is to provide a stock of goods (material) in accordance with the capacity of its processing for this period in full satisfaction of customer orders. Therefore, determining the need for purchase of inventories should be consistent with the sales team and the available capacity of the warehouse. Accounting and control of inventory flow and shipping orders allows rhythm processing of cargo flows, the maximum use of available storage volume and the necessary storage conditions, to reduce the time stockpiles and thereby increase the turnover of stock. To unload the cargo and acceptance should focus on the delivery conditions of the concluded contract. (See Graph 2) Accordingly prepared place for unloading said vehicle (truck, wagon, container) and the necessary handling equipment. Special equipment in unloading places and the right choice of handling equipment can effective conduct discharge (in the shortest possible time and with minimal loss of load), and therefore less downtime of vehicles, which means that the treatment cost are reduced. Conducted at this stage of the operation include: unloading of vehicles; monitoring compliance with documentary and physical delivery of orders; documenting arrived cargo through the information system; formation storage unit load. (Richards 2011.)

Transportation inside warehouse involves the movement of goods between different areas of the warehouse; from unloading area in the zone of acceptance, and from there to the storage area, picking and loading area. The basic principle of rational storage is efficient use of storage area. The reason for this is the optimal choice of warehousing, and primarily handing of equipment. Equipment for storage should meet specific characteristics of the cargos and ensure maximum utilization of the height and area of the warehouse. The space for aisles should be minimal, but with the normal working conditions for industrial machines and mechanisms. For safe cargo storage and economical location of it the address system is used. Goods can be located according to principle of a solid (fixed) or free (load placed on any free space). The process is to prepare the goods according the customer orders. Packaging and shipping of orders include: receiving a sales order, the selection of each item of goods according to the order, a complete set of the selected product for a particular client,

preparation for dispatch, documentation of the order, overseeing the preparation of the order and design of bills of lading, loading of cargo in the vehicle.
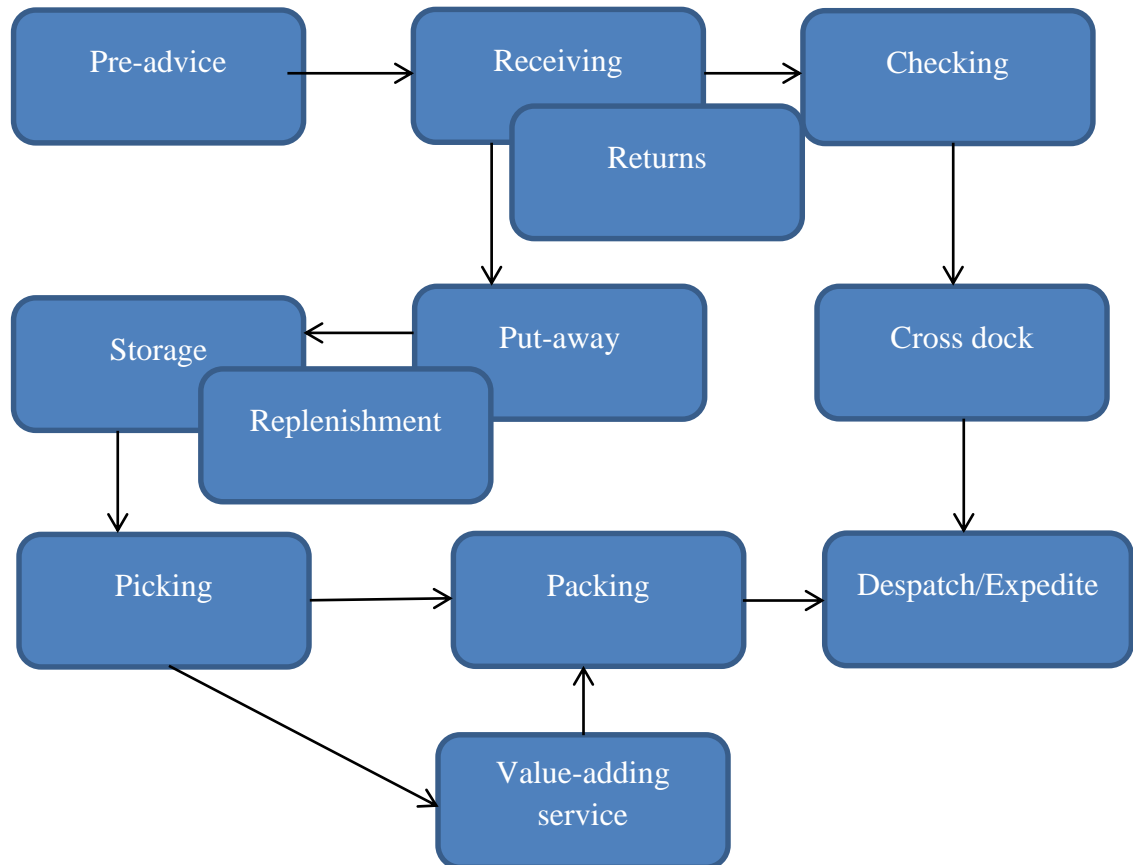
GRAPH 2: Warehouse process (adapted from Grynne Richards Warehouse management: a complete guide to improve efficiency and minimizing costs in the modern warehouse)

