The Importance Of Material Handling In Logistics System

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Abstract: Materials handling is an integral part of the materijals flow in logistics systems that incorporates activities related to the physical supply of materials in an organization. Specifically, handling of materials means the administration of the raw materials, intermediate products, packaging materials and supplies in the production facilities.

Material handling is not directly related to consumers, but the extent to which raw materials, materials and semi-products will be available for production determines the availability of finished products to consumers.

The foregoing means that the decisions made in this part of the logistics system have direct effects on the level of customer service, which affects the competitiveness of the firm and the level of profit made in the market.

Without efficient and effective management of the internal flow of materials, the manufacturing process cannot produce the products at the desired price and place for consumers. Having regard to the foregoing, the paper will provide a theoretical overview of material handling, particulary the activities incorporated in this process, as well as systems MRP, ERP, DRP, bar code technology and RFID technology whitch are important for succesful materials handling.

Keywords: material handling, MRP, bar code technology, RFID technology

1. Conceptual determination of materials handling

Materials handling is an integral part of the materials flow in the logistic systems, comprising the activities related to physical materials supplying in an organization. Specifically, the materials handling means the raw materials, semi-products, packing materials and stocks in the production plants administration.

The materials handling is not directly connected with the consumers, but the degree to which the raw materials, materials and semi-products will be available for the production, determines the ready products availability to the consumers.

The above means that the decisions to be made in this part of the logistic system have direct effects on the level of services for the consumers, that has influence on the firm's competitive ability and the level of the profit realized on the market.

Without efficient and effective management of the internal materials flow, the production process cannot produce products at the desired price and in time requested by the consumers. Due to all these things, it is very important for the managers in the logistic system to understand properly the role of the materials handling and its influence on the costs from the one hand, and the service offered to the customers, on the other hand.

Simultaneously with the increasing importance of the logistic activities in the beginning of the 1980s, more attention was also paid to the materials handing importance.

The materials managing presents 30-70% of the production costs. Most often, as a consequence of the wrong materials managing, the following things can occur: waste, losses due to damages, non-fixed currents, too much movement, lost warehousing space or too big warehouses dimensions, large number of employees, lack of parts/suppliers etc.

2. Activities associated to materials handling

Generally, the materials handling comprises 4 activities, i.e.:

- Predicting the needs for materials
- Determining the materials sources
- The materials delivery into the organization
- Monitoring the state of the materials as current assets

The materials handling aim is to solve the problems with the materials in the entire organization, by coordinating the performances of the materials various functions, providing communications network and the materials flow control.

While the specific aims of the materials handling are very similar to the basic aims of the firm, in the sense of realizing an acceptable profitability level and the investments return, and also enabling a favorable competitive position in the market that is characterized by an increasing competition today.

When we set the aims of the materials handling, we should mention that there is not only one approach, and further in the text, we will explain the materials handling aims according to Regodic.

- *Materials movement.* The efficient materials movement in a sequence and out of the warehouse helps in the costs managing and improves the services to the users.
- *Time.* The parts and raw materials must be available when they are needed in the production areas, loading/unloading places and terminals. The existence of unsuitable raw materials of inappropriate quality, quantity, time, is a consequence of inefficient materials handling.
- *Quantity.* The necessary goods should be in the right quantity, both in the production sites and for the users.
- *Space.* The materials handling must use the space in the warehouse, terminal or plant efficiently.

As it is explained in the beginning, the business logistics consists of two parts, which in this case will be:

- Inbound logistics that presents the materials handling and
- Outbound logistics that presents the physical distribution.

In this part, the subject of elaboration is the materials handling. That comprises a large number of activities. Or specifically, the logistic activities that belong to inbound logistics are: buying, purchasing, stocks control, warehousing, arranging, order processing, transportation and any other logistic activity. Therefore, the basic difference between the materials handling process and the physical distribution, is that in the first case we work with raw materials, parts, semi-products, and the buyers are producing firms, while in the second case those are ready products, and the buyers are the end consumers.

Seeing integrally, the materials handling includes(Baseska, 2006)

➢ **Buying and purchasing**

The buying presents the process of real buying and other activities associated with that process, while the purchasing is a wider term which includes in itself buying, transportation, warehousing and materials accepting.

