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KEY PERFORMANCE INDICATORS FOR SUPPORTING DECISION-MAKING PROCESS IN MAKE-TO-ORDER MANUFACTURING

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Abstract

In conditions of global crisis demand falls and pressure on price reduction increases. A significant implication is that enterprises begin to pay more attention to cost management, economic effectiveness and efficiency of business processes. Performance measurement systems (PMS) are tools widely used for the management of enterprises and in decision-making processes to assess the level of accomplishment of objectives including different kinds of indicators. The first one there are elements which can be measured (e.g. quantity, frequency) and other ones which cannot be measured, but it is possible to asses them using an appropriate scale. In this paper a new approach of performance management in make-to-order sector is proposed. The use of key performance indicators (KPI's) to assess effectiveness of business processes for make-to-order manufacturing is suggested. These indicators help to guarantee appropriate degree of product quality, execution time and costs of orders. KPI's allow the re-planning of objectives and the decision-making process to be improved.

Key words

Key Performance Indicators, Make-to-order Manufacturing, Performance Management

Introduction

The current competitive context puts manufacturers under increasing pressure to provide products that meet the particular requirements of individual customers, calling for high flexibility in business processes. The make-to-order sector is marked by the complexity and the uncertainty of demand. So the ability to deal with more and more differentiated requirements in terms of products features, delivery lead time and cost is crucial. Due date quotation and capacity evaluation at the customer enquiry stage are of a strategic importance

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to be competitive. They have the large impact on the company performance. Despite of that due date setting, order acceptance processes and related decisions is often underestimated in practice (9), (14). The nature of the problem is: how connect operational decisions about production order acceptation with strategy of the company?

Good preparation of the planning, organizing, monitoring and control of performance of business processes, along with an efficient decision making process enables companies to develop and take advantage of business opportunities. The decision making process has to be analysed not only according to the most profitable option, but also to consider important information such as: influence of nonfinancial factors, conformity of decisions taken with overall enterprise strategy, influence of company functioning determinants and its environment on the decision making process, varying probability of different events occurring, costs of obtaining information, lack of information about total costs of different solutions, and influence of decision-makers′ character on decisions which are made (11).

Nowadays, a process approach is most popular in organization management, which is based on the assumption that activities should be optimized to take processes into account, rather than functions. The process approach is the result of the need to seek new sources of performance growth in enterprises. Very high adaptational abilities are expected of organizations, which means the ability to quickly adjust the course of processes to individual customers requirements is expected (process individualization). Companies try all the time to increase performance and to optimize the use of resources which they possess (3).

The make-to-order (MTO) sector of enterprises, which manufacture their products according to production orders, has grown. Organizations very often form different kinds of strategic alliances, which have led to the popularization of the organization-network model, which consists of small units with simple skills that give a competitive advantage (4).

Low costs and short time of production order realization have become key success factors in make-to-order manufacturing (14). The small and medium manufacturing enterprises sector must adapt to different customer needs. To save time and reduce the cost of manufacturing products, a company can be seen as a set of business processes. Manufacturing companies must strive to reduce the time and costs of business processes in a way that does not cause deterioration in the quality of the manufactured products.

In the paper a new approach of performance management in make-to-order sector is proposed. The main goal of this paper is to investigate the possibility of using Key Performance Indicators (KPI's) to measure and assess effectiveness of business processes for make-to-order manufacturing. Consideration of KPI's in the decision-making process concerning production order realization allows permanent monitoring and control of the strategy realization of the company in day by day decisions. These indicators help to guarantee an appropriate degree of product quality, execution time and costs of orders. KPI's allow the re-planning of objectives and the decision-making process to be improved.

Implementation of performance management in make-to-order enterprises

An important problem of enterprises operating make-to-order manufacturing is as follows: how to link the strategy of the enterprise, which usually changes very quickly, with operational planning and conditions which are investigated during production order verification? In this paper a new approach in make-to-order sector to implement is proposed.