During customer service control of order of fulfillment is important. A level of service depends on control of order execution and control of providing of service. After-sales services cover the range of services provided to consumers of products: plant production; warranty service; provision of spare parts; temporary replacement goods; receiving a defective product and replace. Efficient implementation of the logistics process in the

warehouse is the key to profitability. Therefore, the organization of the logistics process is necessary to achieve the following objectives:

- Rational planning of warehouse in the allocation of working areas, lower costs and improve the process of goods processing;
- Efficient use of space in the placement of equipment which allows to increase the capacity of the warehouse;
- Using the universal equipment performing various warehouse operations, which gives a significant reduction in fleet handling machines;
- Minimization of intra transportation routes in order to reduce operating costs and increase the capacity of the warehouse;
- Cut number of shipment and application of centralized delivery can significantly reduce transportation costs;
- Maximize the use of the information system, which reduces the time and costs associated with the document, the exchange of information, etc.(Richards 2011)

The main objective in inventory management is to provide a stock of good (material) in accordance with the capacity of its processing for this period in full satisfaction of customer orders. Therefore, determining the need for purchase of inventories should be consistent with the sales team and the available capacity of the warehouse. Accounting and control of inventory flow and orders shipping allow to provide rhythm processing of cargo flows, the maximum use of available storage volume and necessary storage conditions, to reduce the time product storing and thereby to increase the turnover of stock.

The main goal of the company's logistics is to provide everything for supporting of competitive position of the organization at the market. The logistics reaches the goal by material flows. The principles of material management are delivery needed product to defined client (to production) in the shortest time with minimum expenses. The purpose of supply management is to ensure that the organization has a reliable supply of materials of appropriate quality, the required volume, at the right time, from a qualified supplier, with a high level of service and at an affordable price. The company has reliable and continuous material flow to ensure the smooth operation of the business. Stock is maintained at the normative level, the stock of material resources.

The enterprise inventory management has a serious impact on the whole organization. The task of inventory management is to optimize the volume, variety and placement of stocks. The main goal of inventory management is to prevent deficiency. On the one hand, production deficit can cause large losses in the enterprise or loss of market share; and on the other a glut of inventory warehouses leads to obsolescence, damage, as well as ineffective investments. The enterprise selects inventory model with fixed periodicity of replenishment stocks according to customer order. To prevent overestimation of the volume of stocks in the warehouse, or deficit, orders are made not only at a specific time, also when this is minimum level of profitability. This system is more resistant to fluctuations in demand. The positive side of this model - increased protection against stock-outs, negative - the need to keep track of stock levels. (see 3.4)

According to the theoretical part 3.5, ABC-analyze was done for better understanding of inventory management. Based on interview and researches about inventory management in Kannustalo, the conclusion was prepared. (See Table 2)

