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INVENTORY MANAGEMENT IN DYNAMIC CHANGES IN THE MARKET ENVIRONMENT

Petr Besta
University of Entrepreneurship and Law, Michálkovická 1810, 710 00 Ostrava, Czech Republic,
petr.besta@vspp.cz
Vendula Fialová
VSB - Technical University of Ostrava, Ostrava, Czech Republic, EU,
vendula.fialova@vsb.cz
Martin Čech
VSB - Technical University of Ostrava, Ostrava, Czech Republic, EU,
martin.cech@vsb.cz

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Abstract: In the area of production planning and material resources, manufacturing companies often find themselves in difficult situations. On one hand, pulses in the form of market incentives difficult to estimate come to the enterprise, on the other hand, every production entity tries to plan all production processes as realistically as possible. Therefore, two systems that are diametrically opposed come into conflict. The fundamental problem often arises in the area of inventory management. The production tries to satisfy the highly stochastic demand to the maximum extent, but it tries to manage the resources it uses by deterministic methods. In inventory management, one of the key roles is played by the variability in their consumption. If the majority of planned production orders is based on orders, or if expected consumption can be predicted with high probability, a range of exact logistics tools can be applied in inventory management. With increasing degree of variability in consumption, combined with long delivery times, however, the information value of these methods is significantly reduced. This article analyses the use of the concept of safety stock as a tool for correction of strong changes in the current market environment.

1. Introduction

Methods for inventory management can be generally based on the principles of statistical analysis or simulations. Statistical methods are based on analysis of past consumption and production requirements, on the basis of which they try to predict optimum inventory levels. If the development of future consumption converges with the previous period, conclusions drawn in this way have a high information value. Simulation methods are normally used in situations when there is not enough relevant information, or significantly different future scenarios of development can be expected [1]. A simulation model then allows the evaluation of the consequences of serious situations. In real practice, mainly the statistical methods based on statistical analysis of historical data are applied. Therefore, scheduling and inventory management is often based on the analysis of data that may no longer be current. Conclusions drawn and defined forecasts may therefore have a limited validity. However, in the case of inventory management, we can correct any deviations using the model of safety stock.

2. Stocks in the manufacturing plant

Stocks are perceived as an imminent natural element in the manufacturing and distribution organizations. Stocks mean the part of utility values which have been produced but not yet consumed [2]. Stockholding represents benefits, as well as risks for the manufacturing enterprise. The main advantages of stocks can be classified into the following points:

- Stocks contribute to solving time and capacity disharmony in the production company,
- Stocks promote the production of a wider range of products,
- Stocks contribute to realizing the manufacturing process in the optimum range (good production batches),
- Stocks contribute to minimizing the impact of unpredictable fluctuations and failures,
- Stocks minimize the impact of unexpected supply outages [3].

The negative impact of the inventory can be seen in the fact that they lock up capital, consume more work and resources carry the risk of loss of value, and the risk of becoming unusable and unsaleable [4]. Increasing competition in the markets together with high interest rates for short-term loans may lead to the fact that the capital invested in stocks is missing for financing technical and technological development, it threatens the liquidity of the company and reduces its credibility in negotiations for credits [5].

Stocks are undoubtedly a factor that significantly affects the competitiveness of any company. High levels of inventory causes the allocation of funds in stocks, but they also optimize the adequate flexibility of supply. Both of these effects, however, are antagonistic, and it will always be important to find a compromise. In the case of manufacturing companies, stocks represent one of the financially most voluminous categories. It is one of the reasons why decisions regarding the inventory management system are often of strategic nature.

3. Risks associated with lack of supplies

Lack of supplies for the production can have many causes and it can seriously affect the continuity of the production process. Large fluctuations or higher and unforeseen material consumption will mean the emergence of shortages of raw materials. The same problem can occur when the cycle of the order realization is extended. For the company, these facts may represent a threat for the work flow, a risk of failure to meet delivery deadlines, or even the loss of a customer. One of the ways to avoid these problems is keeping extra – safety stock. In this case, it is necessary to consider the costs of maintaining safety stock and the risks and losses associated with the depletion of stocks. The specific amount of safety stock can be determined either through simulation or statistical methods. Maintaining safety stocks at a level that would prevent inventory shortages in all cases would be unnecessarily costly for the company. Impacts of deficiency that occurs once a year can be much smaller than the cost of maintaining extra supplies year-round. For this reason, it is normal practice that the company decides to maintain safety stock that protects it not in all cases, but, for example, in 80 % of all cases [6]. The percentage of cases when no shortage of supplies occurs is called the level of service. In other words, it is the probability that the size of the demand during the cycle of the order realization will not be greater than the available supply. The greater the level of service, the higher the required safety stock and the associated costs of maintaining inventory, but the lower the possibility of lack of supplies and its impact. One hundred percent service level means that the probability of lack of inventory is zero and all demand will be satisfied [7].

Statistical approaches to determining the level of safety stock may be significantly different. The simplest option is to determine the multiple of the standard deviation of consumption. This principle is quick and easily applicable to virtually all areas where stocks are created. However, the approach to determining safety stock in this way is considerably simplified.

A more relevant approach is based on the evaluation of the probability distribution of demand and the order realization cycle. Within this concept, it is assumed that the variation of both parameters can be described by a normal distribution. It can often be used to describe sales of finished goods of the production enterprises or general goods in commercial enterprises. In this case, it is then possible to calculate the safety stock using the basic statistical characteristics, such as the arithmetic mean and standard deviation. The relationship to calculate the necessary amount of safety stock then has the form of the formula 1:

$$PZ = k\sqrt{\overline{R}\cdot(\sigma_d)^2 + \overline{D}^2\cdot(\sigma_R)^2} \qquad (1)$$

This model of safety stock is based on the assumption that future data on the consumption and the order realization cycle will be similar in nature to the analysed data. If future material consumption is of significantly different character (variability), the information value of this method will also be limited.

4. Determining the appropriate level of safety stock

Determining the safety stock level can be demonstrated on the stock item, for which we have available data on the consumption and delivery time. The data are displayed in the context of Table 1 and they are based on the real needs of the company in the area of forming the material. In the case of consumption, the data are provided for thirty days.

Table 1 Input data about the particular stock item

Day	Consumption (Pieces)	Delivery (days)
1.	0	5
2.	3	4
3.	2	6
4.	1	8
5.	1	7
6.	2	
7.	5	
8.	3	
9.	2	
10.	2	
11.	4	
12.	2	
13.	2	
14.	4	
15.	2	
16.	3	
17.	2	
18.	4	
19.	4	
20.	4	
21.	3	
22.	2	
23.	4	
24.	1	
25.	2	

26.	4	
27.	3	
28.	2	
29.	4	
30.	6	
Average	2.70	6.00
σ	1.39	1.10

For the time of delivery, the data are provided for the duration of the last five orders (delivery cycles). Based on these data, we can perform a calculation of the possible level of safety stock based on Formula 1. For both monitored parameters of the stocks (consumption, time of delivery), we will determine the arithmetic mean and the standard deviation. The results are shown is Table 1 again.

These values are then substituted to Formula 1 and the required amount of safety stock is calculated. It will be determined for the service level 85, 90, 95, 99 %. This allows us to choose an appropriate strategy for inventory management later, where it is possible to use any level of safety level. However, it is necessary to be aware of the fact that the level of service is essentially the level of the risk that the company is willing to undergo. Therefore, in the case of service level of 85 %, the company accepts a 15% risk of a shortage of supplies. Each level corresponds to a specific value of the hedge ratio which is based on Gaussian curve. The determined values of safety stock then have the following values:

$$PZ = k\sqrt{\overline{R}\cdot(\sigma_d)^2 + \overline{D}^2\cdot(\sigma_R)^2}$$

$$PZ(99\%) = 2{,}326\sqrt{6\cdot 1{,}39^2 + 2{,}70^2\cdot 1{,}10^2} = \underline{\underline{10{,}51}}$$

$$PZ(95\%) = 1{,}645\sqrt{6\cdot 1{,}39^2 + 2{,}70^2\cdot 1{,}10^2} = \underline{\underline{7{,}41}}$$

$$PZ(90\%) = 1{,}282\sqrt{6\cdot 1{,}39^2 + 2{,}70^2\cdot 1{,}10^2} = \underline{\underline{5{,}78}}$$

$$PZ(85\%) = 1{,}036\sqrt{6\cdot 1{,}39^2 + 2{,}70^2\cdot 1{,}10^2} = \underline{\underline{4{,}67}}$$

Due to the fact that the given stock is registered in pieces, the determined values can be rounded to whole numbers. For rounding, we can apply the normal rules of statistical rounding. Thus the estimated value of safety stock represents an amount below which the supply should never fall. If we display everything graphically in a simplified form, the determined general level of safety stock is shown in Figure 1; it is marked with the abbreviation PZ. The symbol Q1...n represents a specific amount of a regular order. This diagram is based on the concept of Harris-Wilson model of stock consumption.

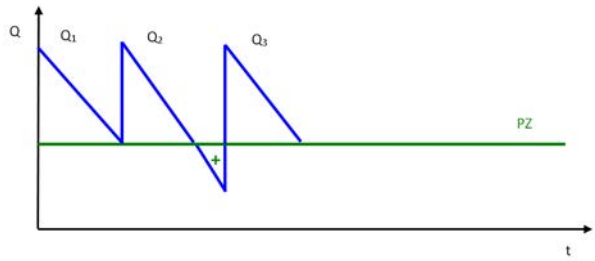

Figure 1 Graphical representation of safety stock

In the event of an unexpected high consumption, it will be the covered from safety stock. In the event of drawing of stocks, there is no production interruption or threat to the continuity. For analysing the stock for which the amount of the safety stock was determined, we can recommend the use of values determined mainly for the service level of 90 % and 95 %. This is mainly due to relatively low variability in the consumption of the reserves and simultaneously low fluctuations in supply. Here, however, we must also take into account the extent of the potential damage resulting from lack of stock. In the event that it is the case of a stock item, the lack of which can mean high costs, it is necessary to take advantage of higher levels of safety.