Performance Management (PM) is a concept of management which focuses on providing employees with information necessary for the effective performance of their duties. PM includes the area associated with the planning, measurement and evaluation of the effectiveness of the organization (10). According to M. Sumiński the main goal of PM is the integration of all the financial and operational data, ensuring their quality, reliability and availability (10).

Controlling systems have high dynamics of data. New objectives and strategic directions, projects and products must be reflected very quickly in plans, budgets, forecasts and management reports. The system must function in a manner responsive to the constant changes in the enterprise. The basic requirement for this system is the ease of making changes (10). Strategic controlling in the enterprise combines two functions: a provider of information and business advisers (8).

The modern structure is built around processes, which are treated as dynamic objects around which to build a system of relationships within an organization. The process is a set of sequential steps that are associated with the cause-effect dependencies (3). The process is a series of activities or tasks that leads to the creation of a specific product (1). The results of the preceding activities are the inputs to the activities which follow, i.e. the input is transformed and enriched by the added-value which is a result of the process (3). In accordance with process management, the company manufactures products using available resources. Process management is understood as an activity which relies on optimizing the structure of the elements of the organization with regard to their impact on the creation of the final value of the effect of separate processes. It seeks to maximize participation of those elements which add value and minimize the participation of inefficient operations within the structure of the organization (3).

A significant implication is that enterprises begin to pay more attention to cost management and economic effectiveness and efficiency of business processes. Performance measurement systems (PMS) are tools widely used for the management of enterprises and in decision-making processes to assess the level of accomplishment of objectives including different kinds of indicators. There are elements which can be measured (e.g. quantity, frequency) and others which cannot be measured, however, it is possible to assess them using an appropriate scale.

Enterprises are constantly changing. The success of enterprises depends more and more often on factors which cannot be measured by the means of financial metrics (e.g. the relationship with the client, a rich and well organized network of suppliers, etc.). The financial system of measuring efficiency in such conditions is no longer efficient, and indeed prevents monitoring of the implementation of the strategy.

A strategy can be effectively implemented by using Key Performance Indicators (KPI's) where the role of non-financial indicators is particularly important (6). They allow planning for frequently changing enterprise strategies and objectives to be quickly adjusted and the strategic objectives of the company and the implementation of operational measures (financial and non-financial) to be linked (8). Besides, strategy is closely linked to the analysis of cause and effect relationship scores. These relationships describe the strategic logic, showing how investing in employees, information systems and innovative products leads to improved future financial results. The mission and strategy of the organization is transformed into a coherent set of measures of performance, which is the framework of a strategic management

system (6). KPI's allow business processes performance to be measured and to take into consideration expected levels of key performance indicators to verify production orders. KPI's can link the strategy of the enterprise with a decision-making process concerning production order acceptance, operational planning of order realization, and order realization, which is presented in Figure 1.

