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ANALYSIS OF THE POSSIBILITY OF USING KEY PERFORMANCE INDICATORS IN THE SYSTEMS OF LOGISTICS AND PRODUCTION ENTERPRISES

Key Performance Indicators (KPIs) are one of the most important management tools in enterprises. Their proper implementation and application help to improve and control both the processes and the effectiveness of activities undertaken in the organization. The study aimed to analyze the degree of use of the Key Performance Indicators in information technology (IT) systems by logistics companies and manufacturing companies and to investigate possible differences in the scope of knowledge and use of KPIs between logistics and manufacturing companies. The conducted analyses indicate that production companies tend to use financial and non-financial KPIs, while logistics companies mainly use financial indicators. Based on the pilot studies, the degree of use of KPIs was assessed as high. Respondents in the survey indicated a high or very high level of efficiency in the use of KPIs in the context of general objectives of enterprises from the perspective of customers, finances, processes, and development.

Keywords: Key Performance Indicators (KPIs), Quality Management, Efficiency.

1. INTRODUCTION

In recent years, economic changes have contributed to the fact that both the quality of products and services as well as ISO standardization, affect innovation. These factors have become a priority criterion determining the success of enterprises (Mentel, Hajduk--Stelmachowicz, 2020; Ostasz et al, 2020; Sudoon, 2006). They can support the achievement of economic, environmental and social objectives as well as support sustainable development (Hajduk-Stelmachowicz, 2014). Equally important is the management's knowledge of the possibilities of increasing the effectiveness of work. The knowledge of management is the result of both theoretical and practical knowledge and can result in the improvement of the company's operations and processes. (Babica, Pająk, 2006;

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Karaszewski, 2005; Wolniak, Skotnicka, 2005). Sustained and effective continuous quality improvement (CQI) can be achieved by directing the organisation's efforts towards planning, monitoring, and preventing problems right at their source (Bamford, Greatbanks, 2005; Grudowski, 2006).

Lack of feedback on the functioning of the components of the whole enterprise may be one of the reasons for the failure to achieve the objectives set. The control of the achieved results can take place in the sphere of finances, customers, processes, and development. For this reason, Key Performance Indicators (KPIs) should be seen as the tool most frequently used by managers who contribute to increasing the level of effectiveness of strategic and operational management. By monitoring the KPIs and the extent to which they have been achieved according to the objectives set, the management can be provided with information enabling them to make quick decisions, prioritise their activities and improve the company's development strategy. (Borsos, Iacob, Calefariu, 2016; Grabowska, 2017; Pacana, Czerwińska, 2020; Parmenter, 2016).

The study aims to analyse the degree of use of Key Performance Indicators in IT systems in logistics companies and manufacturing companies. The study will also examine possible differences in the scope of knowledge and use of KPIs between logistics and manufacturing companies.

2. CHARACTERISTICS OF KEY PERFORMANCE INDICATORS (KPIS)

Key Performance Indicators is the methodology for the application of measuring and assessment in management of an enterprise. KPIs combines both controlling of the processes and Lean Manufacturing tools. The use of key indicators is based on the rationalization and selection of an appropriate profile of indicators to facilitate the measurement and assessment of achievement of the objectives, defined by the SMART (*Specific, Measurable, Achievable, Relevant, Time-bound*) concept. (Czerwińska, Pacana, 2020; Drucker, 2004; Mourtzis, Fotia, Vlachou, Koutoupes, 2018; Podgórski, 2015; Zhou, He, 2018).

Key Performance Indicators are being used for the purpose of assessing the economical, technical and organizational parameters describing the functioning of the enterprise. The assessment of the KPIs will allow to identify the factors influencing the values of the performance indicators (Bartecki, Król, Skowroński, 2018; Czerwińska, Pacana, Dwornicka, 2020; Hollender 2016).

