Danuta Głowacka-Fertsch
Wyższa Szkoła Logistyki w Poznaniu
E-mail: danuta.glowacka-fertsch@wsl.com.pl

RESOURCE MANAGEMENT IN A PRODUCTION ENTERPRISE

ABSTRACT

Background: Resource management is a very important function in a production company. Its importance grows under the conditions of changes that modern production is subjected to. Concepts such as Industry 4.0 and its various varieties create new conditions and pose new challenges to resource management in a modern manufacturing enterprise.

Methods: The purpose of this chapter is to identify the requirements that modern production poses before resource management. Analysis begins with the presentation of the essence and classification of resources in a production company. Traditional resource management methods are briefly characterized. The most important features of modern production management concepts are presented (process approach, St. Gallen model, intelligent manufacturing, network-centric operations).

Results: Comparisons of similarities and differences between analyzed concepts are compared. On the basis of this comparison, the concept of a holistic approach to resource management in an enterprise is presented. This concept is a proposal for solving the problem of resource management in a modern manufacturing enterprise.

Keywords: resource management, modern production, resource management methods, holistic approach to resource management

INTRODUCTION

Manufacturing in a production company is possible thanks to their disposal of specific resources. In the above statement, the word 'possession' was intentionally used, not 'possession'. In the conditions of modern production, outsourcing is used on an increasingly larger scale [Matejun 2006]. The problem of resources owned by an enterprise is becoming more and more a problem from the sphere of finance. The answer to the question how much should it be worth and what the assets of the enterprise should consist of, so that they are reliable for clients, suppliers and banks as well as potential investors, does not belong

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

to the issues of organization of production. From the point of view of the smooth course of the production process, it is important to ensure accessibility (the right to use, dispose of a specific type of resource), which is necessary at the moment.

Contemporary classification of enterprise resources includes 16 categories of resources [Cross 1995]. The company's possession of resources is a condition that ensures the possibility of its operation, it determines the success or failure of the enterprise.

Enterprise resources can be divided into two categories. The first of these are so-called countable resources. Their feature is that they can be expressed (measured) in natural units such as art, persons or units of value. This category of resources includes: labor, capital and material resources in the form of fixed and current assets. The second group of resources are so-called uncountable resources. They cannot be expressed in natural units, but they can be valued (such as a brand - trademark) are the subject of purchase or sale and constitute part of the enterprise value. This group includes all other resources except the countable resources mentioned above.

From the point of view of the organization of production, another classification of resources is important. It divides resources into so-called production resources - used for production and non-production processes. The category of production resources includes both countable and uncountable resources.

Modern production is characterized by very large changes that occur among production resources. These changes are caused by technological progress, innovations, changing customer demand caused by the emergence of new needs. They require expenditure on their preparation and implementation. They often lead to the modernization of entire enterprises. The manner of implementing changes is important for the successful implementation of changes. We can distinguish the following ways of making changes:

- elimination - withdrawing from the production of some products or excluding (permanently or periodically) selected parts of the production system,
- modernization - changes are introduced to a small extent, they concern the improvement of selected parameters of products or the production process. This mode of action seems to be attractive from a psychological point of view due to the minimization of the introduction time changes, outlays associated with these changes and the state of social climate in the enterprise. It is recommended by some concepts of modern management (Kaizen - continuous improvement). However, the effectiveness of this mode of operation raises doubts. The author did not find in the subject literature any example of a company that was successful thanks to this mode

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

of operation - it clearly improved its competitive position. The practice of "continuous improvement" is part of the Japanese production organization model, Just-in-Time model and lean production. Small, systematic changes in the production system, however, can accumulate, leading to the need for a thorough reconstruction of this system at some point. However, such a scenario and the issue of its effectiveness are ignored in the literature on the subject. They are not considered by the literature dealing with the practice of continuous improvement. Modernization (the practice of continuous improvement) in the conditions of modern production, it seems, has gone to the area of routine activities in the field of production management, becoming the standard work tool of every manager dealing with human resources in the sphere of production. It is currently a tool for building and maintaining production organization at a level ensuring proper use of all means of production, i.e. production at the lowest in existing conditions (design of manufactured products and applied manufacturing technology) costs [Papaj 2016].

- innovation - changes are introduced to a large extent, they concern the launch of production of new products or the introduction of qualitatively new, significantly different from currently used, elements in the production system. These changes should be introduced quickly and firmly to maximally reduce costs and negative social effects (crew resistance) associated with introducing changes. Innovation is the most widely used and surest way to improve a company's competitive position.