Defined in a narrower sense, the purchase is an act of buying things and other services for the firm, while in a wider sense, as a process of attaining things and services, the purchase is more than one activity. It is a successful finishing of a series of activities that often break the boundaries of the firm.

The effective purchase of materials and services contributes to realization of a company's competitive advantage. The purchasing process links the members of the supplying chain and provides quality of the suppliers in the chain.

It is evident that the quality of the materials and services included in a ready product has a direct impact on its quality, And with that, also on the degree of the consumers' satisfaction with it. All that will have the revenues realized by the company as a final effect.

The purchasing costs are an important part of the total expenses in many business activities. Having in mind the mentioned facts about the purchase importance for the revenues, expenses and the relations in the supplying chain, it is clearer now why so much attention has been paid to the purchasing in the recent time, both by the theorists and practical people.

Also, having in mind the fact that today the products' shelf life is becoming shorter and shorter, there are fast technological changes, while the consumers are becoming more sophisticated, the importance of buying and purchasing will increase even more.

All a.m. imposes the need for flexibility and agility in the buying process. The process of globalization presses the companies to widen their horizons in the view of sourcing everywhere in the world, where lower costs and products, and services of best quality, can be found. Besides this, especially strong influence has the revolution in the area of information technology, which causes replacement of the traditional activities within the purchasing departments, by the automated ones, with which the approach to and the way of their performance is completely changed.

3. The production control

This activity is most often carried out within the production, but besides that, the role of the logistics is very important because they are complementary.

Specifically, in the production we determine how many and what kinds of products are produced. That influences the time and the way in which those products will reach the consumers.

From the other hand, the production directly determines the company's needs for raw materials, intermediate-goods and parts. From this, the necessity of mutual participation of the production and the logistics in the process for production controlling, is evident.

> ➢ **Inbound logistics**

The materials handling is connected to the products delivery to the firms as well, i.e. to the production sector. This process includes both the inbound transport and the raw materials and intermediary-goods storing.

In the way of administrating the inbound transport (delivery) and the outbound transport (dispatch).

First, the market demand that causes a need for delivery is uncertain and fluctuating. The materials manager is faced with the demand which depends on the production activities and it is more predictable and stabile. This shows that the decisions made during delivery are faced with different problems than those made during the dispatch.

Second, the materials managers are faced with strong raw materials movements or with big parcels with parts and intermediary-goods. Furthermore, they need different handling than that which is characteristic for the ready products.

Third, the firms mainly control the inbound transport (delivery) less, because usually the buying procedures look like "costs for the complete delivery". As the firms very rarely make a special analysis of the inbound costs, and even if it is made, it is not detailed, it can be concluded that there are possibilities for savings on important costs.

> ➢ **Storing and arranging**

Until they come to the production process, the materials, raw materials and parts are put in a warehouse. Here, they are put near the place of their use or are delivered by the JIT-system.

> ➢ **Information systems**

The materials managers need direct access to the information systems in order properly to manage the materials flow in the organization. They most often need information relating to prediction of the production's demand, the suppliers' names and their characteristics, data on prices, the stocks levels,

production schedule, the transport directions and a lot of other information relating to the finances and the marketing.

Moreover, the materials managers also provide the firms' information systems with data concerning the materials stocks, deliveries schedule, pricing and information they have received from the suppliers.

> ➢ **The stocks planning and controlling**

What was said about the stocks in the previous part, and the concept that was elaborated, applies directly to the materials handling.

> ➢ **Reversible logistics**

One of the more important parts in the materials handling is the reversible logistics.

The materials allocating and recycling, excessive or outdated materials, returned products handling and defects, are some of the aspects of the program for reversible logistics.

And, at the end of this sub-point, it should be mentioned that the materials handling can be manual, mechanical and automated.

4. MRP-method application in the materials handling

In managing the stocks and the materials schedule, a very important approach is MRP to work especially with the materials and parts which demand depends on the demand of some ready products.

This concept has been known since 1960s of the previous century, but even with the appearance and application of the computers and information systems, the firms can use it completely.

MRP system is a sum of logically linked procedures and decisions specially designed for the needs of shortening the time for purchasing the materials indispensable in the production.

