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Zarządzanie projektami logistycznymi

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APPLICATION OF ABC METHOD FOR EFFECTIVE PLANNING OF WAREHOUSE PROCESSES

1. Introduction

Nowadays intuition itself is not enough to manage an organisation effectively, but it should be combined with various activity methods and concepts. For the purpose of effective and efficient functioning on the market it is often necessary to evaluate processes taking place in organisation and redesign them if needed. As much as possible, only known and efficient methods should be used for this purpose.

ABC is a simple optimisation method originated from experiments by Vilfredo Pareto. This method is widely used in logistics, where not only value of particular elements, but also their number influencing the complexity of numerous logistic processes is important.

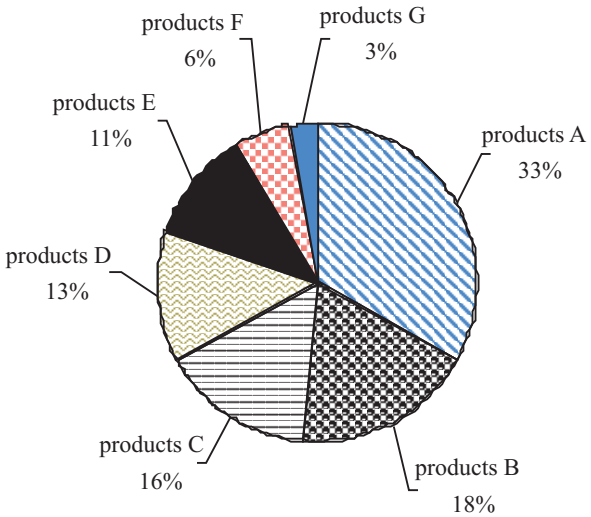
It has been proven in a number of research studies that raw materials and materials included in group A, to a largest extent influencing the total value of usage, constitute a considerably small set of items. The proportions are such that approx. 20 % of items relates to approx. 80 % of the usage value. With regards to this particular group rational premises indicate purposefulness of using a strict regimen when ordering the items. As far as other materials are concerned, especially these in group C (having a smaller value), more liberal rules of ordering and making reserves are allowed for. In ABC method a stress is put on the assortment with profound significance for production. ABC method usage is possible especially in case of assigning places for storage of various types of elements (products, semi-finished products, parts, packages, etc.) in wholesale and retail warehouses, in horizontal and vertical arrangement. As far as horizontal arrangement is concerned a frequency of orders in a given period of time is a decisive factor. The elements that are collected most often should be located as close to the point of delivering, compiling or packaging as possible, because in this way the sum of all manipulation and transport activities is minimised. In consequence the work consumption associated with these actions also decreases, which is equivalent to the increase of

effectiveness of the warehouse functioning. Regarding vertical arrangement the foreground is occupied by a number of items collected in a given period of time. The objects whose largest quantities are used should be stored in the area within normal reach of a regular warehouse employee. Storage places in shelf stands that can be accessed only by bending or reaching up should be reserved for the items taken less frequently and in smaller quantities. Picking objects by a warehouse employee from less accessible places requires increased energy expenditure and from the ergonomic point of view is usually unfavourable.

The study presents the application of ABC method for establishing the way of arranging warehouse stock regarding the issuing and receiving sites, which is in relation to rational arrangement of items in stock areas when organising a warehouse.

2. Presentation of the research area

The results presented in the paper are an element of the research concerning measuring the effectiveness of functioning of warehouse processes in production enterprises, carried out on the basis of the research questionnaires and direct interview as well as the researchers' own experience and observations. In order to present the application of ABC method for effective design of warehouse processes a case study made for one of the studied enterprises has been used. As the enterprise did not give its consent for using its name in the study, it will be referred to as "Company", and accordingly all its products will be coded.



products A, B, …, G

Fig. 1. Range of the "Company" products – percentage share according to demand

Source: the authors' on the basis of data obtained from "Company"

„Company" employs over 250 people and operates in the rubber industry trade on the Polish, EU and world market. The offer of the enterprise is addressed to people employed in various branches of processing and chemical industry, power industry, mining, firefighting, construction, transport, agriculture, forestry and fishery. Fig. 1 presents the share of particular types of products according to demand.