The changes that occur in modern production among production resources relate to each of their elements. The number of used materials and raw materials is changing. For traditional production, it was characteristic to use a small pool of universal materials that were processed in complex, long-lasting technological processes. For modern production, which is constantly faced with the need to reduce costs and shorten the delivery cycle, other relationships are characteristic. Special materials are widely used. At the same time, as a result of the change in the way products are designed, the number of levels of structural complexity and the number of collections of elements at individual levels are reduced. At a certain level of constructional complexity of products manufactured today, a relatively small set of universal assemblies is being extracted, from which various products intended for specific customers are further assembled. The client of a modern manufacturing company often participates in the design and manufacture of the product intended for him. These interventions usually relate to this level of product complexity. The teams that make up it are

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

rarely manufactured in a production plant where a customer-specific product is manufactured. They are usually purchased from external suppliers - other production plants [Fertsch 2013].

Changes that occur in modern production among production resources apply to each element of this collection. Modern machine tools are on the one hand more and more efficient. On the other hand, they are increasingly replacing human work. This is done by expanding operating parameters, reducing energy consumption by using increasingly efficient drives, combining automated machines into teams that comprehensively implement specific technological processes and automation of the machine tool control process using computers. Contemporary production systems are increasingly being transformed into so-called cybernetic-physical systems [Lee 2008].

The changes that occur in modern production among production resources relate to each of their elements. We observe two trends in the scope of auxiliary and service processes as well as machines and devices used in them. The first is characteristic for producers using the lean production model. It involves the widespread use of outsourcing. External contractors are commonly commissioned processes such as internal transport, tool service, maintenance and repair service, quality acceptance of finished products and quality control in the production process, production planning and control. Other manufacturers also use outsourcing. It usually concerns simple, technically uncomplicated operations such as storage of materials and their delivery to work stations, internal transport. In the remaining areas, they use to a large extent the mechanization and automation of ancillary and service processes [Duguay 1997].

IMPACT OF CHANGES IN ORGANIZATIONAL AND PRODUCTION CONDITIONS ON THE SHAPING OF RESOURCES BY MODERN PRODUCERS

Changes that occur in terms of production resources in the conditions of modern production result in changes in the production and organizational conditions in which the manufacturer operates. The production and organizational conditions are taken to be the general factual and informational limitations in the sphere of production and organization of the enterprise creating the environment in which the production process is carried out. The origin of these restrictions can be different, they can come from the sphere of technology and technology, have an economic, formal - legal or organizational nature. Of this complex, technical and organizational conditions are the most important for the phenomenon under consideration. They are formed by the continuity of production and construction-technological and technological-organizational similarity of products. This is because along with the increase in production continuity, there are, with varying strength - depending on the

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

similarity of the assortment, tendencies to autonomy manufacture of individual products, create separate production units. Today, this trend is supported by the actions of individual producers striving to improve their competitive position by deliberately shaping production concentration and specialization. Manufacturers focus on their key competences. In the case of final producers, these are usually the design of new products and their final assembly. Suppliers of assemblies, subassemblies and components usually builds their key competences on mastering specific technology or on ensuring proper organization of supplies (supplies of small batches, often carried out with constant changes in the production plan). This way, conditions are created for the construction of strategic alliances created on the basis of the specific implementation of outsourcing carried out by replacing part of the manufactured range according to the "give in to accept" model. Such action creates conditions for an increase in production continuity and similarity of the manufactured range. The continuity of production results from two quantities:

- the size of the assortment measured by the number of products produced,
- production programs for individual product items.

Construction-technological similarity is the extent of overlap between product features such as dimensions and dimensions, weight, type of materials used, and size of production programs. Technological and organizational similarity - the scope of compliance of the type and sequence of phases and individual operations in the technological processes of products, and the similarity of the proportion of labor intensity of subsequent phases and operations between products.

Based on the size of the product range and product production programs, and taking into account the similarity of product features, we can distinguish variants of production and organizational conditions relevant for the organization of production. The combinations of production and organizational conditions below are typical. In practice, there may be situations with intermediate features between the distinguished variants and there may be (especially in large enterprises) more than one of the distinguished variants.

The following variants of the combination of features of the considered conditions can be distinguished:

- few assortment, high production programs for individual products, strong similarity of their features. Production in such conditions is continuous for long periods of time, carried out on special machines, largely automated. In such conditions, the tendency to use highly efficient specialized production resources is strong.