KPIs are one of the tools of Business Performance Management, i.e. a group of concepts in the field of operational management. KPIs promote the improvement and effectiveness of the organization's functioning with the use of measures, processes monitoring and performance management systems. At the same time, KPIs are an integral part of a set of global best manufacturing practices known as World Class Manufacturing (WCM). In the literature on the subject one can find over 2000 definitions of KPIs being used by organizations in diverse sectors. (Grycuk, 2010; Parmenter, 2016; Piasecka-Głuszak, 2017). Selected KPI definitions are included in Table 1.

An analysis of the attributes of KPIs listed in Table 1 allows for the formulate of the definition of performance – based indicators as follows: *Key performance indicators are a method of assessing a specific process for the purpose of calculating the success rate from economical, technical, and organizational perspectives.*

Table 1. Definitions of key performance indicators

Number	Source	Definition
1	ISO 22400-1:2019, 2019	Quantifiable level of achievement of the critical objective. ISO 22400 also states that key performance indicators measurements come directly from the aggregation function, physical measurements, data and other KPIs.
2	Clifton, 2012	Any measure, percentage, index or average that can help an organization to quickly understand incoming data in the right context and time.
3	Berrah, Foulloy, 2013	The process of measuring performance representing a relationship expressed by a type of measure in combination with the target point and reflecting on the objective.
4	Onyemeh, Lee, Iqbal, 2016	A KPI indicates how far the organization is pursuing operational, tactical or strategic objectives that are key to its current and future success.
5	Neely, Adams, Kennerly, 2002	Parameter to quantify past performance and/or efficiency.
6	Vaser, Forconi, 2015	KPI is a mathematical combination of elements called performance counters or permanence indicators. The performance measures identify systemic events reflected in the KPI formula and prove that something has happened, e.g. failure or success in a specific networked procedure.
7	Paulen, Fnken, 2009	Key organizational indicators that stimulate the company's performance.
8	Melnyk, Bititci, Platts, Tobias, Anderson, 2014	It is a tool to measure efficiency and/or effectiveness and is therefore both measurable and verifiable.
9	Ortega, 2012	Financial and non-financial indicators used to determine achievements over time towards achieving operational and strategic objectives.
10	Enns, 2005	KPIs are parameters that show the condition of the company and its business development system. They combine the company's objectives and strategies with its results, outputs. KPIs provide management with past, current and future status information.
11	Al-Mutairi, 2012	Key performance indicators are commonly used by companies as a tool to assess performance. They form the basis for a system of achievements that turn the company's long-term strategic goals into short-term ones. The establishment of a clear and able to be assessed indicators are critical. KPIs facilitate good performance management.
12	Rolo, Pires, Saraiva, 2014	They are measures of the achievements of processes in an organization. They are used as communication tools between the management and the lower levels of the organisational structure. KPIs also reinforce the organisations mission and vision. Key performance indicators can also be used to measure the performance of the network, which makes it possible to set targets for achievement and the effectiveness of the entire organisation

Source: own study based on: (Neely Adams, Kennerly, 2002; Clifton, 2012; Berrah, Foulloy, 2013; Onyemeh, Lee, Iqbal, 2016; ISO 22400-1:2014, 2014; Vaser, Forconi, 2015; Melnyk Bititci, Platts, Tobias, Anderson, 2014; Ortega, 2012; Enns, 2005; Al-Mutairi, 2012; Rolo, Pires, Saraiva, 2014).

Key performance indicators need to identify the priorities of the actions needed to improve the process and actions needed to mobilize the workforce to reach the goals and strategies of the enterprise.

3. METHODOLOGY OF THE STUDIES

The research methodology adopted in the study includes a survey questionnaire. The first stage of the pilot study was addressed to a group of 50 manufacturing companies and 40 logistics companies. The survey aimed to check the knowledge of selected KPIs – a set of current and forecasting measures based on four perspectives:

- customers,
- finances,
- processes, and
- development.

These groups can be extended with relevant indicators used by the enterprises. The target group of respondents were people employed in positions from the area of operational management, such as:

- directors,
- production managers,
- sales managers,
- quality specialists,
- quantity specialists
- quality managers, and
- project managers.

The research was conducted in enterprises located in the southeastern part of Poland.