5. Conclusion

Inventory management is carried out in the current market conditions in the large variability. Safety stock protects manufacturing enterprises against lost output and threat to the production continuity. Correctly set safety stocks then simultaneously reduce the costs associated with capital locked up in inventories. In the case of the applied model, it should be noted that the effectiveness of the identified safety levels is also influenced by the nature of future consumption. If this is significantly different from the analysed data, the quality of the detected levels of safety stock will not be sufficient. Generally, it is important to note that in the case of safety stock, the current market trends have to be continuously monitored and their amount continually optimized. The current dynamic market environment will also bring big changes in the requirements on stocks that may be rather different in the short term. Therefore, it will always be necessary to compare the determined values with the current market developments.

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IMPROVING OF MATERIAL FLOW IN AUTOMOBILE ENTERPRISE

Veronika Verebová
Technical university of Košice, Institute of Logistics, Park Komenského 14, 043 84 Košice,
veronika.verebova@gmail.com

Keywords: material flow, logistics, information systems, simulation systems, system analysis
Abstract: Today's market puts more and more pressure on manufacturing companies. If the company wants to keep on market and to prosper, it is necessary to constantly innovation of the products, to better calculate the prices, to control costs, to be flexible in the relationship to the customer. Requirements on the logistics are constantly getting harder and more differentiated. Production companies are forced to tolerate piece production for the customer with rapid supplies. So that the production could be effectively implemented, it is necessary to constantly maintain inputs and outputs of material with customer requirements. The aim of logistics is to increase the efficiency of logistical processes, since only properly working logistical processes ensure the cost competitive and properly functioning society. Each of companies understands the logistics from different views. It depends on the specific company, field of activity and sector. For one of the companies it is a planning for another it is purchase and shipping, or handling with materials in the production.

1 Introduction

To ensure the fluent material flow it is necessary to constantly monitor and provide input and output of material according to customers' requirements. For material flow there are a number of definitions, however, I define at least one: “Material flow is controlled by the movement of material, raw material, semi-finished products, products in progress , the media and others in the production and distribution sphere” [1].

To streamline the material flow in translation means to find the effective level, to ensure a smooth flow of material, to prevent from downtimes or missing material, to minimize the costs, staff, to reduce the time of transport operations [1].

Material flow analysis mainly takes place in order to effectively manipulate with the material through the various steps of the production process. In order to make the flow effective, it is necessary to ensure direct flow of material by the shortest way and without unnecessary stops, obstacles, detours and counter movement. „In practice, we know several methods of material flow analysis, which can be divided into 4 groups. Wherein each of the groups has different conditions of relations of basic input SPMT data, compound of material and its quantity.

- Phase “A“ – characterizes such a production system that produces a few types of product in a large number. In this case, the material flow is analysed by the production process method scheme.
- Phase “B“ – characterizes the company with relatively large production volume and the relatively wider range of products of production program. For the analysis of material flow in this case, we use a scheme of production process for more products.
- Phase “C“- is a transient phase that characterizes the production of production process, in which the middle number figures, but a wide range of similar products. After the grouping of similar products, similar technological processes and selection of product representatives, there is applied, according to the number of representatives, either method of phase “A“ or “B“.
- Phase “D“- characterizes the company with the production of small volume but relatively very different product range. For analysis in this case is preferably used checkerboard table [1].

It is possible to divide material flow into two main groups:

- active group of material flow, where there are transport-handling and storage devices classified,
- passive group of material flow, where there are material, raw materials semi-finished products classified [2].

The role of the active logistical elements is to physically secure movement and manipulation of passive elements. On the other hand, passive elements are during handling and transport more like the handling unit with which it is manipulated.

French multinational company with production sites across Slovakia manufactures components for the automobile industry. Košice plant has been producing door panels, which assembly is realized in a Boblingen. The material is provided to the company by 70 suppliers, who are mainly from abroad. The main supplier for leather and PVC is Hungary, for the input material is the supplier from Hungary and Spain.

2 Material flow, warehouse - production

After the material entering to the warehouse and subsequent delivery to the chipping, the process is managed through Kanban. The material is, after the chipping of required components, gradually moved to the

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Rollercoating, by using the FIFO system, from where it is further moved by FIFO to lamination. Material is after the lamination temporary stored in the shopstock, where there are consoles with the chipped material completed. From the shopstock, again by the Kanban system, the operator-Kanban specialist supplies workplaces according to the regular control which material is missing on the given workplace. After the recording of missing material and returning to the shopstock for material, the specialist supplies the given workplace and subsequently returns Kanban card back to chipping, where the released material is chipped again.

After the entering of material into the warehouse, following input check made by the worker, operators supply individual workplaces with the material. These workplaces are supplied by so called electrical logistical trains. Each employee has his own "logistical train " that supplies the assigned workplaces by regular supply of input production material from one side of the workplace, while at the same time it takes finished products intended for the warehouse for the temporary storage from the other. Operators also have set times for supply and collection of finished products. At each shift there are four operators, where each serves assigned workplaces.

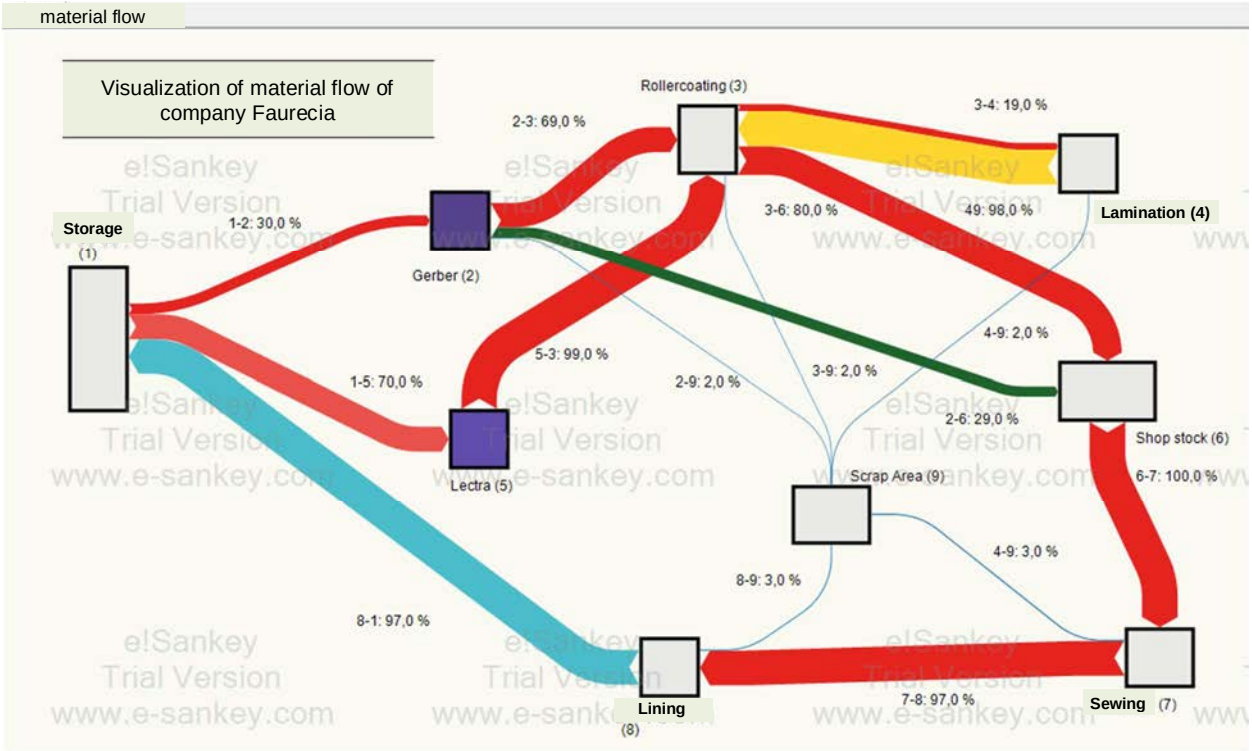

Figure 1 Visualization of material flow

Figure 1 is a visual representation of material flow, which is moved from the warehouse after the input check of the material (leather or PVC) to the chipping, where there is material rolled on the disc, while the leather is prepared after the visual control and defect indication for the chipping of components, on which is the applied glue, foam, if the perforation is necessary, then it is moved to the specialized workplace in Germany. Stabling of single components of the leather or PVC follows after this process. Stabled components are further moved to the workplace where the actual coating on the woodfiber takes place.

For the production of already mentioned door panels a number of components are required, woodfiber is used as the basis on which are subsequently used various plastics, and finally it is the leather or PVC material, under which is located the base foam or even supplementary foam that is used for softening of the material.

3 Production process

The process begins with the income of the material into the input warehouse, where it continues according to the type of the material (PVC, leather) farther, where after the chopping of components, the material farther moves to Rollercoating and some components which are intended to lamination, which are parts intended mainly for the production of car, pass the lamination, where the foam is applied to the bottom of the material. Subsequently, the pieces are placed in shopstock (temporary warehouse) where the operator farther supplies the sewing workplace with the material, where the components after the sewing wander farther to the

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final coating line. Leather is supplied from the warehouse of input material where it is subsequently after the visual inspection and identification of defects by the operator with the marker for it, components will be chipped. The leather is covered by the transparent protective film before the chipping to prevent possible damage of the material. We distinguish three areas of cutting, zone A, B, C, while the highest quality requirements are placed on zone A and in zone C there are already authorized certain types of defects.