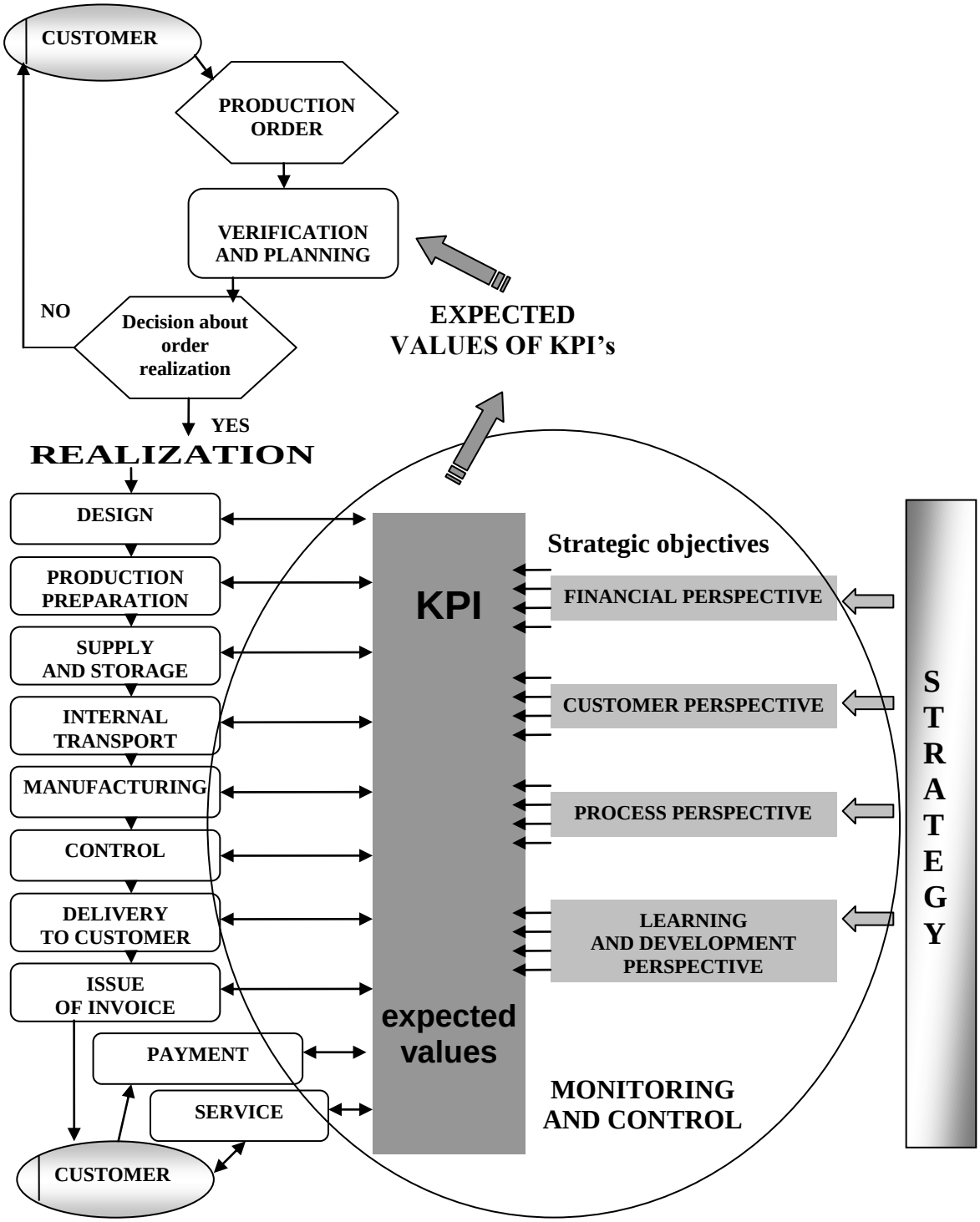

Fig. 1 *The scheme of performance management in make-to-order enterprises. Source: own study*

The authors of papers propose to implement a new approach of performance management in make-to-order manufacturing. This approach includes two parts. The strategy formulation and using Key Performance Indicators to measure performance of business processes are in the first part. The monitoring and control of a strategy realization, adjusting of verification of production orders and a decision-making process about orders acceptance to an enterprise strategy realization are the second part. The proposed by authors approach of performance management in make-to-order manufacturing consists of nine steps:

1. clarify and translate vision and strategy;
2. determine strategic objectives in four perspectives;
3. determine key performance indicators (KPI) for each strategic objective;
4. determine expected values of all KPI's;
5. monitoring actual values of KPI's;
6. compare actual values with expected values of KPI's;
7. determine causes of deviations;
8. correction of business processes;
9. consider performance measurement in verification of production orders and a decision-making process about production order realization.