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

- a slightly diversified assortment, including a small number of similar products with clearly different production programs. Continuity of production only applies to certain product items. Others are manufactured alternately or on individual customer orders. In such conditions, manufacturers try to use, as far as possible, high-efficiency, specialized production resources. They also use a certain pool of universal resources.
- the average range includes products with various characteristics. There are versions and variations of individual products. Production programs vary depending on the product version and variety. Production is continuous in the group of unified items between products. Continuity of production occurs only in certain groups of product items or in certain technological phases. In such conditions, producers try to make their production resources as versatile as possible. In areas with high production continuity, flexible automation is used [Lofti 1995].
- the range includes several groups of structurally diverse products. Production programs are varied, with a tendency to fluctuate around average, constant values over longer periods. The technologies used and the machine park are highly diverse. The numerous range of parts and / or materials necessary for the production of individual product items significantly exceeds the number of unified items. Production is repetitive, but not rhythmic - the demand for individual products is constant for longer periods, but it changes significantly in the short. In such conditions, producers try to make their production resources as versatile as possible. Attempts are being made to use flexible automation.
- the range is numerous and strongly diversified. Production programs are low, approaching the limit of individual orders. Unique production, unified items in the assortment of parts are almost exclusively normals. Diverse technological processes and a universal park machine. In such conditions, producers try to make their production resources as versatile as possible. The high costs are a barrier limiting the use of flexible automation. In this situation, reconfigurable production systems seem to be an alternative.

The variants of production and organizational conditions presented above (continuity of production, similarity of manufactured products) determine the organization of production at producers. This impact is less significant in the case of final producers [Wysocki 2010]. In their case, the production and organizational conditions are significantly overlapped by the impact of technical progress and the manufacturer's attitude towards implementing

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

innovations. In the conditions of manufacturers - suppliers of assemblies, subassemblies and components, production and organizational conditions are the strongest determinant of the choice of production organization model.

DETERMINING THE DEMAND FOR RESOURCES OF MANUFACTURING ENTERPRISES

The enterprise resource management process begins with determining the demand for resources. Demand is calculated separately for each type of resource. The general sequence of actions and the order of decisions taken in the demand account for a given resource is rather simple and intuitively understandable. It is based on the "classic" balance model. It is very difficult to trace the subject of origin in the literature and find the author of this solution. It occurs in two variants, which "customarily" are referred to as "planning" and "designing". It is practically impossible to trace the subject of origin in literature and find the author of this methodological decision. When calculating the demand for a given resource, the "planning" option is used.

This option relies on the following sequence of actions:

- definition of tasks,
- calculations, based on previously defined tasks and adopted technology, of the demand for a given resource,
- acceptance of the permissible load factor (use) of the resource, permissible under existing conditions for which calculations are being developed,
- resource demand calculations.

Calculations are always carried out for the adopted period - the planning horizon. The above sequence of actions is used to determine the demand for countable resources.

Calculations carried out according to the balance model are difficult to support IT. In the process of calculating the demand for a given resource, it is necessary in many cases to make decisions on an ongoing basis - the intervention of the person conducting the calculation. It is very difficult to take into account the substitutability (mutual substitution) that occurs in many cases resources or occurring sometimes, resulting from a change in operating conditions (failure), variability of consumption of a given resource in time, or a variable in the considered horizon of resource availability planning. The result of calculations gives us an average demand for the considered type of resource in the adopted planning horizon. It is only true if the tasks are evenly distributed.

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

During the development of management support information systems based on the ERP standard, the "demand requirements planning" procedure was developed. This is the procedure used in the material demand planning method to verify the feasibility of material demand schedules due to the available potential. It is mainly used in the production area, although advanced ERP system users also use it in the sphere of supply or (in the case of distribution demand planning) also in distribution. There are also possibilities to use this procedure in the sphere of transport or to manage locations in a warehouse [Fertsch 2017]. This procedure in ERP class systems It fulfills the same role as the balance model in the "planning" version. It is used in a sequence of planning activities called "closed-loop MRP" [APICS 1992].

Because the closed MRP loop usually applies to short periods of time (short planning horizon), there are versions of "potential demand planning" adapted to planning in the longer planning horizon. They are called "resource requirements planning" and "rough-cut capacity planning" [Blackstone 2008]. Software modules that implement these procedures are not available in any ERP system. Users wishing to use resource demand planning or initial capacity demand planning face the problem of implementing these procedures themselves using the available software.