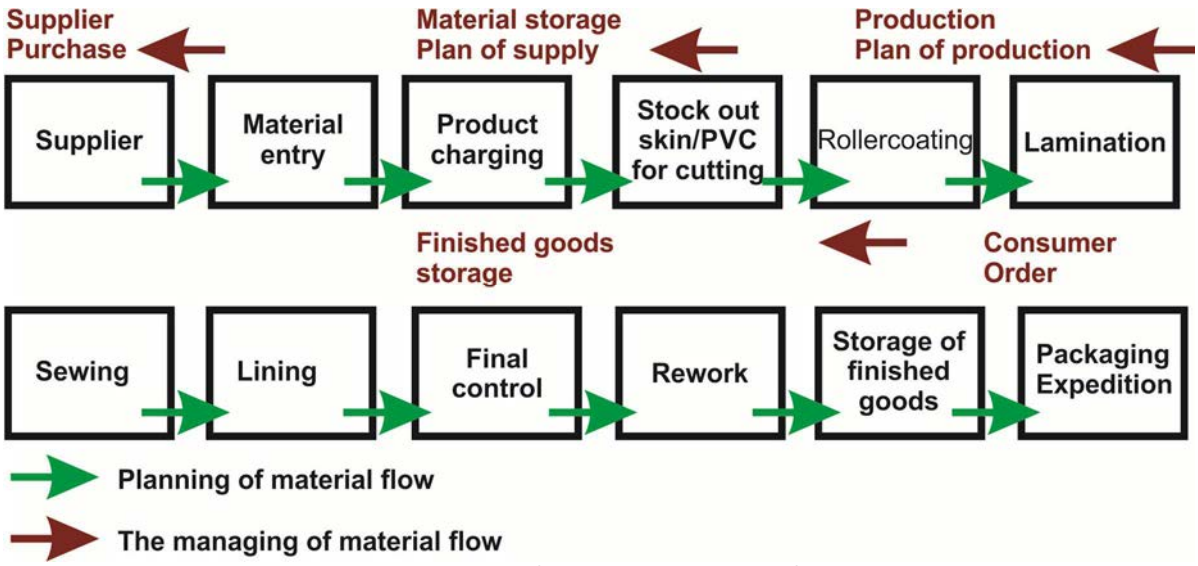

Figure 2 The production process of the material processing of automobile seats [3]

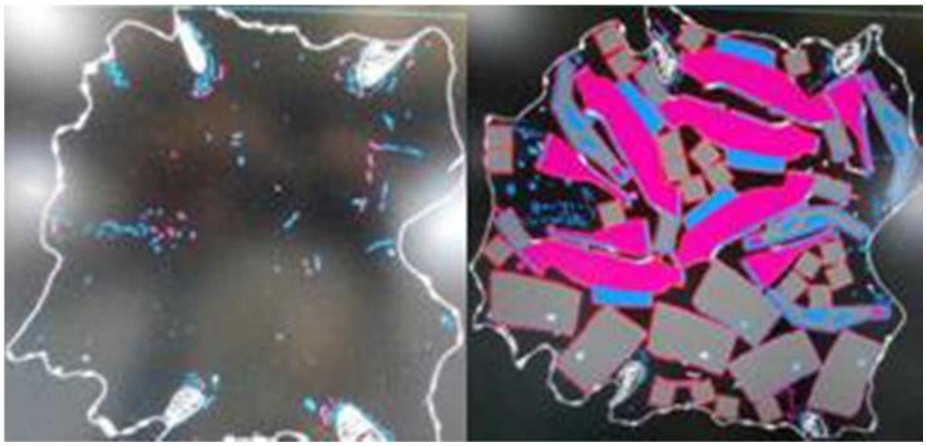

Figure 3 Indicated defects, chipped components [3]

Figure 4 Shopstock (temporary warehouse of the material) [3]

4 The streamlining of material flow

Current problems in production can be improved by proper functioning of the Kanban system. However, the system requires careful implementation, employee training, or change of the layout. The analysis reveals that the company had introduced pull production management system also based on Kanban. However, when conducting a detailed analysis, the problem was detected when using the system, but also there was created space for the implementation of Kanban, and more precisely in the coating process.

When using Kanban system, it is necessary to storage the material into the crates and then on the shelves. This activity would be provided by the operator servicing the logistical train. At the moment, when operator on the coating workplace would have consumed all the material, GAP leader would provide desired material stored in the crate and operator would be continued in the work. Each piece should have its Kanban card that would be included in the sequencer. The operator would read from the given card what he needs to produce. Subsequently, the card would travelled along with the material throughout the production process to the final control, which, after a careful checking of the product along with the Kanban card, can store the product on the shelf ready to save of the finished products before moving of these pieces into the warehouse. After the withdrawal of pieces from the shelves, the Kanban card is returned back to the sequencer on the sewing workplace.

5 The streamlining of warehouse arrangement

The defined storage, just like the system of products laying on the defined space represent the current active state in the storage. For the following years, it would be appropriate to determine the storage space for the most frequently used material that would be as close as possible to the production. This means, that it is firstly necessary to define the most used material and vice versa with the least. Then, it is necessary to define the storage space that would be the closest to the place of the removal place. The gain is represented by the savings in the manipulation time of the storage workers, removal and by the prevention of the downtime when the shifts change.

Conclusions

According to the analysis, the main causes of the downtime and missing material was the long waiting for input material scanning, which had to be transcribed from the storage and also the crossing of the two logistic trains, which endangers the production, because of the lack of continuous income of material. Another observed problem was the disregard for Kanban system by employees. We should divide disregard into the employees, who refused to respect it and employees, who did not have sufficient information about the given system. One of the benefits for the company is the introduction of the system Warehousemanagement system, which ensures perfect overview of the material and finished products in the company, specify the warehouse operations and significantly reduce error rates. At system boot and its perfect overview of the material and products in warehouse, there would be a clarifying of order picking and clarification. By this it would no longer be necessary that operators would be searched at the last minute in the warehouse products intended for shipment. Another important factor is that the WMS system is not based on the human factor and therefor there is no threat of errors that are often caused by the human factor. In this case, it would save the time that the company had spent on employee training, as in the WMS system there is no need for lengthy training, system itself navigates employee where he can the given product finds. Subsequently, the system will announce using a voice tag also the right number needed for shipping. The only training that had to be undergo by the employees is the one, that teaches how to as effectively as possible save the material/product on the pallet, how to fix, stack and sort it.

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INFORMATION LOGISTICS AS MEAN OF SECURITY OF COMPETETIVENESS OF COMPANIES

Daniela Pristačová
Technical university of Košice, Institute of Logistics, Park Komenského 14, 043 84 Košice,
daniela.pristacova@student.tuke.sk

Keywords: information logistics, information backup, information flows, companies, competitiveness
Abstract: This article is concerned with analyze and with possibilities of increasing of competitiveness of companies within the Europe via means of information logistics. The article is targeting especially European logistical association (ELA), which expressively contribute to the increasing of awareness and competitiveness of the companies in the Europe, within analyze of the problem. After the detailed analyze of the companies, which belong into this association, it is possible to come to the certain assumptions, which should small and middle companies in Slovakia meets, so that they would integrate into this significant association. The part of the synthesis is not less interesting. The article solves project of information security of the companies, by which it is possible to reach competitiveness of the companies at the international level.

1 Introduction

Information represents an inseparable part of everyday life. Their value increases mostly when they are exactly formulated and when they have considerably explanatory ability, they come in right time and on the right place.

Nowadays are information the source of wealth, they allow fast reaction of the company to abruptly changing market and they mutually help to increasing of competitiveness of business subjects. Every company, which wants to survive on the market, have to promptly reacts to environs influences, which are acting on it and especially it has to know how to adapt to new conditions of marketing environment.

During the increasing of competitiveness there also helps European logistical association (ELA) – major company that brings together subjects across the logistic field across the whole Europe and helps them to develop, continual advancement and dissemination of information in logistics. Due to the fact that Slovak republic has no representative in this association, this diploma thesis is focused on this association and tries to identify the environment, in which it acts and what assumptions must company fulfills to become a member, since membership in this organization would be a huge benefit to the further development of logistics in Slovakia.

Based on the analysis of the environment, in which European logistical association (ELA), member associations, as well as companies in Slovakia act, it is possible to create an information security project, which contains solution at financial and information point in relation to the identified shortcomings and increasing the competitiveness of the companies.

2 Information

It is possible to include the information to the most important aspects that affect the decision-making and management of the enterprise. Recently, they become the source of power and they are necessary for the realization of different functions in the management (control, planning, organization, leading of the people, etc.). They are the main condition for success in the work of managers and it is possible to consider them as important in the company as the material, various devices and equipment, personnel or time. They are very important because of the influence of efficiency of behavior and communication of the managers.

Information is frequently used term in any area of life and has a wide range of interpretations. The term information comes from the Latin word informo – informatio – informare, which means moving of messages, notification but also describing of something.

"In the most general understanding is the term information understood as something, that is notified, i.e. perceivable image of the known or assumed content of the facts available in adapting of the man to the environment"[1].

Based on the different understanding of the term information, it is possible to classified three basic groups that illustrate delimitation of the definition the best [1]:

- Mathematical delimitation – definitions belonging to this specific group focus on the information that acts as a parameter. This parameter is trying to decrease or eliminate entropy (uncertainty), resp. uncertainties in the recipient,
- Practical delimitation - is based on the possibility, where the information are mainly used practically in various decisions, which basically means that information are used during decision-making process,
- Technological delimitation - focuses more on the relationship between data and information. The definitions, which make up this group, say nothing about

reducing uncertainties or about the fact how to use the information during decision-making process.

"The definition of the information should be based on the fact of its unique resolving power from the other terms, which processes of change notification and results of objects and units interaction transfer"[2].

3 Benefits and risks of information support

When putting of information support into the practice, it is necessary "think one step ahead". If the information support is applied globally in each company, it can bring many benefits. The introduction of such support in the processes in logistics can help companies to improve all processes in the company. These can become less demanding and so the possibility of removing of the weak parts appears.

Information systems can assist in minimizing the threat of loss of goods or materials, thus helping to permanently reduce the cost of operation of the business.

Transparency of information support in terms of benefits in logistics process can mean the transparency of the process, e.g. in businesses related to transportation. Among the important contribution it is possible to include limitation of error rate that results from failure due to human factor [3].