TABLE 2: ABC-analyze

	Group	Aprox. %	Material group	Required cond.	
	A	80%	Wood, isolation	No	
	B	15%	Windows, doors	t, humidity	
	C	5%	joining parts, electrical part	t, humidity	

Group A is stored in warehouse without special condition. The group takes the biggest storing area (3 warehouses outside). Materials from Group B and Group C are located in the same warehouse with special temperature and humidity mode.
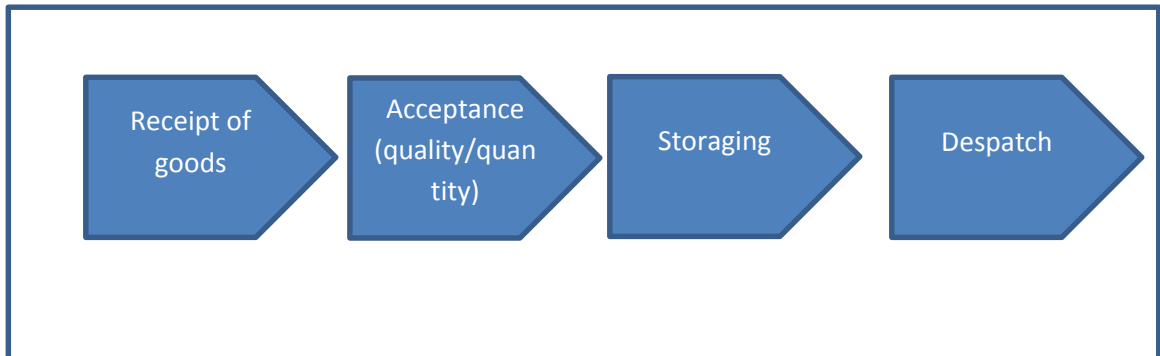
In order to be able to manage a large number of units of goods passing through each link of the supply chain, it is necessary to have information about incoming and outgoing material flows. It allows knowing material flows circulating within the system at any time. This problem is solved by using of Enterprise Resourses Planing System such as V8 ERP. Technology is based on the following chain of operations:

- Order

- Delivery

- Receiving of good

- Storage (place and deadline date)

- Sending to production

- Receiving from production

- Despatcher

- Inventory checking

- Write-off of goods from the system

Use of Enterprise Resources Planning system automate the registration and control of material flows, automate the process of inventory and to increase the speed of receiving of the goods. It is needed to follow the material flow of raw material for each house, because the order of raw material is done separately for each house. Those materials can be used for some other houses. The cost of the house depends on material from which it was produced. Application of the Pareto minimizes the number of movements in stock by dividing the whole range of groups that require a large number of movements and groups that are accessed infrequently. (See 5.6)

5.3 Material handling: objectives, principles

Material handling is a main part of the logistics process in the warehouse. It is a set of operations of accounting, control and sorting of goods into the warehouse, within the warehouse shipping to their places of temporary storage, installation of goods on store shelves raids or sites, the formation of consignments to be sent to the consumer. (See Graph 3 on the next page) The time for performing these operations is called as operational time of material handling. (Ivanov 2006.)

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┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│   ┌──────────┐    ┌──────────┐    ┌──────────┐    ┌──────────┐            │
│   │ Receipt of │   │ Acceptance │  │          │    │          │           │
│   │   goods    │>  │(quality/quan│> │ Storaging │>  │ Despatch  │>        │
│   │            │   │   tity)     │  │          │    │          │           │
│   └──────────┘    └──────────┘    └──────────┘    └──────────┘            │
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
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GRAPH 3: Material flow in warehouse (adapted from Dmitri Ivanov Logistics. Stategic Cooperation)

There are a number of principles, the observance of which allows to reach a rational organization of the process handling. The principles are:

- Planning. Material handling process should be clearly planned. Based on data about the planned income and outgo goods, volume of necessary work is determined. According to volume of work, equipment and labor power will be prepared in time.

- Rhythmicity. Efficient use of manpower and equipment is only possible while maintaining the rhythm of the storage process.

- The rational organization of material flow. In warehouse a movement of material flows should be carried out during the shortest times periods with the lowest coefficients overlay flows to each other.