First the enterprise should formulate vision and strategy of company for next few years. After clarification of vision and strategy, strategic objectives in four perspectives: financial, customer, process, and learning and development are established (see next paragraph). It can be used a strategy map which is a tool which helps to formulate strategic objectives in four perspectives and show relationships between them (7). Then key performance indicators for each strategic objective are determined. The main task of KPI's is business processes to measure. The next step relies on formulating the expected values of KPI's. The enterprise managers should be explained what values of KPI's guarantee to realize a strategy in defined time. Next an enterprise must control and monitor a strategy realization. It is tested what are actual values of KPI's and they are compared with expected values of KPI's. Causes of deviations should be carefully identified. According to them must be defined a plan of business processes correction. The main part of the proposed approach is consider performance measurement in verification of production orders and a decision-making process about production order realization. The proposed approach allows a long-term strategy of a company with a daily decision-making process about order realization, to be linked. It guarantees that verification of production orders based on the indicators which help a strategy to realize in the company.

Measurement of business processes performance

Measuring the performance of business processes should be determined on the basis of the specific objectives in each of the four perspectives: financial, customer, process and learning and development (or knowledge and development). Each of them should be determined by strategic objectives, measures, specific objectives and activities (2). The financial perspective shows how the company is perceived by its owners (i.e. shareholders). It is an essential element because the defined level of return on investment is the most important objective of the manufacturing enterprise's functioning. The other perspectives should contribute to the implementation of the financial perspective's objectives. The perspective of the customer shows how the enterprise should be seen by customers. The internal processes perspective determines which processes should be improved to measure up to the expectations

of clients and owners. In the perspective of lifelong learning and development, ways to create the potential for change and improvement in the enterprise in the future should be sought (6). The potential here is understood to mean the intangible infrastructure, i.e. employees, organization of information systems, culture, etc. The strategic goals in four perspectives for enterprise from make-to-order sector are presented in Figure 2.