Integration represents joining or even blending of all the information (data) into the one group. Integration can accelerate or made work more effective at any stage of the logistics process. Among the important benefits belongs also the archiving of internal and external documents or increase of productivity as well as reduction of laboriousness. One of the benefits that require a greater emphasis is to increase the quality and customer service.

When using information support (Figure 1) in the company as efficiently as possible, it is possible to achieve not only increase of the working efficiency with employees but also multiply the customer satisfaction of the company.

If there is information support implemented into the logistical process correctly then significant functional improvement of this logistics process occurs. This consists in improving the quality, not only in services but also in the quality information in economic field as well as in the actual access to information, whereas, in today's terms is this age called as information age. It is important, for information systems and information, to create some transparency and integration in order to allow information, that are in required amount, to specific users.

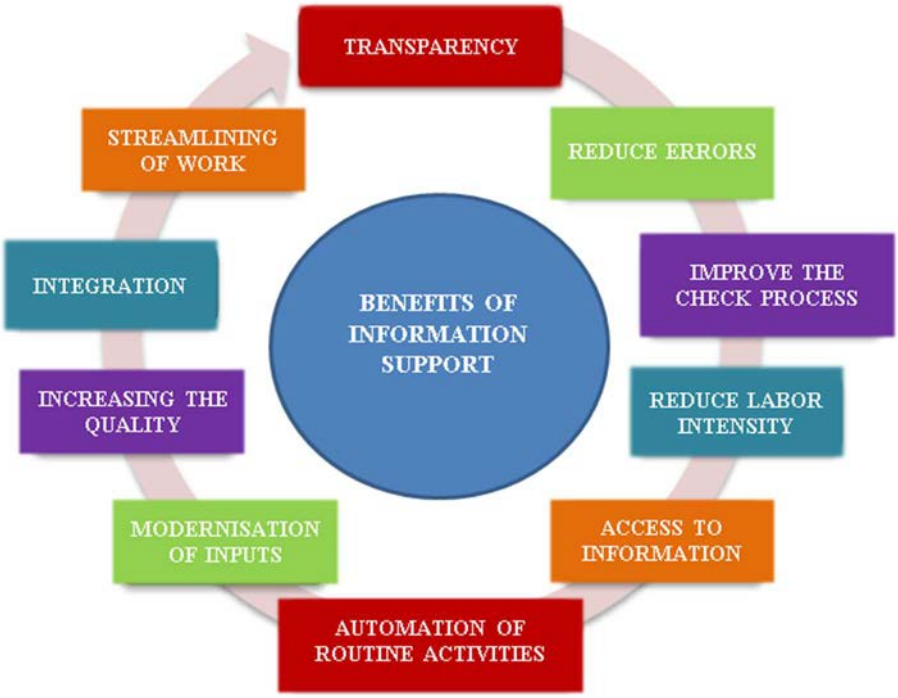

Figure 1 Benefits of information support [4]

4 ELA, European Logistics Association

ELA, European Logistics Association, is an association founded in 1984 and is based in Brussels, Belgium. The Association brings together 30 national organizations of Central and Northern Europe. The aim of ELA is to provide a public discussion on the cooperation of individuals or companies dealing with logistics within Europe, thereby furthering the development of industrial production and trading in Europe.

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European Logistics Association has created a comprehensive system of rules (standards) for the field of supply chains management and logistical systems - In order to increase the qualification level of European logistics experts and their implementation at national and European level. It has introduced a Europe-wide certification program for those logistics workers which satisfy this standard [5].

European Certification Board for Logistics (ECBL) manages the certification program at European level. It represents to independent bodies of ELA member countries that voluntarily agree to apply uniform qualification standards and adhere to established certification procedures to ensure the necessary quality of certification process. National certification centers operating certification at the national level, ECBL is methodically managing and re-examining them [5].

Information flows (Figure 2) extend between single subjects constantly, through various means of information support, for example: internet – internet applications in the form of web pages, electronic mail – mail communication, telephone networks – established hotlines. Information also take place in the form of various published materials, brochures, magazines or technical literature provided by the company to the general public. But also by organizing of congresses, various lectures, where individual companies may exchange the information and skills in the logistics field. Some feedback between organization and member associations is also creating there.

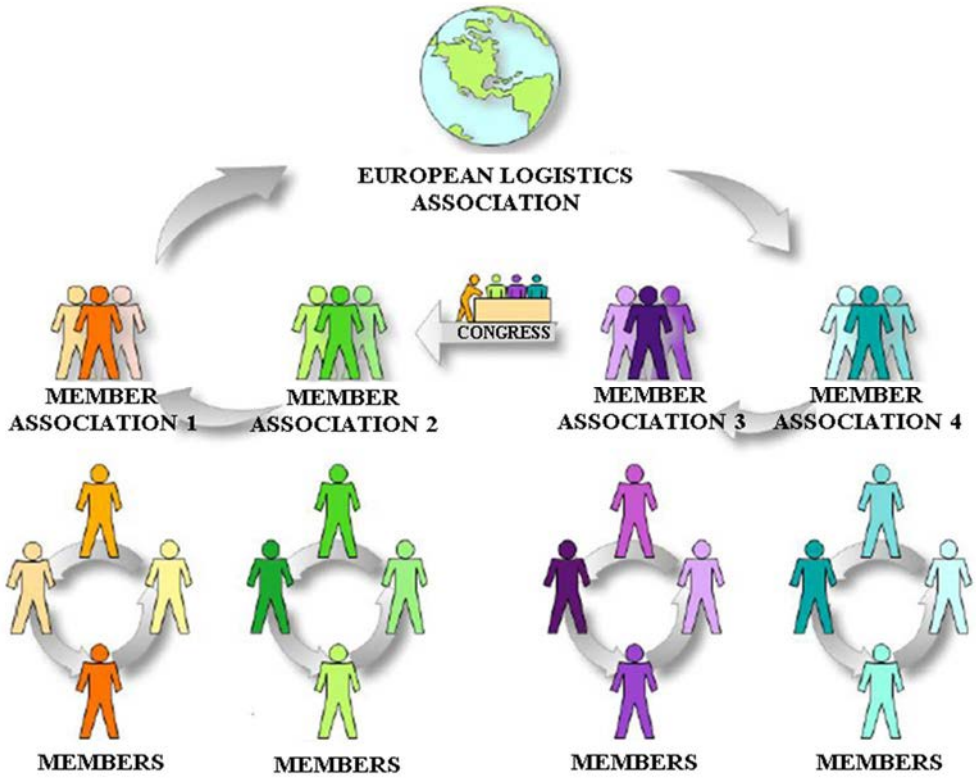

Figure 2 Information flow in ELA [4]

5 Information security of companies dealing with the logistics, ensuring the competitiveness

In Slovakia, there is a weak network of companies, which would be competitive in its field and within the Europe. Companies in Europe are economically more developed and therefore it is necessary that state authorities in Slovakia would make greater contribution to increasing the competitiveness of companies and the economic stability of companies.

As mentioned earlier, ensuring of competitiveness at the international level is possible with Slovakia's membership in ELA (European logistical association). So that Slovakia, which so far does not belong to the association, could become a member, it must fulfill certain fundamental conditions of membership:

- to find a company that has the same features as ELA, thus, the company focused exclusively on logistics, which have legal form: association,
- to set out the area for which the company will offer certification,
- to file an application for membership in the deadline, which will be published on the website of the association,
- to pay an annual membership fee and registration,

- to actively contribute to the development of the logistics, to disseminate information about the logistics, to educate in the given field,
- to support its members and ensure them professional help in dealing with logistical problems,
- it is not necessary to follow the structure of educational programs of ELA, preparation of training programs and courses is based on satisfying the needs of local candidates.

The terminology of the individual companies in Slovakia is disunited. Inconsistency in terminology worsens the access to the professional or scientific knowledge; it makes it difficult to subjects to communicate in professional as well as in everyday speech.

If the terminologies becomes established and unite, naturally there occurs a situation where minimizing synonymous variants of terms and many other terminological problems and barriers in communication will be destroyed.

One of ways how to align terminology is to choose from Slovak companies the one that will actively participate in its creation and unification. This fact can be provided for example by creating of register or a database of terms that will be mandatorily applicable for all the other companies in Slovakia.

The problem of varied terminology could be also removed through the membership in ELA (European logistical association) organization, which seeks to ensure the uniform terminology. The company takes the terminology over from association, which is recognized worldwide and by the usage of uniform terminology at the international level it is ensured that it would avoid errors, false, respectively misinterpretation of the terms.