The quality of the "Company" products is highly rated not only on the local market but also in Austria, Sweden, Great Britain, New Zealand, USA, the Czech Republic, Slovakia, Russia and Baltic countries.

All types of goods produced by "Company" have proper certificates and CE label.

Various ranges of goods are produced depending on specific orders. Each type of a product is divided into specific articles, and on this basis ordered by customers. In every group a leading article can be differentiated often having a significant share in the total of articles. Some types of goods are ordered in minor quantities, sometimes only a few pieces. The enterprise produces in total 144 kinds of articles, out of which 25% is exported.

The manufactured goods are stored in the warehouse of ready products. The stored products are not harmful to the environment and are not in the group of hazardous, flammable, explosive or radioactive products. They do not demand special conditions for storage, like assuring proper temperature, light or humidity. The only factor that can affect the properties of the products is a long-term solar radiation, because it influences their physicochemical properties, which could thus be altered, and in consequence the products would not stand up to specific requirements. With reference to the above, the enterprise does not have to store them in specially allocated rooms or at a proper distance from walls, gates or windows. Yet it is obligatory to keep the distances resulting from the fire safety rules and assuring safe and hygienic work conditions, which is fulfilled.

All products in the warehouse are properly labelled.

The maximum time for each product to be stockpiled in the warehouse without being used is two years after the production date.

In the warehouse there are both, products characterised by high rotation – *A* goods - and by low rotation – *C* goods. Unfortunately their arrangement does not comply with the frequency of issuing. The amount of range of products in the warehouse varies especially in the September – March season.

Most of monthly turnover of ready products in "Company" is around 90 thousand. During the season the number is even twice as big.

Next area strictly associated with the stockpiled products is the warehouse itself. It was analysed as a building and also as a place for storing ready products. The processes taking place in the warehouse were a subject to analysis.

The warehouse of "Company" where ready products are stockpiled is a closed, 6 m tall, one-storey building, with the area of 2.153 square metres. In the building electrical and daily light (coming in through the middle part of the roof) is used.