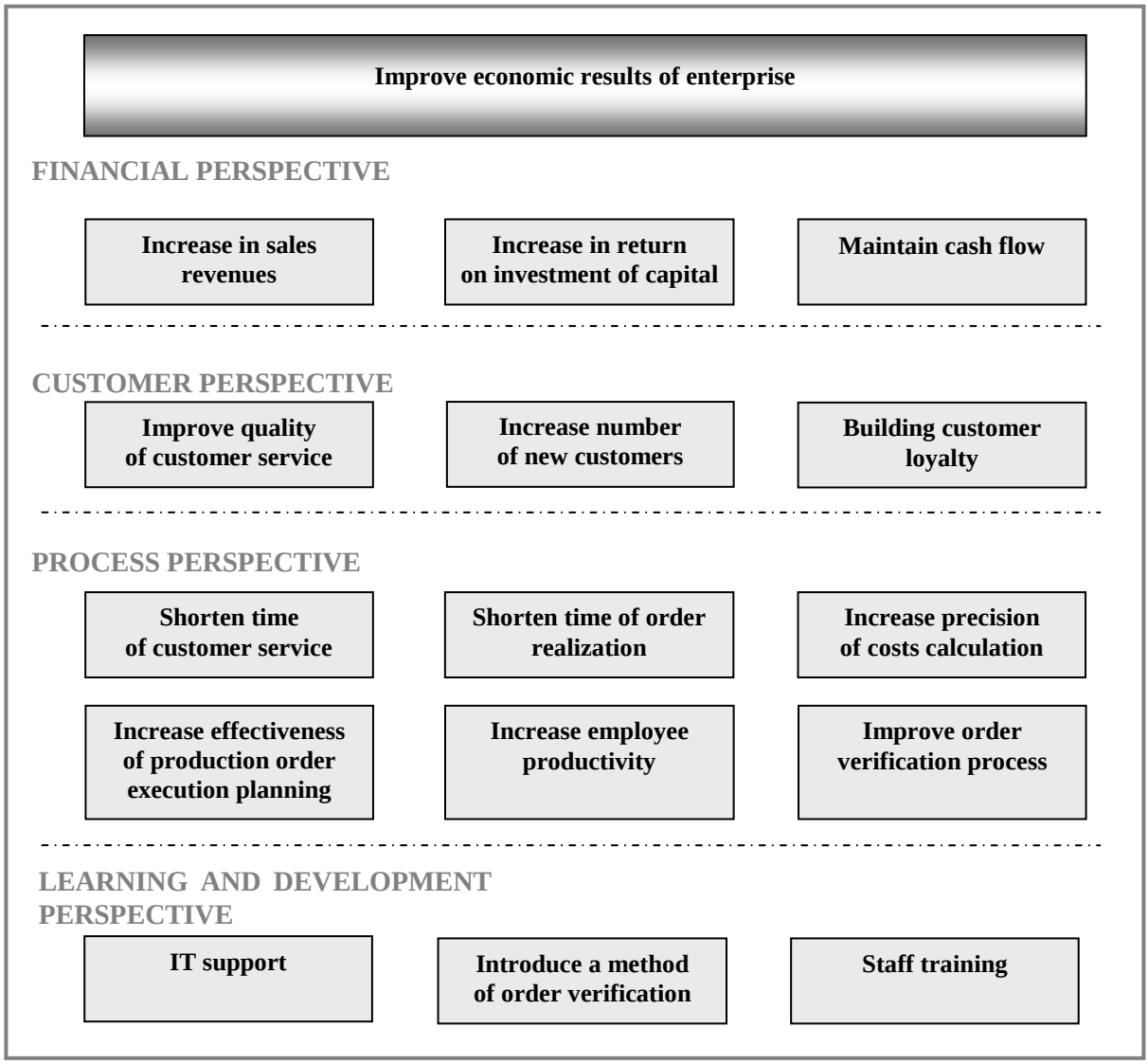

Fig. 2 *Strategic goals of the enterprise from make-to-order sector*
Source: own study

The financial perspective is a long-term objective of the functioning of the enterprise. It can be measured using a variety of indicators. Most commonly applied are: the size of revenue, profitability indicators, as well as the value for the shareholders (in joint-stock company) (12).

According to Kaplan and Norton, the financial strategy of the company may be achieved by two levers: increasing revenue, and productivity growth (5). The increase in revenue can be obtained through new sources of income (e.g. new products, new customers, new markets, etc.) or by increasing the value of the revenue of currently supported clients (e.g. creation and satisfaction of new needs, deepening relationships with customer, offering new products to current customers, etc.). Productivity growth strategy is based on the assumption that the effects can be achieved by reducing financial costs or optimizing the utilization of assets held. Therefore, the strategy focuses on improving productivity by: reducing direct or indirect production costs, improving the structure of expenditure, and increasing efficiency in the use of assets held by minimizing the size of working capital, as a result of the increase in the efficiency of operational processes (12). Establishment of objectives in the customer perspective depends on the kind of customers and their needs. The company has to determine what a value to the customer is. That value can be: descriptions of products, prices, relations, image, and other attributes (12). M. Treacy and F. Wiersema formulated three strategies of value for customer (13):

- strategy of operational value – is connected with continuously maintaining competitive prices, high quality of products, wide range of products, short time of production order realization and delivery;
- strategy of intimacy with customer – create relation with receivers through addition of extra services to the main offer and guarantee the highest level of completeness of an offer;
- strategy of product leadership – rely on care of specific products: product brand and knowledge and market reputation of a company.

Enterprises usually adopt all the strategies together; however, one of them is usually a dominant strategy. There are four groups of processes in process perspective (internal process perspective) according to R. S. Kaplan and D. P. Norton (6):

- operational management processes;
- customer management processes;
- innovative processes;
- control (regulatory) and social processes.