6 Information support of companies

Internet nowadays represents a dynamic and the fastest growing market in which if the company wants to push through, it requires to present itself through the websites. Through the creation of webpage, it is possible to increase the market potential of the company and also to make company more attractive to the new, potential members and customers of the company. Nowadays this is one of the means, as you can share information easily, continuously and especially fast. The structure of the web presentation can be defined in terms of content and technical (design) page:

- Section “About us” provides brief information about the company and its history. It is necessary to describe what activities the company deals with, what goals and opinions holds the company, what is its primary mission. It is also important to write who are the target customers. This area may also include the organizational structure of the company as well as the general provisions in the form of a statute or code of ethics. This section provides information flow in relation to society and the general public, as well as in relation to the associated companies.
- Section “News” is dedicated to innovations in the field of logistics. It is possible here to provide information about events or changes in the association as well as information about events in the world in the past year. It is possible to provide information about the deadlines or for congresses, lectures, issuing new publications, etc. News allow the flow of information in relation to Member Company and ELA, as well as the company - customer.
- Section “Certification” provides the necessary information to companies that want to become qualified in their field. In this section it will be possible for the general public to provide information about the deadlines of the tests, the possibility of signing on, in what areas it is possible to perform the certification exam, which conditions must the company meet for granting of the certificate as well as a list of already certified companies and links to their websites. Information flows with connection to certified companies and also to customers who are interested in certification are provided by certification. It also allows the flow of information between the company and ECBL - European Certification Board for Logistics.
- Section “Projects” contains an overview of the projects solved by association. Focus can be on the following functions: are of the project focus, start and end dates of the project or even the content part of the project or persons responsible. It is possible to include here also references from companies where the individual projects take hold and how they have contributed to the improvement of production process as well as logistics within the given company. This section provides information flows between the company and the customer, who is interested in improvement of processes in production as well as the activities of her/his business.
- Section “Education” focuses on the forms of education that are organized by society for the general public, as well as other organizations and member associations. It should include a brief description of courses, seminars, conferences and workshops, as well as date for holding, necessary information related to the event logging in.
- Section “Career” solves the employment area where there will be briefly described job offers for candidates of each of the member companies, which conditions for employment applicants must meet and terms of the interviews in the given organization. This area provides information flows in the link between members of the association and individuals who are seeking employment in member companies.
- Section “Publication” solves the familiarization of the general public with information in the form of conference proceedings which are aimed at professional articles and contributions negotiated in conferences, congresses and lectures. It can also provide information about publishing of professional literature as well as the possibility of signing up in the newsletter withdrawing, where the public can find out always up to date news in the field of logistics as well as in world affairs. This section allows

the flows of information between the authors of the articles with each other as well as in Relation Company and the general public which is interested in the logistics branch.
- Section "Contact" provides in case of doubt by visitor of webpage and allows answering any questions. It is possible to contact the competent persons to arrange a meeting with them. For this option there are necessary contact information: the site of action of the organization, an e-mail address as well as telephone number or also office hours. This section provides information flow in Relation Company - competent persons that provide the information and the general public that asks for information.

Conclusions

This article provides a brief overview of opportunities, how to ensure the competitiveness small and medium businesses in Slovakia by the membership in a professional organization grouping similar companies in the logistics industry. Membership in the association ELA can help companies to become a leader in its field, and thus increase their awareness within Europe. After analyzing the problems, it is possible to identify major benefits of the integration of the company into the European Logistics Association (ELA) namely:
- company, that will integrate into the association, may have permanent access to current, free status information and events in the fields of logistics, which can be obtained from available sources from abroad,
- membership will provide, to the company, the opportunity to actively participate in all activities organized by the association, to contribute to professional and scientific articles in the issuance of publications (proceedings), books or magazines,
- to obtain mutual recognition and to increase awareness of companies across Europe,
- to participate in the establishment of certain common profile for logistics managers,
- by membership it can achieve unification of terminology contained in this field,
- to participate in the delegating competencies and skills in the logistics field between member companies within whole Europe,
- possibility to obtain a vocational competence to provide certification fitting to standards, which are ensured by ELA.

Increasing of the competitiveness of small and medium-sized enterprises can be done by the enriching changes in the field of information logistics, which is closely related with the information support. It is clear that an essential condition for the seeking of information is accessibility and transparency of information resources in the form of web pages. By the fulfilling of the required conditions, it is possible to not only respond to a request for information, but also to meet the need, and then enable the relevance of the information flow. By the realization of modern methods of web communication of companies in Slovakia, it is possible to raise customer awareness about the services offered to the general public and especially to ensure competitiveness within the national as well as the international environment in which companies act.

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OPEN INNOVATION SYSTEM IN E-BUSSINES WITH INBOUND MARKETING AND LOGISTIC USING

Erika Loučanová
Department of Marketing, Trade and World Forestry, Technical University in Zvolen, T.G. Masaryka 24, 960 53 Zvolen, Slovak Republic, loucanova@tuzvo.sk
Miriam Olšiaková
Department of Marketing, Trade and World Forestry, Technical University in Zvolen, T.G. Masaryka 24, 960 53 Zvolen, Slovak Republic, olsiakova@tuzvo.sk

Keywords: open innovation system, e-bussines, inbound marketing, distribution logistics, logistics
Abstract: This paper focuses on marketing and information distribution logistics within it, which is one of the most important elements in online sales as well as in e-business.The paper also brings knowledge about open innovation system in e-business with inbound marketing using. Open innovation system is connected to the phase of commercialization and communication with customers as the subjects of the innovation process. It provides information about all stakeholders' needs in the innovation process. The aim of the open innovation process is to effectively identify valuable and profitable innovation in business, as well as problems related to management decisions and practices in the innovation process.

1 Introduction

Nowadays marketing presents a tool of business linking with its environment and customers to meet their needs. In a rapidly changing market conditions, so it is necessary to react to changes and customer requirements as quickly as possible. That can be realized through involving them directly into marketing using the innovative tools that fall into the open innovation system of businesses and provides two-way communication with customers. The open innovation system in this case is the ability to share information among different subjects in the network [1]. Snyman et al. [2] mention that an open innovation system represents a significant competitive advantage with respect to the limited access to information in the context of in-house innovation process, known as closed innovation system. Real-time innovation process operates on five basic principles of courage, openness, realism, influence and sustainability [3]. Open innovation system is connected to the phase of commercialization and communication with customers as subjects of the innovation process, so it provides innovators with information about their needs as well as needs of all stakeholders in the innovation process.

As Wu et al. [4] state, the aim of the open innovation process is to effectively identify valuable and profitable business innovation, as well as problems related to management decisions and practices within their innovation process. It brings knowledge about open innovation practices at the project level and provides an enlarged model of market opportunity analysis for high technology markets.

Therefore, the open innovation process is a multi-disciplinary tool that concentrates on new products development and their marketing, where the distribution logistics plays a decisive role and it mainly aims at information. So the open innovation system uses inbound marketing and new innovative forms of marketing communication that are already based on two-way communication within the information distribution among stakeholders (see the Figure 1).

Two-way communication within the Inbound marketing is provided by social media, so the company receives from customers feedback on innovation as well as on chosen marketing campaign. Another advantage of two-way marketing are lower costs.

Inbound marketing is focused on the getting individual attention. This can be achieved by social media and content publishing that is attractive and interesting for customers. It includes blogging, educational articles publishing, publishing the troubleshooting guidebooks and contributing to forums. This presents producing the content that has a certain value and benefits for the target customer. Moreover, it is available free of charge, which also creates a positive brand link with the customer. The likelihood that so involved customer buys the goods is growing. The whole process is cheaper and has a higher effect [5], [6], [7], [8], [9].

Inbound marketing is based on two-way, interactive communication with customers coming through search engines, social networks and different links. The aim and effort of inbound marketing is to entertain or to educate the customer. Within this kind of communication the customer gets a certain value.

In the future it is expected that 61 % of marketing employees are planning to increase expenditures on inbound marketing next year. It is confirmed that the average budget of companies allocated for blogs and

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social networks doubled during last two years. It has also doubled the number of marketing employees who think that Facebook is irreplaceable in their business. In the global market 67 % of B2C (business to customer) companies and 41 % of B2B (business to business) companies have gained customer by Facebook, and 57 % of all companies have obtained a customer through a corporate blog. The answer to the question why inbound marketing is becoming so significant is that the price, respectively the costs used to address one potential customer is about 62 % lower compared to traditional outbound marketing [5].

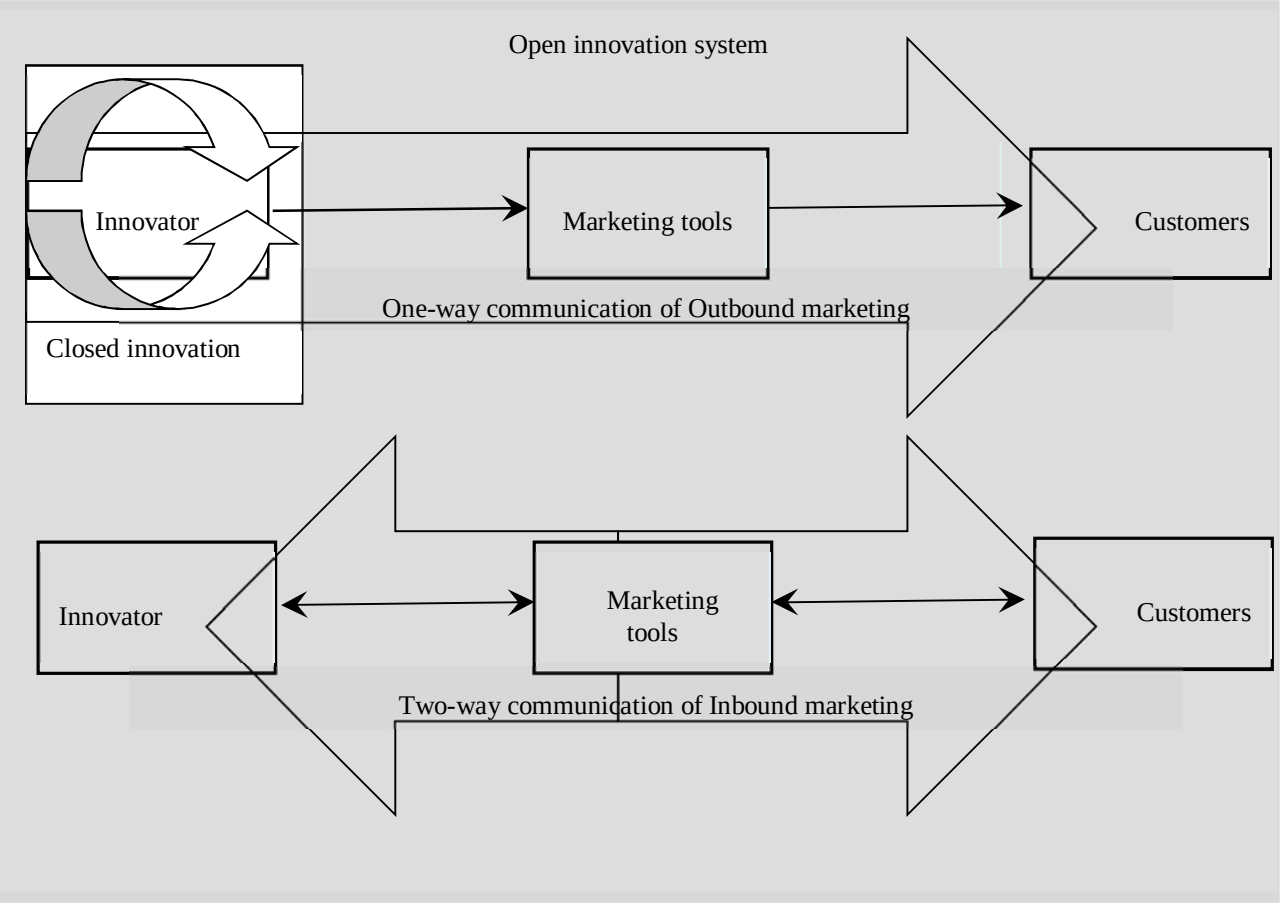

Figure 1 Information flow within the open innovation system for marketing effectiveness
Source: Own processing

2 Logistics of the open innovation system in e-bussines with inbound marketing using

At present e-business reaches a big boom due to the limitless possibilities of the electronic world, ranging in different business areas such as electronic sales, control, electronic commerce management, logistics, marketing and so on. In this paper we will focus on marketing and distribution logistics of information within it, which is one of the most important elements in online sales as well as e-business itself. E-business and all its components provides entrepreneurs with a variety of choices how to business online that can be described by a 4-level maturity model of e-business by Madlenak [10], see Figure 2.