Regarding the utility properties of potential demand planning and derived procedures, it must be stated that they do not differ much from the functional properties of the balance model. The only significant difference is that there is available (as part of ERP class systems) standard software that the user can use to implement these procedures. Other functional properties, especially difficulties with the interpretation of the obtained calculation results are basically identical. Interpretation of the obtained calculation results and inference based on them is carried out by planners by analogy (comparison of results from different periods) and is based mainly on the experience of planners.

RESOURCE MANAGEMENT IN PRODUCTION ENTERPRISES

Enterprise resource management is decentralized. It is implemented individually for each of the resources (there is no global resource management on an enterprise-wide scale. There is no person or organizational unit in the enterprise that is responsible for resource management. Specific resources are assigned to individual organizational units (departments, services and divisions). When a given resource is used and located in many organizational

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

units, the leading organizational unit responsible for a given type of resource is indicated. Resource-related problems are solved by persons or organizational units responsible for a given type of resource in the event of possible cooperation of its users. The resource management process begins with determining the demand for the resource. By comparing demand with resource availability in the analyzed planning horizon, the initial situation is identified. It may consist of the following situations - in the considered planning horizon we will have sufficient size of a given resource or a given resource in the considered planning horizon will be available in an insufficient size. After diagnosing the second of the above-mentioned situations - insufficient availability of a given resource, corrective actions are taken. Detailed quantitative analysis is conducted (and not always) only in relation to countable resources. For uncountable resources, only (usually estimation-based) analysis is performed.

Corrective actions consist in ensuring the availability of a given resource in sizes that cover the demand or (which is less common) correcting - reducing the tasks falling for a given period. The specificity of corrective actions results in most cases from the specificity of a given resource and its availability. A detailed discussion of all the procedures used for each type of resource goes beyond this chapter. In the following, I will deal only with a brief description of problem solving in management.

Let's determine the situation in which a given resource is available in an insufficient size in a given period as a problem. The first step in solving this problem will be to determine the current state. They will include the following activities: - we try to clearly and precisely formulate the problem that we will solve. We do this based on the information collected. Often, the situation requires additional analysis. The next stages of analysis are:

- structuring the problem - identifying all elements of the situation and their mutual relations,
- parametric assessment of the existing situation - comparison of selected indicators with the assumed or planned ones,
- assessment of the impact of the current situation on future alternatives to the situation. Strategic analysis methods for large problems - CSF or SWOT [Kałkowska 2010]
- verification of the information collected and, if necessary, gathering further and returning to earlier stages of the analysis.

The extent to which we conduct analysis depends on the assessment of the size of the problem, its complexity or novelty (large or small) and the time we have to solve it. If the

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

problem is assessed as large and complicated, we go through all subsequent stages of the analysis. For simple problems, we limit ourselves to two steps. One of them is a diagnosis containing the structuring of a problem or parametric assessment of an existing situation. This action is to lead us to understand the essence of the problem. The next step in this situation is - verification of the information collected.

The next step in solving the problem will be to define the problem (the answer to the question "what's wrong?"). You can use the following techniques to define the problem:

- verbal description,
- differentiation - description of an ideal state and comparison with the existing state,
- reconstruction - recreating the events that led to the existing state,
- separation - division of a big problem into elements.

Defining a problem should always include the following:

- identification of the causes of the problem,
- problem location - where does it occur?
- time of occurrence - when does it occur?
- problem size - how much resource is missing?
- checking the causes
- verification of the true cause.

After defining the problem that we will solve, we can define goals - the answer to the question "what do we want to achieve?". It consists in identifying the future state of affairs or processes described by the subject (thing or process), activities to be performed, deadline for achievement, necessary outlays and results,

The following ways to define goals are available:

- searching - finding a different way of acting,
- avoidance - developing forecasts of future threats and formulating objectives to avoid these threats, this method can be used alone or in combination with others,
- building - goals are defined to maximize the strengths of the enterprise,
- recreation - formulating goals to restore the state before the problem appeared.

The combination "build + avoidance" is recommended for very complex problems.

Having identified goals, we can develop alternatives to achieve the set goals. The following ways to develop alternatives are available:

- brainstorming or other creative thinking techniques,
- copying - transfer of proven solutions applied by other,

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

- adaptation - seeking solutions in other areas (analogy thinking),
- connecting - integrating known and proven solutions, based on copying but has a creative element.