- Efficient use of storage equipment. In storage areas placing of goods should be carried out optimally in order to maximize efficiency of space using, and in the same time to maximize efficiency of equipment using.

- Mechanization and automation can increase productivity of workers and equipment use in storage space.

- Full safety the product properties. The fulfillment of this principle is ensured through the creation of favorable conditions of storage of goods - the temperature and humidity in warehouses, special events, protecting the goods from the adverse effects etc. (Ivanov 2006, 74-76.)

The realization of these goals depends on the basic concepts of the organization of cargo handling process; mechanization and automation of manufacturing operations; optimal use of space and capacity of the premises; organization of the through flow of goods; complete safety of goods. (See Graph 4). Supply-delivery chain of Kannus is not long. Firstly, a customer decides which kind of house he wants, and then he makes the order. Form of order is a contract between customer and the company. There should be mentioned type of house, dimensions, and other particular features. Other issue of the contract is that the customer is obliged to pay for the house. According to the house features, engineers make calculation of needed amount of materials and create the list of raw materials for production (Appendix 1). The purchase order is completed based on the list of needed materials. Suppliers bring raw materials. The materials are stored in warehouse, where they are located till they are needed in production. After production blocks of house are loaded to the trucks and delivered to the place where they will be assembled. If a house was manufactured much earlier than date in the contract, blocks are stored in warehouse. They wait to their loading time there.
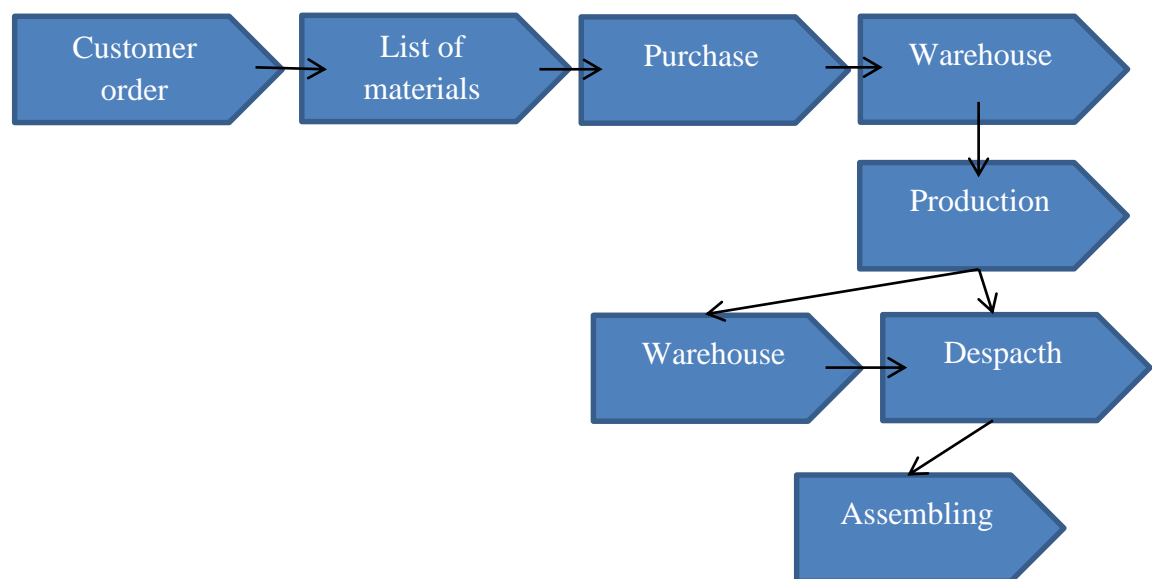
GRAPH 4: Place of warehouse in Supply-Delivery Chain (based on interview)