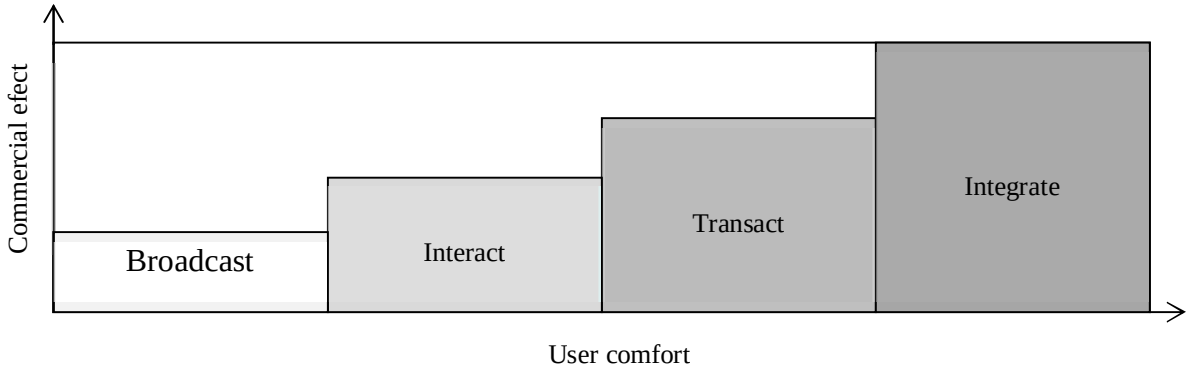

Figure 2 E-business levels
Source: Loučanová et al. [11]

The first level of e-business is called "Broadcast". It represents the elementary level of maturity model of e-business and it is characterized by a basic on-line access of selected information by customer.

The second level is "Interact" and it presents an extension to the first level with the possibility of interactive communication through various applications such as Public Relations, respectively on-line forms.

The third maturity level "Transact" provides customers with the opportunity of ordering, respectively complete products purchasing through the online shop.

The highest level from the point of e-business maturity is the fourth level "Integrate", which is based on the involvement of business into virtual business network, respectively electronic shopping center, also called e-mall [10, 12].

These levels can be developed further with regard to possibilities of the Internet.

However, the ability of the entrepreneur to offer products on the internet at different levels of e-business does not insure him certainty of his products sale. Therefore it is appropriate to encourage the sale by effective marketing.

However, e-business can use only marketing tools that can be put into electronic form. This fact does not harm electronic business, on the contrary, it provides it with new opportunities to constantly develop new marketing tools that can quickly ensure feedback and effectiveness of these tools.

E-business is not longer dependent only on the means of so-called outbound marketing, which is based on one-way communication (such as billboards, television commercials), but it uses inbound marketing and its new innovative forms of marketing communication and distribution logistics of information for marketing.

Today, marketing is a business linking tool with its environment and with customers to meet their needs. In a rapidly changing market conditions, it is necessary to be able to respond to changes and customer requirements as quickly as possible. This can be realized through their involving directly into marketing using the innovative tools that fall into the open innovation system of businesses. It offers the company the two-way communication with customers, see Figure 3.

These innovative forms of marketing communication are the part of inbound marketing. Feedback provided by the innovative forms of marketing communication provides the company with a source of ideas for the innovation process.

Within the level of e-business it is possible to use them at all its levels. However, it should take into account that present consumers are more demanding and often use more comfortable shopping possiblities. This also relates to e-business.

We have to consider that in order to increase customer comfort it also increases our business influence on him. It is due to the fact that if the entrepreneur has his e-business at a higher level, then his actual e-mall - e-commerce center provides customer with various forms of inbound marketing. The entrepreneur is also provided with these services, so the comfort of his business is increasing and he also has a feedback from customer (Figure 3).

Then feedback may be used to improve the products and services through their innovation in the context of the innovation process, where its first part "Invention creation" is provided according to specific customer requirements. They are evaluated by e-shop connected with e-mall or more e-malls (such as electronic business centers) through reports.

The advantage in terms of innovation process is the data (information) gathering within the e-business.

Is also has a significant importance also in terms of timing, because the time of the innovation launching is getting shorter due to accelerated invention gathering and they can be quickly included into new forms of inbound marketing, where Content Marketing, Viral Marketing, Social Media, Gameadvertising, Astroturfing, Marketing Search Engine White Paper and e-newsletters belong.

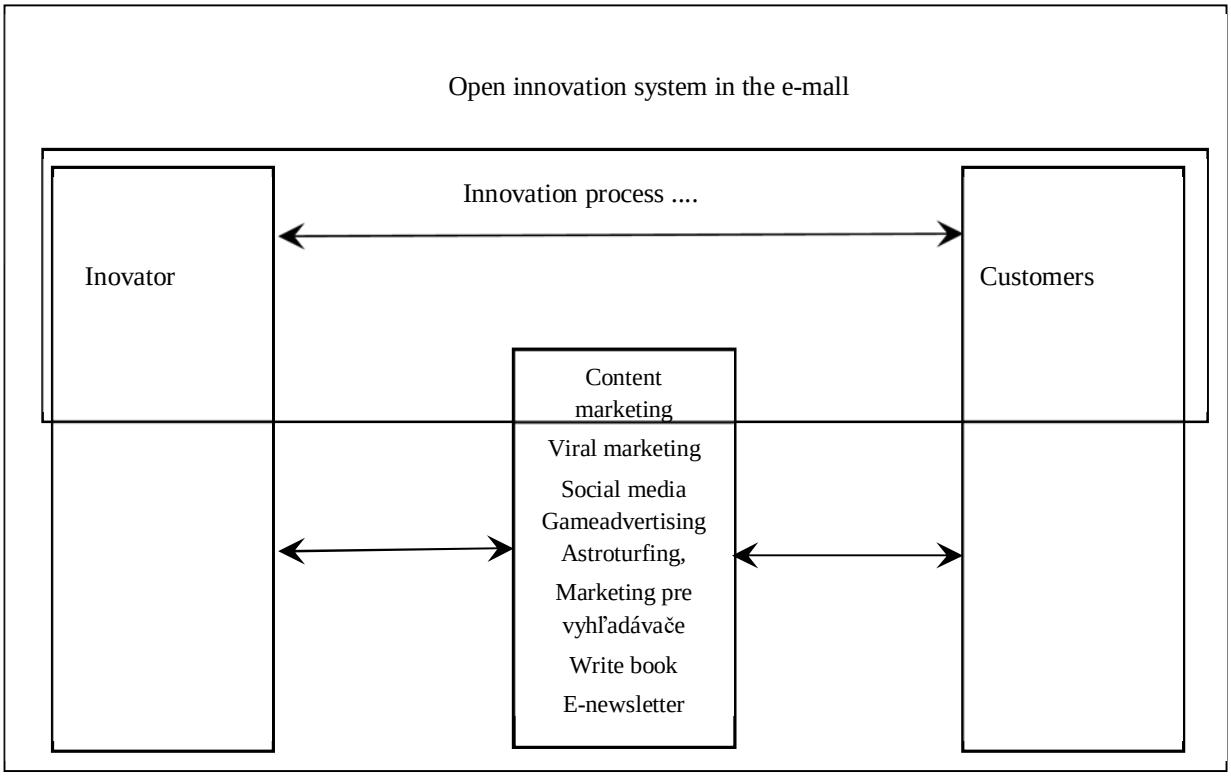

Figure 3 Information logistics with open innovation system, e-mall and inbound marketing
Source: Loučanová et al. [11]

The Internet marketing communication complex is a specific action plan aimed at achieving the company´s objectives by its implementation on the Internet. It contains traditional communication tools, such as advertising, sales promotion, public relations, direct marketing, personal selling, sponsorship and modern possibilities associated wih the Internet (corporate site, content sites, portals, banners, virtual communities, social networks, forums, message boards, search engines, etc.). They use Internet technology (social media marketing, viral marketing, product placement, lead generation, search engine optimization, targeting, etc.). Company's Internet communication complex uses a branded SEO optimized website, analytical materials, contextual advertising, banner advertising, various thematic Internet resources (portals, forums, electronic bulletin boards, etc.). All of them help to adjust analytical and advertising subject content and personal communication [13].

In the meaning of logistics of the open innovation system in e-bussines with inbound marketing using in innovation creation, the distribution policy carries out two tasks. The first one is associated with the creation of the innovation value. That means creating the quantitative and qualitative purpose-built changes. The second one focuses on realization of distribution flows in e-business and innovation process by creating the balance between supply and demand, that means the flows realization between sources and consumers. Finally, innovation implementation and distribution logistics accomplish that businessmen discover at the right time and on the right place what the market requires. This ability is called FIT (flexibility, innovation and implementing activities at the right time). All outputs of mentioned functions of distribution logistics must be in required quantity and quality when managing innovation in business [14,15, 16, 17].