After identifying the available alternatives to achieve the assumed goals, we must make a choice among the alternatives. We can do this using the following techniques:

- comparison of individual variants,
- formulation of criteria and then the selection of alternatives on their basis,
- gathering the pros and cons of each solution, assigning weights to them and comparing them according to a uniform scale.

In the event that we cannot finally choose one of the available alternatives, making a subjective choice is the responsibility of the manager (manager).

An action plan is developed for the chosen alternative. This is usually done using a technique known as 'project management' or 'change management' [Wyrwicka et al. 2014].

The task that should be completed before implementing the chosen alternative is to build a system with those implementing a new solution. Its purpose is to motivate subordinates to act. In this regard, all possible means of communication with subordinates should be used. If necessary, outside assistance should be used. A built communication system must take into account the specificity of the environment in which communication takes place, as well as social and cultural conditions.

CONCLUSIVE REMARKS

The analyzes showed that the weak point of resource management in modern production enterprises is primarily the resource demand calculations and determining the size of needs in relation to planned tasks. Available procedures for carrying out these tasks, regardless of whether they are implemented with the help of IT support or without its use give only approximate results. Their use is only possible for countable resources. Interpretation of the results obtained is mainly based on the principle of analogy (comparing results between different periods and is based on the experience of planners. Lack of tools to even estimate the demand for uncountable resources.

The situation is slightly better when solving problems related to resource availability. There are procedures used to solve these problems. They are based mainly on methodologies such as "project management or" change management ".

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7

It seems that in the conditions of changes facing modern production enterprises - implementation of the concept of Industry 4.0, there is a need to develop new and more perfect tools for demand counting resources and to develop tools for demand counting resources. Procedures for solving problems related to the availability of resources also require improvement and further development.

REFERENCES

APICS Dictionary, 7th Edition, American Production and Inventory Control Society, 500 West Annandale Road Falls Church, VA, p. 8.

Blackstone J. H., Capacity Management, Cengage Learning, Mason, OH, 2008, p. 42- 45.

Cross W., Prentice Hall Encyclopedic Dictionary of Business Terms, Prentice Hall International, Inc., London, 1995, p. 403 – 413.

Duguay, C., Landry, S. and Pasin, F. (1997), "From mass production to flexible/agile production", International Journal of Operations & Production Management, Vol. 17 No. 12, pp. 1183-1195. https://doi.org/10.1108/01443579710182936.

Metoda planowania zapotrzebowania materiałowego w planowaniu produkcji i sterowaniu jej przebiegiem, Wydawnictwo Politechniki Poznańskiej, 2013, str. 74 – 77.

Fertsch M., Developing a timetable for radiant and circular transport organization with implementation of the Transportation Requirements Planning Method . Logistics and Transport , nr 3, 2017, p. 45 – 50.

Kałkowska J., (2010), Zarządzanie strategiczne. Metody analizy strategicznej z przykładami, wyd.I, Politechnika Poznańska, Poznań, 2010.

Lee E.A., Cyber Physical Systems: Design Challenges, Electrical Engineering and Computer Sciences, University of California at Berkeley, Technical Report No. UCB/EECS-2008-8, http://www.eecs.berkeley.edu/Pubs/TechRpts/2008/EECS-2008-8.html, 2008.

Lofti V., Implementing flexible automation: A multiple criteria decision making approach, International Journal of Production Economics, Volume 38, Issues 2–3, March 1995, p. 255-268, https://doi.org/10.1016/0925-5273(95)00013-EGe

Matejun M., Rodzaje outsourcingu i kierunki jego wykorzystania, Zeszyty Naukowe Politechniki Łódzkiej, Nr 989, Organizacja i Zarządzanie, z. 42, 2006, str. 19 – 34.

Papaj E., Rachunek ciągłego doskonalenia kosztów jako element koncepcji lean management, Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach ISSN 2083-8611, Nr 307 • 2016, str. 75 – 91.

Wyrwicka M. K., Jaźwińska D., Percepcja uwarunkowań rozwoju przedsiębiorstw, Economics and Management, University of Economics in Katowice, Nr 2/2014, DOI: 10.12846/j.em.2014.02.19, str. 259 – 275.

Wysocki J., Kompetencje przedsiębiorstwa a innowacje. Zeszyty Naukowe Uniwersytetu Szczecińskiego, nr 579, 2010, str. 71 – 82.

Brzeziński Ł. et al. (Eds.), Modern solutions in production and warehousing, Spatium, Radom 2019.
https://doi.org/10.17270/B.M.978-83-66017-87-0.7