In this directions, Orlicky has defined the planning of the necessary material as

"a sum of logically linked proceedings, rules of making decision and reports that have an aim to translate the production program into net-demands in time-phases, and to indicate the planned covering of those demands for each stocks component, indispensable for implementing into the production program."

The MRP system plans the net-r *demands* and their covering according to the changes in the production program, stocks or in the production composition. Orlicky claims that "MRP systems realize their aim in such a way that they estimate the net- *demands* for each stock item, plan them in time phases and determine their right covering."
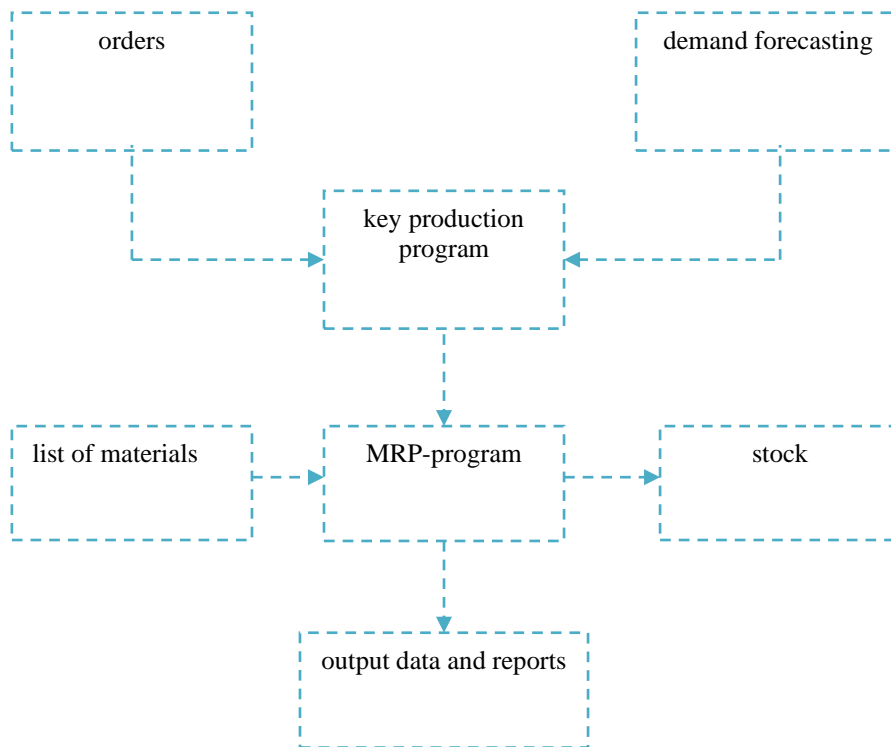
MRP is a method that is realized by the assistance of a computer. It takes into account the following: the production schedule in the firm, sales forecast, open orders, stocks and the list of materials with all necessary inputs in it. MRP starts from the fact that the demand for all components depends on the demand for the final products. Traditionally, the companies want to keep higher amount of materials and parts in order to avoid the possibility of the production delay. Of course, this practice is expensive one because very high costs for purchasing and the stocks storing occur. MRP is a direct challenge for this traditional concept, because it allows keeping minimal amounts of stocks, i.e. supplying the production process in all points in the moment when there is a need for some input.

The MRP-system aims are the following:

- To provide the materials, components and products availability for the planned production and dispatch to the consumers;
- To keep the smallest possible amount of stocks;
- To plan the activities of the material production, deliveries schedule and the buying activities.

In doing these things, the MRP-system reviews the current and planned quantities of parts and products for stocks, and the time used for planning, as well.

The MRP-system first of all determines the number of final products wanted by the consumers, and the time when they need them. Based on this, this system "ejects" the time schedule and the needs for the parts on the basis of the planned needs for the final product. The way of functioning of such a system is given in the following figure.

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  ┌──────────────┐                        ┌──────────────────┐
  │    orders    │                        │ demand forecasting│
  └──────┬───────┘                        └────────┬─────────┘
         │           ┌──────────────┐              │
         └──────────▶│ key production│◀─────────────┘
                     │   program    │
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  ┌──────────────┐   ┌──────▼───────┐        ┌──────────────┐
  │list of materials│─▶│ MRP-program │─ ─ ─ ─▶│    stock    │
  └──────────────┘   └──────┬───────┘        └──────────────┘
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                     ┌──────▼──────────┐
                     │output data and reports│
                     └─────────────────┘
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On the basis of the consumers' orders, and on the basis of the demand predictions, the main production program is formed. It drives the entire MRP-system. Namely, the plan for the main production program gives all details about the kind and the characteristics of the final product to be produced by the company, and the time when the consumers need it.