Conclusion

Current sales statistics indicates increasing consumption. Marketing employees follow new trends and look for incentives that motivate customers to buy and to consume (despite their reluctance towards classic advertising forms). The companies have at their disposal a large number of tools to reach and influence the customer. They choose among classical tools, but in an effort to gain a competitive advantage they use even less known but more innovative forms of marketing communication that are supposed to be more effective. It is difficult to determine which of marketing communication tools can be considered to be the most effective, because the nature of products and services is variable. On the other hand it is necessary to take into account different expectations and needs of our customers. Therefore distribution logistics has a significant role in this process, which provides very important information in the open

innovation system that uses innovative forms of marketing in e-business.

Similarly open innovation system within this information distribution brings information directly from customers, which is very appreciated by them. Their direct entry into the process of meeting their requirements creates them the opportunity to become an active element of the process.

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LOGISTICS OF WORKING ROLLERS AND POSSIBILITIES OF PRODUCTION STREAMLINING

Marek Majoroš
U. S. Steel Košice, s.r.o., Prevádzka Príprava Valcov, U. S. Steel, 044 54, Košice, Slovak republic,
marekmajoros@hotmail.sk

Keywords: streamlining, simulation, material flow, logistics, production process
Abstract: Within the preparation of the production – rolling of flat surfaces, it is necessary to ensure the required amount of rollers with different diameters and lengths. This article deals with the logistics of the working rollers of the service of the specific working place. It aims to provide solution possibilities and to determine the optimal state using the simulation approach. The experiments in real companies are very rare, expensive and tedious. Simulation models allow us to explore more options, they avoid the system failures, machines damaging and human exposure to danger. Although the simulation requires some time to create the model and some professional knowledge, it takes less time, saves costs and does not involve in the production process and has a limitless number of experiments.

1 Introduction

Since nowadays the production output of rolled products for the automotive industry, constructions, etc. rises, so does the number of rollers replacements and therefore the number of the timely deliveries of the working rollers.

The problem that occurs is the determination of the working rollers number for the individual stools. Gradual grinding lowers the working rollers diameter. Afterwards, the number of working rollers with low diameter rises and the number of larger ones is decreasing. The required number of working rollers for the individual stools change and there occurs an excess of the lower diameter working rollers for the first stools and vice versa with the last ones. [1].

One of the solutions consists of the production process modelling, using the simulation language EXTEND. The simulation of the rolling tracks aims to determine the optimal number of working rollers for the individual stools.

Simulation models allow us to explore more options, it avoids the system failures, machines damaging and human exposure to danger.

The simulation requires a certain model. Simulation model imitates the system we want to simulate, which is limited to artificial, substantial object, created for the purposes of the simulation. Later on, the simulation represents the experiment with the object, which aims to predict the system's behaviour, lower the costs and understand the system and to improve it.

Simulation model contains static objects (production machines, storages) and dynamic objects (moving items, e.g. raw materials). After the creation of the simulator, there is the modelling, where the dynamic process is replaced by simulation model [2].

Computer simulation allows us to do infinite number of experiments on the created model, to evaluate the results and to optimize and apply them to the real process. The aim of the simulation also is to verify, whether the system would work better after applying the obtained parameters and it helps us to verify our ideas and decisions in the simulation model [2].

2 Production working rollers flow

When working, the rollers are exposed to high forces, therefore it is necessary to grind them and prepare them for the rebuilding into the rolling tracks [3]. The working rollers have a lower diameter then the supporting rollers (outer rollers). It limits the bending of the rollers and rises the stiffness of the rolling stool. The axes of all the rollers lay in the same plain (Figure 1).

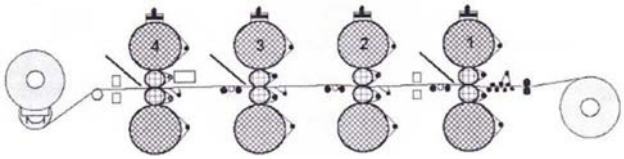

Figure 1 Working rollers deposition scheme of a 4-stools tandem [4]

In order to make the working roller usable again, it has to undergo several procedures. The working rollers are transported in sets by the overhead cranes to the "Rollers Preparation – Mounting and demounting of the working rollers" working place. There, the mounting and demounting of the bearing bodies take place. The mechanic performs their inner and outer control and eliminates the defects. When the defects are more serious, he removes the bodies and sends them for revision, where the bearing bodies are inspected more precisely and the defects are removed. Then, the rollers themselves are transported using the transporting trolleys to the "Working rollers – grindery" working place. Here, the rollers are grinded, electro-sparked and chromed to the

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required shape. The remade rollers are paper-packed and equipped with a label, which contains this roller information:

- number
- diameter
- facet
- roughness
- stiffness
- oval information
- conic information
- grinders name
- roughness after the electro-sparking
- final surface finish (EIS- sparking, T- jet, CR- chroming, EL- polishing)

Such rollers are returned by the transporting trolley to the "Rollers Preparation – Mounting and demounting of the working" working place.

After the mounting of one set of the working rollers, the mechanic uploads the mounting to the system. Then, he prints the protocol about the release of the set, which contains the following information:

- numbers of the upper and lower roller
- diameter of the rollers
- facet of the rollers
- roughness of the rollers
- stiffness of the rollers
- finish
- oval and conic information.
- numbers of the bearing bodies
- name and signature of the grinder and other mechanics

After the preparation of the working rollers sets, they can be rebuilt into the roller tracks.

3 Simulation of the production process of the roller tracks

The simulation model is created by the blocks of the simulation program EXTEND. In order to achieve the most correct results, it is necessary to have the information from all the production machines. With the help of this information, it is possible to create the simulation model of the roller tracks. According to the analysis, the best values for the 4-stool tandem are the values from the first month and for the 5-stool tandem the values from the second month. The noted months have the highest number of the working rollers replacements.

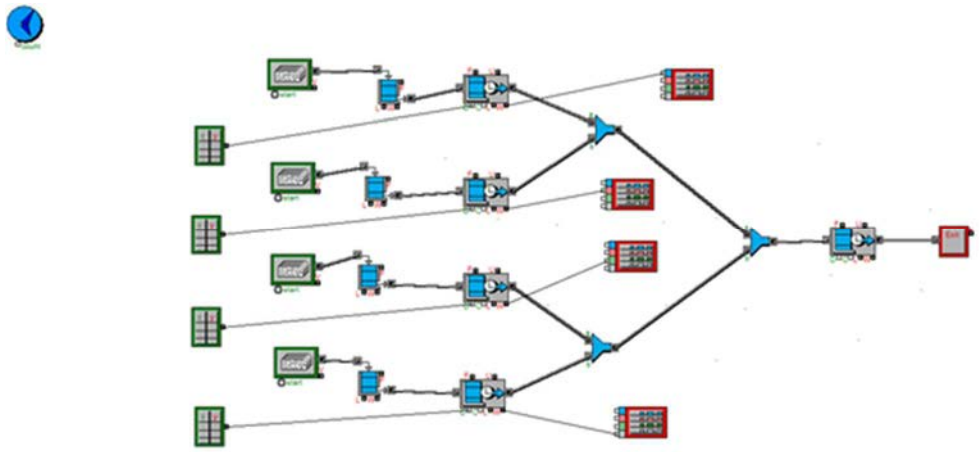

Figure 2 Simulation model of a 4-stool tandem [4]

Simulation model (Figure 2) is created from the individual blocks of the simulation system EXTENDSIM.

The block "Executive" sets the time of the simulation, the length of one month. The parameters of the block "Program" are set directly from the production. The block Queue "FIFO" is the queue of the waiting requirements (First in - First out), meaning that the requirement that entered the queue the first, leaves if the first. The block "Activity delay" processes the requirements from the queue. In this case, each block in the simulation represents one rolling stool. This block processes the requirement according to the data from the block "Input Data". This block contains the information about time of the roller stool replacements and also about their delay, which means the time length of the roller set usage. This block contains the real times, because of the high rate of dispersion of the usage length of the sets in the stools. The block "Activity Multiple" processes the requirements that leave the individual stools. In our case, it represents the storage of the built working rollers and their 480 minutes long cooling. The block "Combine" connects the output of requirements from the individual stools into one – input of all the requirements into the "storage of the built working rollers". The block "Plotter" displays the graph of the delay course and replacements according to the individual rolling stools. The block "Exit" is used to let the requirements out of the system.