Operational management processes are simple, daily processes, which allow products to be manufactured, service to be provided and delivery made to customers. These are: material purchasing, production processes, provision of service, distribution of products and risk management. Customer management processes rely on extending and increasing contact with customers. This includes: selection of target customer segments; taking the target customers and maintaining and managing the customer relationship (CRM) (12). Through the processes of innovative new products and services, the following modification of processes and new markets and customer segments are obtained. Innovative processes include the identification of opportunities associated with new products and services and the introduction of new products and services to the market. From the perspective of knowledge and development of intangible assets of the organization and their role described in the process of implementation of the strategy, the most important intangible resources include (12):

- human capital;
- information capital;
- organization capital.

Conclusion

A make-to-order sector is a specific kind of organization according to a management. A decision-making process about production order acceptance plays a key part in enterprise. A strategy should be translated to the conditions concerning order verification. There are a lot of factors which have to include in the moment of order realization planning. Implementation of Performance Management in enterprises with make-to-order manufacturing help to monitoring and control of business processes and formulate conditions which are a base to verify the production orders. Measuring the performance of business processes in enterprises allows the realization of strategy to be assessed and quality of processes to be controlled and monitored. Key performance indicators help to guarantee an appropriate degree of product quality, execution time and costs of orders. KPI's allow the re-planning of strategic objectives. Furthermore, KPI's can be used to support a decision-making process concerning acceptance of production order and execution. A presentation of the new approach was the main goal of this paper. A detailed description of a strategy map building and indicators creating will be published in next scientific papers.

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References

1. ADRIA C. B., MURRAY B. A. *Radykalna reorganizacja firmy*. Warszawa> PWN, 2002, s. 29.
2. DVORAKOVA L., HOROVA M. Integrace udržitelnosti do finančního řízení podniku a její vliv na hodnocení výkonnosti podniku. In: *Aktuálne problémy podnikovej sféry*. Bratislava: Vydavatelstvo EKONOM, 2012, s. 80-85.
3. RAJEWSKI P. *Organizacja procesowa*. Warszawa: PWE, 2001, s. 7-14.
4. GRUDZEWSKI W., HEJDUK I. *Projektowanie systemów zarządzania*. Warszawa: Difin, 2001, s. 55-56.
5. KAPLAN R. S., NORTON D. P. Having Trouble with Your Strategy? Then map it. In: *Harvard Business Review*, September-October 2000.
6. KAPLAN R. S., NORTON D. P. *Strategiczna karta wyników. Jak przełożyć startegię na działanie?* Warszawa: PWN, 2001, s. 18-22.
7. KAPLAN R. S., NORTON D. P. *Strategy maps. Converting intangible assets into tangible outcomes.* Boston- Massachusetts: Harvard Business School Press, 2004.
8. KOTULA K. Controlling strategiczny i Zrównoważona Karta Wyników w spółce Energia Obsługa i Sprzedaż. In: *Controlling i Rachunkowość Zarządcza*, 2012, **154**, Nr 7, s. 10-18.
9. STRAKA M., MALINDZAK D. Definovanie periody pre tvorbu vyrobnych planov firmy Alfa Folie. In: *Acta Montanistica Slovaca*, 2009, rocnik 14, cislo 1, s. 121-126.
10. SUMIŃSKI M. Performance Management to nie tylko rozwiązania informatyczne. In: *Controlling i Rachunkowość Zarządcza,* 2012, **154**, Nr 7, s. 27-32.
11. ŚWIDERSKA G. K., *Controlling kosztów i rachunkowość zarządcza*. Warszawa: Difin, 2010, s. 188.

12. ŚWIERK J. *Mapa strategii i strategiczna karta wyników w planowaniu działań przedsiębiorstwa.* Lublin: Wydawnictwo Uniwersytetu Marii Curie-Skłodowskiej, 2009, s. 94-98.
13. TREACY M., WIERSEMA F. *The Discipline of Market Leaders*. New York: Addison-Wesley, 1995.
14. ZORZINI M., CORTI D., POZZETTI A. Due date (DD) quotation and capacity planning in make-to-order companies: Results from an empirical analysis. In: *International Journal of Production Economics*, 2008, No 112, pp. 919-933.

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