The company has 130 employees. They are engineers, designers, managers, salesmen, installers, warehouse workers, etc. Kannustalo OY has hierarchical organization structure. The head of the company is director. He manages four departments: accounting, production, sales and design departments. (See Graph 5) The warehouse is a part of production department. There are 6 people in warehouse: warehouse manager (production director), 2 fork lifter drivers, 3 warehouse workers.
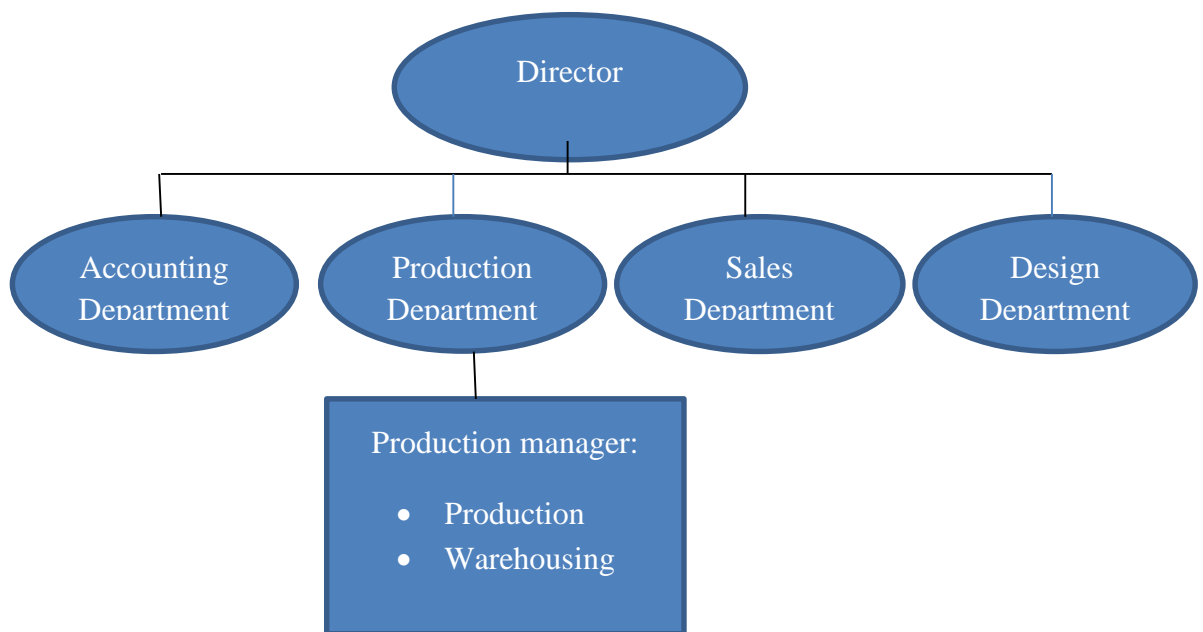
GRAPH 4: Organization structure of Kannustalo (based on interview)

The warehouse workers occur storage of goods and also taking into account all the values, cleaning shelves, receiving purchase, and prescribing procurement of purchase. Prescribing procurement procedure is to assign addresses for newly received items. The production manager writes information about expected arrival to database of the company. After that warehouse worker gets list with the name of the goods, quantity (number) in the package, the expected number (pieces, packs). Warehouse worker prepares a place on the shelf and he gives "address" in warehouse. The information is written down into an electronic database (V8 ERP). Warehouse workers take care about special condition (temperature, humidity, light) in warehouse. His responsibility is to protect materials from damage and theft. He takes part in inventory checks.

The second group of warehouse personal is the fork lifter drivers. Their work is transportation of raw material from delivery trucks to warehouse and put it to the place, according to the warehouse address of the item. During the receiving, driver takes delivery inside of warehouse, where warehouse worker checks the delivery and makes receiving. After that, driver moves new materials to their place. Other important part of driver job is to provide needed raw materials to the production line according time frames. Then, he loads ready block of house to truck or takes back to warehouse for waiting of the house departure time.

The boss of warehouse in Kannustalo is the production manager. He is also a purchase manager of the company. He gets information about needed raw materials from engineers. The list of the materials is done by calculation in special program. The cost of the house depends on amount and material cost which were used for production. Production manager orders materials from supplier. According to the supply contract time limits of raw materials are: 4-5 weeks (wood), 7 weeks (windows, doors).