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LOGISTICS OF WORKING ROLLERS AND POSSIBILITIES OF PRODUCTION STREAMLINING
Marek Majoroš

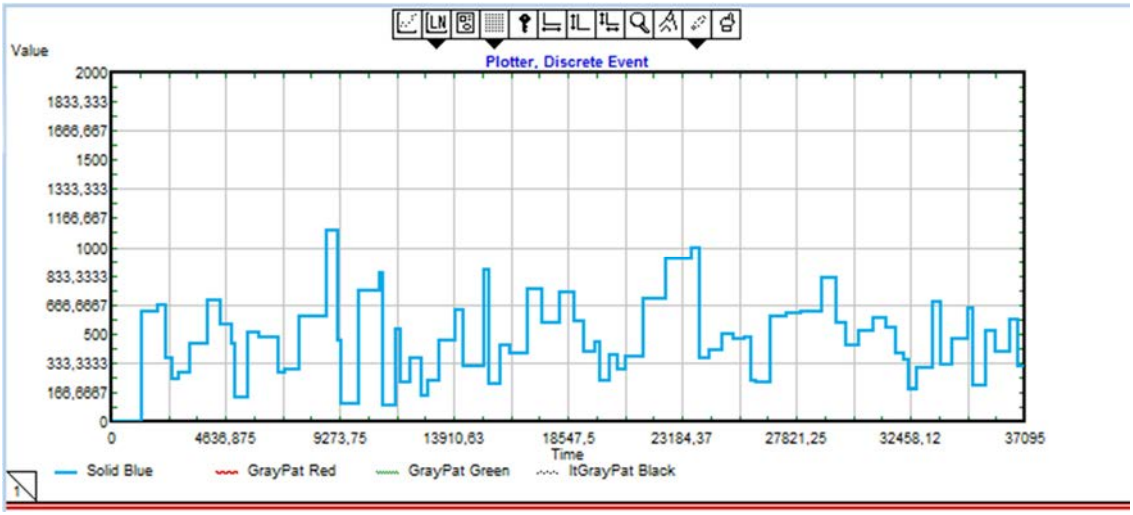

Figure 3 The course of the replacements on the first stool of the 4-stool tandem

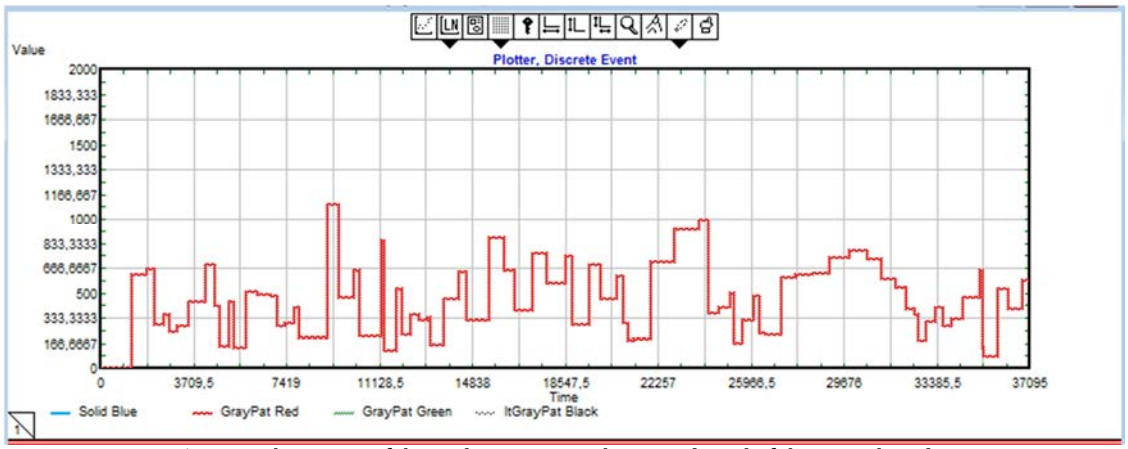

Figure 4 The course of the replacements on the second stool of the 4-stool tandem

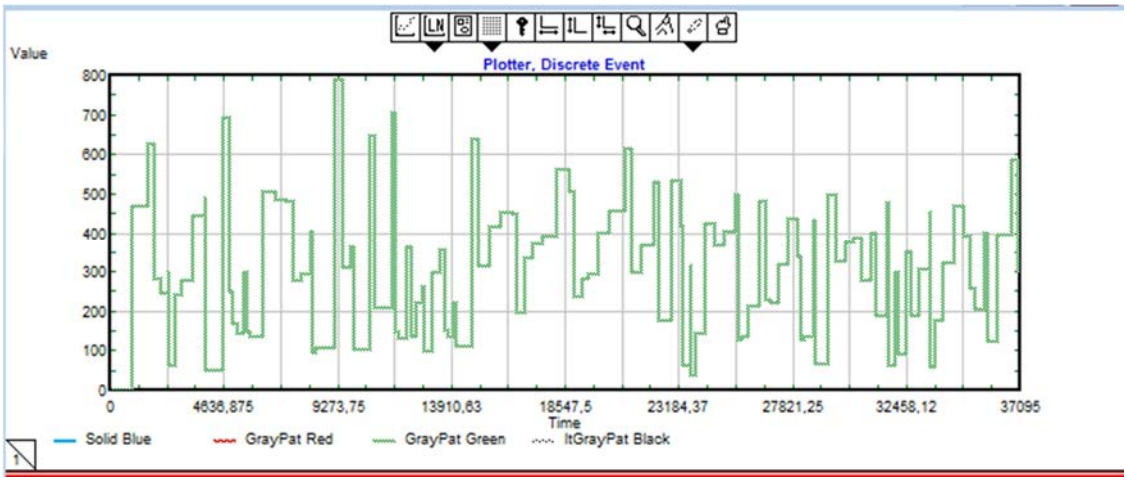

Figure 5 The course of the replacements on the third stool of the 4-stool tandem

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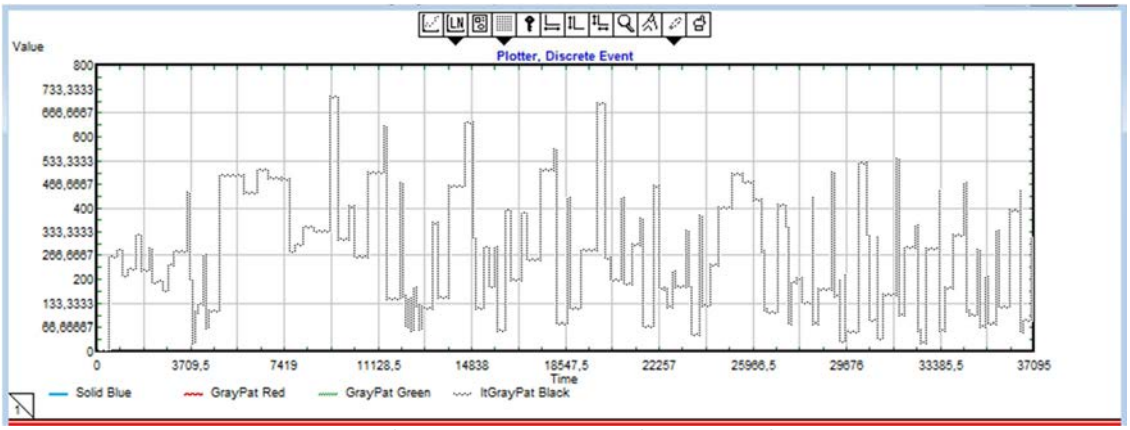

Figure 6 The course of the replacements on the fourth stool of the 4-stool tandem

The graphs show that the first and second stool contain a lower cadence of replacements, which means that the working barrels stay built in the tandem longer. The graphs of the third and fourth stool show that the barrels are replaced more often and their working time in the tandem is shorter.

The first rolling stool (Figure 3) used 78 rollers in the particular month with the usage of 98,34% and with an average delay time of 471 minutes.

The second rolling stool (Figure 4) used 81 rollers with the usage of 98,34% and with an average delay time of 452 minutes.

The third rolling stool (Figure 5) used 118 rollers in the particular month with the usage of 98,74% and with an average delay time of 313 minutes.

The first rolling stool (Figure 6) used 145 rollers in the particular month with the usage of 99,31% and with an average delay time of 255 minutes.

The simulation data that matters to us is the average delay time in the individual stools. It allows us to calculate the usage of one rollers set in each stool. (Table 1).

Table 1 Usage time of one rollers set in individual stools [4]

4st / time	1st. stool	2nd. stool	3rd. stool	4th. stool
Time of rolling (delay time)	**471 min**	**452 min**	**313 min**	**255 min**
Cooling after the building	480 min	480 min	480 min	480 min
grinding	90 min	90 min	90 min	90 min
Chroming + manipulation	60 min	60 min	0 min	0 min
manipulation + transport to the grinded rollers storage	100 min	100 min	100 min	100 min
manipulation + mounting of the bearing bodies	30 min	30 min	30 min	30 min
Using	**1231 min**	**1212 min**	**1013 min**	**955 min**

4 Working rollers preparation streamlining

The optimal supply of working rollers consists of the sum of working rollers sets consumption per one usage, supplies before the tandem, supplies on the preparation cube and security supplies (Table 2, Table 3).

The ratio of one usage and average delay time tells us the number of consumed sets, after which the first stool will be ready to be rebuilt.

The supplies before the tandem and on the preparation cube are necessary because of the premature replacements, which may occur even after first 15 minutes and the replacement of the working rollers lasts longer.

The security supplies are stored for the cases of some necessary repairs or premature disengagement of the working rollers in case of some failure. This may be some cracks, excisions or the sheet sticked to the roller. In those cases the repairs last much longer.

Table 2 Optimal state of the 4-step rolling track [4]

4-stool tandem	Current state	Optimal state	Savings
Chromed rollers (CR)	**48 pieces**	**24 pieces**	**24 pieces**
Smooth rollers (H)	**38 pieces**	**36 pieces**	**2 pieces**
EIS rollers (EIS)	**36 pieces**	**22 pieces**	**14 pieces**
sum	**122 pieces**	**82 pieces**	**40 pieces**

Table 3 Optimal state of the 5-step rolling track [4]

5-stool tandem	Current state	Optimal state	Savings
Chromed rollers (CR)	**74 pieces**	**36 pieces**	**38 pieces**
Smooth rollers (H)	**54 pieces**	**30 pieces**	**24 pieces**
sum	**128 pieces**	**66 pieces**	**62 pieces**

Conclusions

The effective state of the working rollers for the 4-stool tandem is 82 pieces, which represents the saving of 33% and the effective state of the working rollers for the 4-stool tandem is 66 pieces, which represents the saving of 48%.

According to the statistics of the grinding, each working roller for the 5-stool tandem is repaired in average 208 times, with the loss of 0,17 mm. The rollers for the 4-stool tandem are repaired in average 180 times, with the loss of 0,17 mm. According to those data and the time of one usage it is possible to set the supply cycle of the working rollers ordering.

Then, it is necessary to change the system of rolling tracks supplying from the current LIFO (Last - in, First Out) to the FIFO (First In, first Out) system. This would lead to the achievement of continuous and managed reduction of the averages of individual working rollers to their discarding and replacing by new working rollers.

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