The base for the necessary materials, i.e. list of materials, gives the right amount of raw materials and components needed for production and completion of the final product. Besides defining the needs for the necessary amounts, the database of lists of materials also shows when each individual input must be available. This database also defines the way in which the different inputs interfere, and at the same time it shows their relative meaning for the final product production.

The part referring to the situation with the stocks consists of reports on the stocks amount, so the company may deduct the current available amount of stocks from the gross- *demands* and in that way to be able to estimate the net- *demands* any time. Or:

Gross- demands – existing stocks = net- demands

This part also contains a lot of significant information concerning the needs of safe stocks and the time limits when the goods should be ordered again.

Based on the needs for the final product, and the information from the list of materials, the MRP-program first puts the needs for the final product into the gross- *demands* for appropriate parts and other materials. Then, the program estimates the net- *demands* on the basis of the information for the situation with the stocks and sends the orders for the needed inputs into the process of production or assembling. The orders meet the needs for precise amounts of materials and the time schedule for those needs.

After a firm finishes its MRP-program, it gets several basic output data and reports which will be helpful for the managers included in the logistics, material production and assembling. Those are in fact the

outputs of the MRP-program in a form of reports referring to the following: which quantities should be ordered by the company and when to do that; the need of accelerating or amending the date of receipt or the needed amounts of products; cancelled needs for the product and MRP-system state.

As advantages of the systems based on MRP, the following ones can be mentioned:

- They try to keep reasonable levels of reserve stocks, and to decrease the stocks maximally or to eliminate them every time when it is needed and possible.
- They can recognize the problems even during the process, and the potential disturbances in the supply chain, rather earlier before they occur, which enables taking corrective measures.
- The production schedules are based on a real demand, but also on predictions of the needs for the final product.
- They coordinate the materials order in all points of the company logistic system.
- They are the most suitable for production in doses or periodical production.

But, as disadvantages of these systems, we can mention the following ones:

- Their use is computer-dependable, and as a result of that, sometimes it is difficult to put in some changes when the system is started on.
- On the account of the maximally-coordinated system for products order into small amounts, depending on the needs, the costs for the order and transport costs may significantly increase.
- They often become very complex, and sometimes they do not function as it is predicted.

In the 1980s of the previous century MRP-system was complemented by MRPII (Manufacturing Resource Planning), which means the production resources planning. This system is more comprehensive and allows the companies to integrate the financial planning and the operations/logistics.

The key characteristics of MRP II are:

- Methodology for efficient planning of all resources in the producing firm.
- Operative planning of the production units, financial planning with a simulating possibility for getting an answer to the question "what-if".
- It comprises different functions, mutually connected, such as business planning, sales planning, arranging, the materials and parts planning, the buyers' requests planning.
- The outputs from this system are integrated into financial statements (business plan, responsibilities towards the suppliers, delivery and planning of the incomes, the stocks predicting etc.).

On the other hand, ERP presents an attempt to integrate all departments and functions in the company into a unique computer system which will be able to meet the needs of those departments by information. Each department has its computer system adjusted to the specific needs for information and way of working, but ERP combines and integrates them into a unique database in order to be able to share the same information and to communicate easier. What is characteristic here, is that each department separate software is a module in the ERP-system, and so there are modules for production, finances, marketing, human resources, logistics etc., depending on the organization and the needs of the company.

The roots of the ERP-system are in the MRP I – Material Requirements Planning and MRP II – Manufacturing Resource Planning.

However, the method for planning the products distribution (*Distribution Requirements Planning)* enables *just-in-time* distribution of the products. As a concept it was developed in 1975 in the Abbott Laboratories, and in 1983 it was successfully implemented in the American Hardware Supply (Servistar today) and the Mass Merchandisers Inc.

Basically, the planning of the products distribution (**distribution resource planning**) applies the principles and techniques of the MRP-system, but on the movement and storing of the ready products intended for the market.