5.4 Organization of receiving of the cargo

Goods from incoming trucks must be unloaded and accepted in the shortest possible time. Unloaded goods are delivered to the reception area of warehouse, where they will be checked. Goods have to be with a following transportation documents: bills of lading, invoices, etc. These documents are registered in the register of incoming cargo and vehicles. During the process of acceptance the actual parameters of incoming cargo are checked with the data of supporting documentation. Identification can be carried out by reading the text and numerical information or bar code located on the packaging. Acceptance of the packaged goods can be carried out on the package or nomenclature. Acceptance for cargo space consists of checking the quantity and weight specified in the transport and accompanying documents. The lack of documents, seals, packaging discrepancy or package damage does not suspend acceptance. In such cases, the company sends for claims against the carrier or supplier.

During acceptance of goods, the package is opened, goods are identified and their number in each package is checked.

After completion of the acceptance of goods the following actions are performed:

- Entering information into the database in warehouse information system;
- Gluing warehouse labels on the package or packaging trade items with the designation required parameters for inventory accounting and allocation, batch number, quantity received places, etc.
- Assignment of marketing units in stock of their code, which as a supplier code, is an important parameter to identify and control the movement of goods.(Richard 2011, 44.)

5.5 Organization of placement, packing and storage

For storage in warehouse, goods are stacked or placed on the shelves; shelf or drive-in pallet racks. Drive-in racks are not interconnected passages; arrivals of warehouse equipment are done directly into the rack, so they are called driving in or looping. Flow racks are comfortable, in which the goods are supplied to the place of withdrawing automatically by gravity. Shelves significantly increase the cost storage of goods, flow racks are especially expensive. Therefore, management decision about installation of shelves is done based of techno-economic research. The need of shelves is bigger when height of warehouse is higher and range of stored goods is wider. In warehouse one of the existing schemes of goods storage can be selected, or warehouse can apply simultaneously multiple methods of storage in accordance with its individual characteristics:

- Varietal. The variety of goods is a gradation one or more indicators.
- Quality. When varietal method of storing products of different grade are placed separately from each other.
- Consignment. When each cargo which came by one document is stored separately.
- By name;
- By the principle of uniformity;

- Depending on the size and weight;
- Depending on the special properties of goods (according to the degree of danger, for instance). (Gadzdinskii 2005.)

Temperature, humidity, lighting form of the storage mode is set by legal and technical documents, in particular, by the state standards. It is highly recommended to use so-called Pareto method during the placing the goods on storage. According to this rule only a fifth (20%) of total amount of objects gives 80 % of the result (profit). Contribution of the remaining 80 % of the objects is only 20% of the total result. Application of Pareto rule minimizes the amount of movement of stock, by dividing the whole range of groups that require a large number of movements and groups that are accessed infrequently. As a rule, often sold merchandise (goods) are only a small part of the range, and they must be placed in convenient as close as possible to the zones of places along the so-called "hot" lines. Less often required items should be located on the "second place" so-called "cold lines". Big-ticket items and goods storing in bulk may also be placed along the "hot line". (Gadzdinskii 2005.)

There are different kinds of packaging ways for cargos. The standard package for transportation and storing is a pallet. The pallet is a wooden construction with dimensions 200 x 800 x 150 mm, weight - 6,5 kg, dynamic load standing - 1000 kg., static load standing - 2500 kg. However, producers don't use standard package for all their products. There are other reasons for using proper package. In general, packaging serves four basic functions:

- Identifies the product and gives basic information
- Protects items during their movement through the supply chain
- Makes handling easier
- Helps in marketing, promotion, advertising, provide information about product to customer

Two types of packaging can be defined: industrial packaging and consumer packaging.

There are five main materials for packaging:

- Glass is easy to clean, reuse and recycle, but is fragile, relatively expensive and difficult to manufacture

- Plastic is light, strong and easy to clean, but can be expensive and difficult to make or reuse

- Cardboard is light, cheap and be recycled, but has little strength and poor durability;

- Wood is strong, durable, easy to use and can be reused, but it is heavy, bulky and difficult to clean

- Metal is strong and durable, but it is heavy and can be expensive.