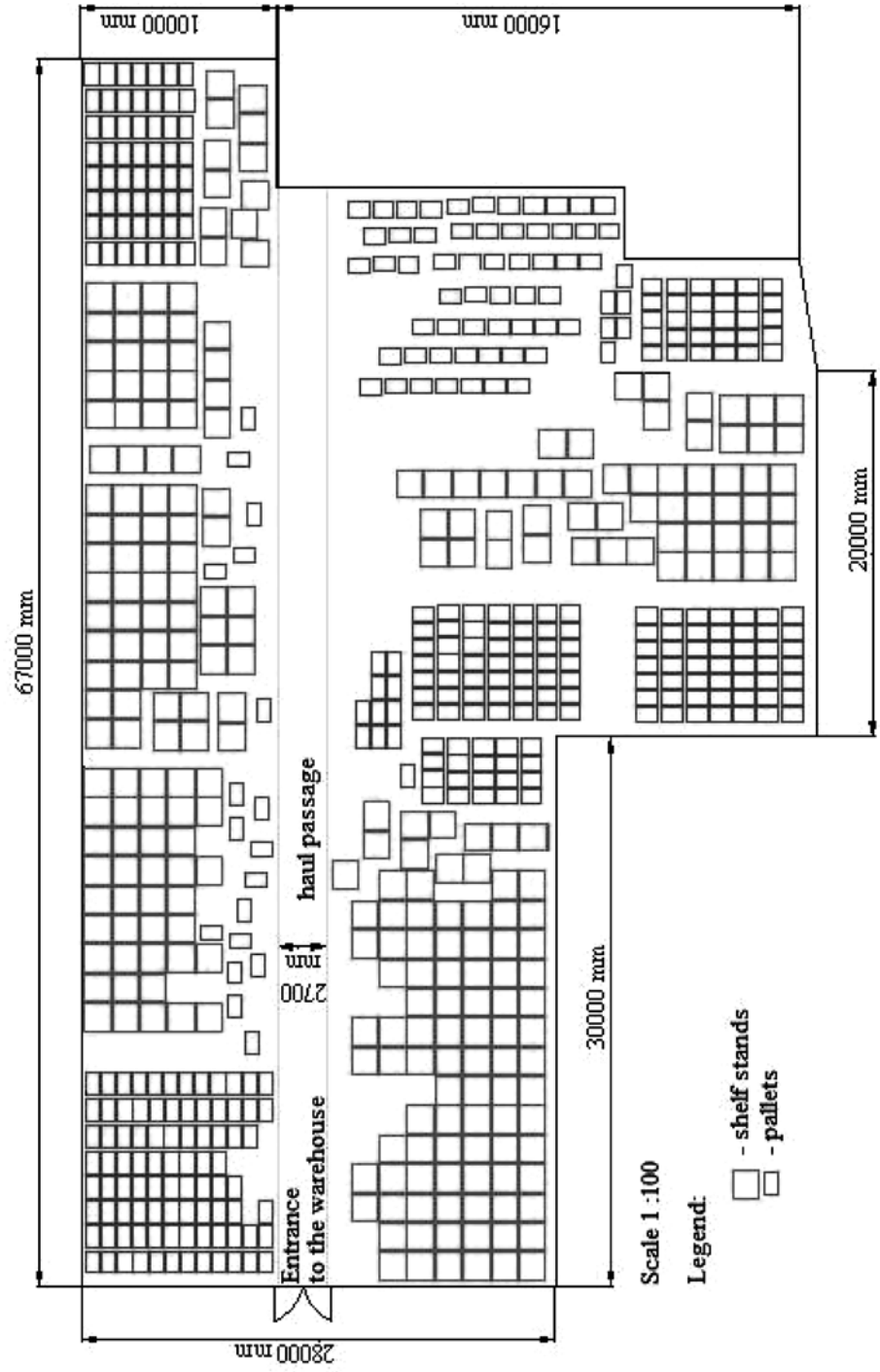


Fig. 2. Organisation of stockpiling area of ready products of „Company" in the period of the research

Source: the authors' on the basis of their own research.

Both, the completion processes and the trade of full load units – pallets take place in the warehouse.

Ready products are stored in collective containers – bags and cardboard boxes. There can be maximum 30 bags or 20 cardboard boxes filled with products on one pallet unit. Each collective container is labelled with a collective label covered with a printout in a proper colour depending on the type of product placed in it.

In the analysed warehouse only the stockpiling area is separated. Receiving and issuing goods takes place on a ramp. The area of the warehouse is fully used. Problems appear during season because then the shelf stands and storage areas are totally full. The current way of arranging the stockpiling area delays the working process in the warehouse, whereas a great number of products hamper the freedom of movement within the warehouse and the performing warehouse activities – Fig. 2.

Products in collective containers and pallet units are arranged basing on the method of free stockpiling spaces. The stockpiling places are not marked in any way. Products identified on the basis of labels are stockpiled on pallet frame stands and on pallets.

The pallets are stocked on the floor of the warehouse with no possibility of piling them, which is due to the fact that they are loaded with cardboard boxes not resistant to heavy loads. Products placed in bags are stocked on removable platform shelves, which are taken off together with bags put on them when an order is realised.

Processes taking place in the warehouse are mechanised. Two battery-powered fork-lift trucks and one hand lift cart are used for transport and reloading.

The research shows that products are kept in proper conditions, and no factors that could affect their properties are observed. They are also appropriately labelled, and thus there are no problems with identifying their type. The main problem is that groups of products being frequently rotating are not arranged in the warehouse in accordance with the rotation volume, which prolongs the time needed to find an ordered product. Another vital problem in the enterprise is the way of stockpiling, causing inefficient usage of the warehouse, which was indicated during the research by sizes of specific rates and measures, e.g. degree of filling the stockpiling area with platform shelf stands is 50% and with pallets is 50%, whereas the rate of filling the warehouse with shelf stands during season is 38% of the whole warehouse, and offseason it is 31%. The rate of filling the warehouse area with pallets during the season is 16% and offseason it is 13% in the scale of the whole warehouse (in total the warehouse area is used only in 53%).