Using the best available forecasts for the demand for ready products, DRP develops time-phase plan for distribution of the products from the factories and warehouses to the places where they will be available for the consumers.

DRP, compared to MRP, is very well prepared to answer the real market needs in the view of the products availability and the efficient time of receipt. The most significant difference between MRP and DRP is that DRP can adjust, modify and again adjust its schemes of orders for matching the dynamic, changing needs for stocks. The DRP-approach also readily answers the needs for stocks for the whole system, contrary to those that are precise only for one sector.

The DRP application understands use of software support and comprises the following steps:

- Identification of the projected needs on the lowest level of a distribution network according to the planned periods on the basis of the predictions of the demand for final products;
- Generating reports for starting planned orders by using MRP-logic and issuing an order (and/or production schedule) on the next higher level of the distribution network;
- Estimation of the projected needs by planned periods on a higher level, under influence of issued orders of lower level;
- Returning to the second step until the highest level of the distribution network is achieved.

Today, there is also a concept called *Flowcasting* (strategic prediction of a retail sale) which is of high importance and is in a way an extension of DRP. This concept allows managing the products stocks flow from the depots on the shelves of the retail spots up to the factories which realize the products production. So, the basic function of the *Flow casting* system is predicting the needed products on the level of retailers and based on that, the stocks planning and completing.

5. Bar-code technology and RFID technology

Today, the bar code technology and RFID technology are the most frequently used technologies for automatic identifications of objects.

For more than 30 years, the bar-code technology has been allowing rather higher and faster flow of information and products. The bar-code is a number converted into an array of dark lines and a light inter-space, which enables the electronic equipment to read the product data. At the beginning, the bar-codes were displayed in lines with different thickness, while today they appear as dots and concentric circles.

The bar-codes can be read by the means of an optical scan called optical reader or can be scanned with an image by a software.

The first patent for linear bar-code was issued by J. Voodland and B. Silver in 1952. Today, the bar-codes are mostly used on the products packages, as per the request of the American food industry.

The basic elements of the bar-code technology are:

- Marks – lines and empty space between them. The group of lines and the empty space is in fact a coded mark for the producer or product recognition or some other relevant characteristics.
- Appliances – that are used for information reading, and they can differ in the speed of information reading, the distance from which it can read the information and in the conditions which should be provided in order to read the information.
- Equipment for connecting the appliance for reading and the appliance for information processing.
- Symbology – Up today, there are over 200 bar-code symbologies or languages, but few of them have practical use. Each bar-code symbology has its own rules of coding, signs, decoding, etc. The symbols differ in the way in which they show the data and in the kind of data they can show – use of numerical, alpha-numerical signs etc.

While the RFID-technology (Radio Frequency Identification – identification by use of radio-waves) has higher advantage than the bar-code technology, because it enables the product following since its

creation up to the end consumer. Namely, the bar-code technology allows identification of the producer and the product, but not of the special item (the products of the same kind have the same bar-code). The RFID-transponder has an identifier – a serial number for only one product, so the following of separate products is easier. Another advantage of the RFID-technology is that it is easier for maintaining because it has not movable parts, nor optical components.

Elements of the RFID-system are: (Regodic, 2014)

- Transponder
- Reader
- Controller (host)

The transponder is the only identifier for the accompanying object. The reader sends radio-signal and in that way the transponder answers in order to be identified. Then the reader converts the received radio-signal into data that can be submitted into the system for processing, and after filtering and analysis to take an appropriate action on the basis of the received information.

Conclusion

Materials handling covers all aspects of all movements of raw materials, work in progress or finished goods within a factory of warehouse. Materials handling comprises 4 activities: predicting the needs for materials; determining the materials sources; the materials delivery into the organization and monitoring the state of the materials as current assets. Considering the fact that the key role of the material handling is: to increase effective capacity, to minimize aisle space, to reduce produce handling, to develop effective working condition, to reduce heavy labor and to reduce cost every firms should take activities in way to improve material handling.

Here are some tips to help get the most out of material handling operations:

- more parts in less space
- more productivity & efficiency with less manpower
- more accuracy with less error
- more picking and less walking
- more orders out the door in less time
- more automation with less manual work
- more safety with less product damage
- more revenue generating activities in less storage space
- more green with less energy etc.

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