Decision about packaging type should be based on balances between many factors such as type of product, level of needed defense, movement during supply chain, cost the packaging and etc. The choice is the important part of material handling. (Walter 2003, 302-306.)

5.6 Preparing goods in accordance with wholesalers' orders

Hand-picking operations and preparation of goods for order are the most time consuming operations. Labor costs of collection can be up to 50% of the total labor force employed in warehouse. Time schedule of selector warehouse worker shows that his working hours are spread about as follow:

- Picking products by buyers' order -10%;
- Downtime during a replenishment- picking in the area or while working in the area of another selector – 20%;
- Work with qualifying sheets – 30%;
- Moving between picking places – 40%; (see Graph 6 on the next page)
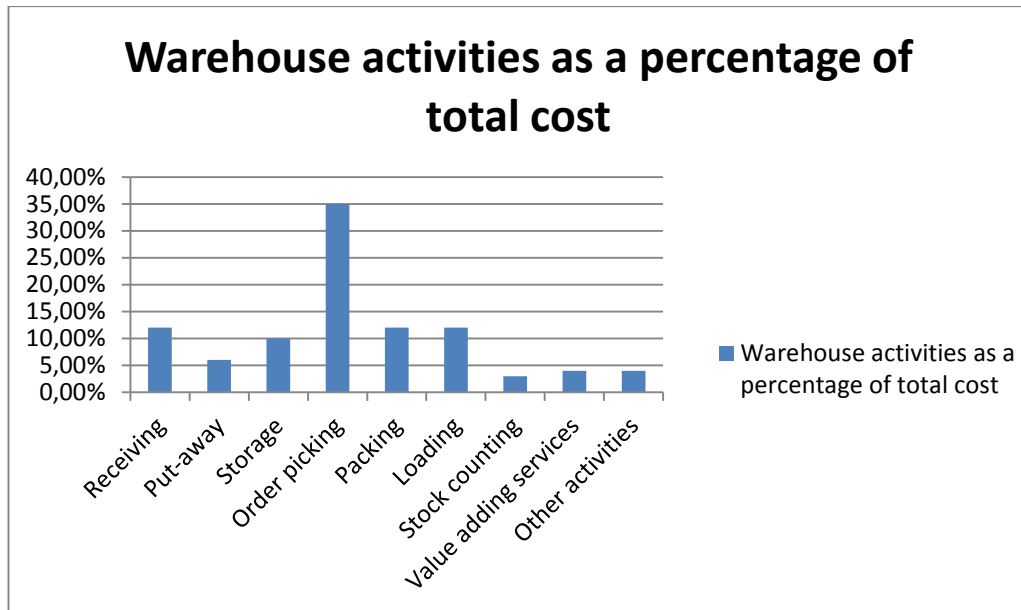
GRAPH 6: Warehouse activities as a percentage of total cost (adapted from Warehouse management: a complete guide to improving efficiency and minimizing costs in the modern warehouse Richards)

The urgency of reducing time of movement is obvious. The solution is to allocate the area in the warehouse safety stock. Selected stocks are on the lower tiers of shelving, ie in the better places for picking goods. Separation of the reserve, in two ways:

- Vertical separation is a reserve stock of select products;
- Horizontal separation – backup and selects stocks are at different locations of the warehouse. Storage area for the stock should be divided into "hot" (as close to the expedition-departure) and "cold" (the rest of the stock available for transactions-picking). In the "hot" zone is placed bleed stock of goods with a high frequency of orders, "cold" – low. In order to determine which items to place in the "hot" storage area sampled stock is necessary to identify the position found in most customer orders. It should be in mind that the high turnover of goods does not mean that selector works with this item a lot, because good can leave large quantities in one time from warehouse. Reduction in forced outage is ensured by the organization of storage of goods, are in high demand in several places of picking zone. Thus, different collectors have bigger opportunity to collect products in the same time. (Keller International Publishing Corp 2014-2015)

Personnel involve in picking of goods and personnel involved in restocking work in the same area – the storage area. Routes of their movement will not overlap if:

- Replenishment of the reserve stocks and working area exercise from different sides of the rack. It is necessary to keep in mind that this method is simple reducing staff, the use of storage capacity is getting worse;
- Personnel work: restock and picking of good are occurred in different time;

There are two methods of goods picking- individual and complex. Complex picking is used usually for relatively small orders. Collector, by passing picking zone, withdraws from storage products for multiple orders according to the synthesis qualifying list. The chain operations on the compilation of a separate order increases. There is an additional step to transform a complex-picking in the individual, but the total number of chains is reduced. It is needed to find a compromise solution in each case. Individual picking is a consistent composing a separate order. In the case, the goods must be immediately packed in suitable containers and at the end of the operation to be ready for shipment. (Richards 2011,73-86)

There is an interesting solution to load goods into the truck as picking complex for different orders and completing them to separate orders by driver during process of delivery.

With a high turnover and a wide range, one order can be selected simultaneously by several collectors in different parts of the storage area. Subsequently assembled parts are joined into a single order. While assembling of order collector should have following information: how many goods are needed; to whom is the cargo; what to do if goods finished; what to do after assembly of order. Transferring information to collector may be done by different ways. Providing information in time is a prerequisite for high-intensity passing through a portion of picking of material flow. Efficiency of operations for preparing goods for release can be characterized by the following indicators:

- Frequency -picking, ie the number of orders in the selected time unit;
- Bandwidth-picking area- the number generated by loading units (containers, boxes, pallets, etc.) per unit of time;
- The level of customer service;
- Cases of non-stock products included in the selection list. (Richards 2011, 86-90.)

In the research theoretical aspects of logistics systems and warehouse logistics were overviewed. Warehouse logistics and storage system were examined on the example of

Kannustalo Oy. As a result of the research conclusions can be prepared. The warehouse system is organized well from point of view safety and risk management issues. Safety issues include marked way for truck and fork lifter trucks, uniform for workers from colorful fire protecting fabric, safety shoes, obligation of knowing instruction and location of emergency exit, first aid kit, fire extinguishers, fire alarm system, and contract with firefighter (they come immediately if fire alarm system starts to work). Risk management issues are raw material stock controlled by ERP system; customer obligation to pay house cost, sick worker can be replace by worker from production department, high quality control. Advices for improvement quality of warehouse logistics system can be done. The old version of ERP system is hard for using. The processes inside software take a long time. The version of ERP system should be replaced. It will help to reduce time of material handling process and to make warehouse process more prepared for implementing lean manufacturing. Nowadays the situation of the house building market is hard in Finland. The company should make changes for being competitive in the market. Lean manufacturing and compliance the sustainable development will help to Kannustalo Oy in the current situation.

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APPENDIX 1:

Kannustalo raw material list:

- Solid Wood: pine, spruce, alder
- Plywood
- Gluebinders
- Impregnated wood
- MDF-profiberboard
- Chipboard
- OCB-plated
- Mineral wool insulation products
- Metal connection parts (nails, screws)
- Plastic sheets
- Plastic insulation materials
- Aluminum sheets
- Bitumen sheet
- Roof materials
- Roof tiles
- Steel roofing sheets
- Nail plate roof trusses
- Windows
- Doors, lockers and handles
- Wallpaper
- Wall and floor tiles
- Parquets
- Moisture insulation materials
- Mortars
- Fixed furniture
- Domestic appliances
- Sauna stoves/heaters
- Rainwater systems
- Electric systems
- Plumbing supplies
- Heating systems

- Air condition parts
- Various seals and stripes for sealing
- Fireplaces
- Element chimney (adapted from company website)

APPENDIX 2

Discussed themes

1. Warehouse process. How does it work? Place of warehouse in chain of company processes.
2. Which kind of warehouses company has? (own warehouse or outsource, by type of stored material, etc.)
3. Does company use ERP system?
4. Ways of organization of storage. Warehouse equipment
5. Staff of warehouse (amount and responsibilities)
6. Health and safety
7. Control and improvement of quality
8. ABC-analyze
9. Risk management