3. Scheme of warehouse arrangement basing on ABC Method

The above analyses gives the basis for developing a scheme of organising the warehouse of the enterprise and introducing a new, fixed arrangement of products in the warehouse to improve the effectiveness of its functioning.

The first step was to arrange ready products grouped according to their rotation within the warehouse area. Hence the products were classified basing on ABC method in accordance with the annual number of orders – Table 1.

Table 1. ABC analysis according to the number of orders for the products stockpiled in the warehouse of ready products of "Company"

Product type	Annual volume of demand for products	Annual cumulated volume of demand for products	Percentage share of the cumulated number of orders for products	Category
products A	287.000	287.000	33%	A
products B	160.000	447.000	51%	A
products C	135.000	582.000	67%	A
products D	116.000	698.000	80%	B
products E	96.500	794.500	91%	C
products F	50.700	845.200	97%	C
products G	25.000	870.200	100%	C

Source: the authors' on the basis of their research.

Table 2. Comparison of parameters characterising the warehouse before and after introducing changes

Variation	Warehouse capacity			Rate of the warehouse area usage		Sum	Maximum number of stockpiling places		Maximum number of collective containers	
	Stock-piling area (Vo) m^3	Stock-piling area (Vor) m^3	Stock-piling area (Vs), m^3	Mv = Vo/Vs						
	pallets	shelf stands		pallets	shelf stands		pallets	shelf stands	pallets	shelf stands
Current stock	1.425	4.050	10.800	13%	38%	51%	500	738	10.000 card-board boxes	36.900 bags
Stock after intro-ducing changes	3.555	4.050	10.800	33%	38%	70%	880	738	17.600 card-board boxes	36.900 bags

Source: the authors' on the basis of information obtained from "Company".

Making ABC analysis enables separating the following zones in the warehouse:
- three A zones (A1, A2 and A3), in which the highest rotation goods were placed,
- one B0 zone,
- three C zones (C1, C2 and C3), with the lowest rotation goods – Fig. 3.

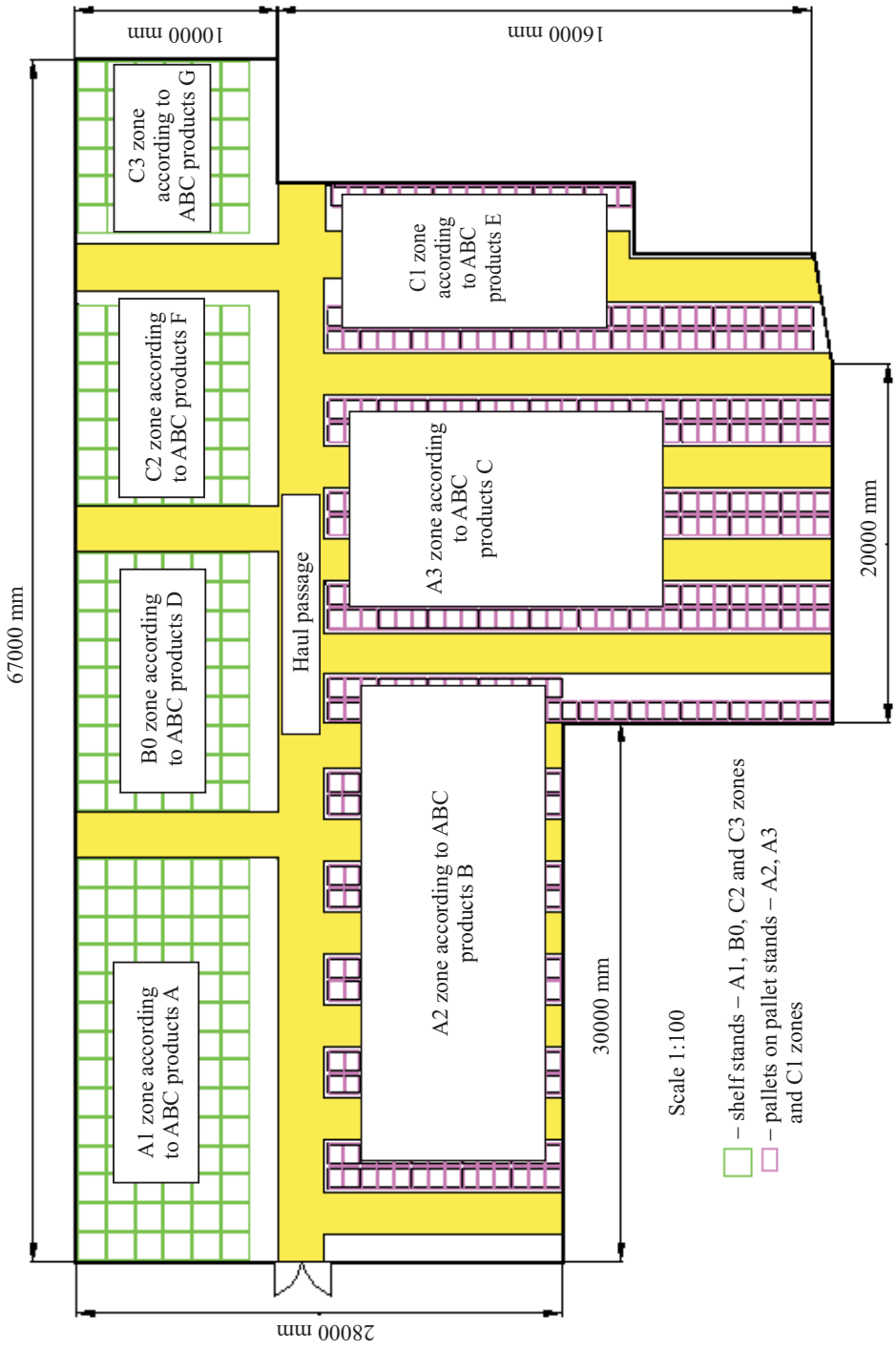


Fig. 3. Design of a new arrangement of stockpling facilities with in-line pallet stands

Source: the authors'.

When planning the zones of ready products arrangement also the possibility of stocking them in collective containers was considered. Accordingly, in zones A1, B0, C2 and C3 removable platform shelf stands were suggested for storing products in bags, whereas in zones A2, A3 and C1 pallet stands for storing cardboard boxes placed on pallets were proposed. The above solution results in making more of the warehouse area, which is presented in Table 2.

4. Final remarks

The research results explicitly prove that the application of the proposed solution based on ABC method and taking into consideration occupational safety and fire regulations allows for:

- separating in the warehouse appropriate stockpiling zones complying with rotation of the produced goods,
- increasing the number of stockpiling places for pallets by 7.600,
- increasing the use of the warehouse area taken by products stockpiled on pallets from 13% to 33%,
- fixing stockpiling places associated with determining particular zones differentiated on the basis of ABC analysis, which will also result in the reduction of time needed for finding particular products in stock.

The research indicates that the application of ABC method enables effective planning of warehouse processes, and that the specificity of products and the number of different articles corresponds with the way of arranging the stockpiling area and thus with the design process. Another important element of the design process is the size of the building and possibilities of applying appropriate facilities for stockpiling, often depending on financial means of a company.

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WYKORZYSTANIE METODY ABC DO EFEKTYWNEGO PROJEKTOWANIA PROCESÓW MAGAZYNOWYCH

Streszczenie

W obecnych czasach przedsiębiorstwa zwracają szczególną uwagę na efektywność funkcjonowania procesów występujących w firmie, w tym procesów magazynowych. W związku z tym istotne jest odpowiednie zaprojektowanie procesów magazynowych, ponieważ przekłada się to na redukcję czasu przeznaczanego na obsługę, jak i miejsca przeznaczonego na składowanie czy bezpieczeństwo pracy osób zatrudnionych.

W przypadku procesów magazynowych jedną z metod pozwalających na optymalne zagospodarowanie przestrzeni magazynowej jest metoda ABC. Dzięki jej wykorzystaniu w odpowiedni sposób można dokonać stosownego podziału składowanych surowców, materiałów czy wyrobów gotowych pod różnym kątem.

Uwzględniając powyższe przesłanki, w niniejszym opracowaniu przedstawiono na wybranym przykładzie zastosowanie metody ABC do efektywnego projektowania procesów magazynowych.