The second stage of the research was related to the analysis of the knowledge of KPIs within the selected groups manufacturing and logistics entrepreneurs. The survey was conducted in sixty companies (31 production companies and 29 logistics companies). Respondents were chosen deliberately – as was the case in the first stage of the research. Fig. 1 shows a diagram of the procedure presented in the study.

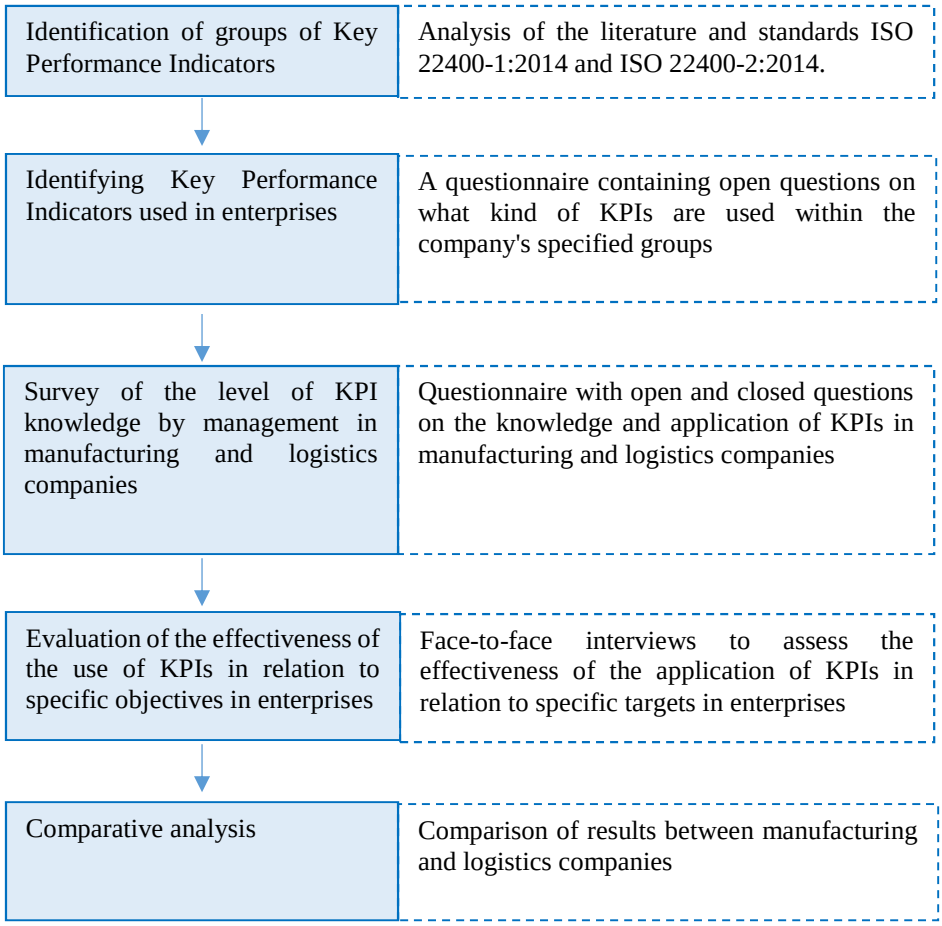

Fig. 1. Research methodology

In the face-to-face interviews, the respondents were asked to express their opinion on the effectiveness of the application of KPIs in relation to the objectives set in their enterprises. The research is concluded with a comparative analysis of results obtained in manufacturing and logistics companies.

4. RESEARCH RESULTS AND ANALYSIS

As the type of KPI influences the way it is used (Corbin 2009; Kaganski, Paavel, Lavin, 2014) and the type of measurements determines its impact on other measures of this type (Germany, 2019), it is important to classify the KPIs. KPIs can be divided into financial and non-financial (Kaplan, Norton 1996). In the first part of the survey, it was decided to check what kind of measures are used in companies to assess performance (Table 2).

Table 2. Answers to the question: "What kind of method of measurement is used in your company to measure performance?"

Answers	Production companies	Logistics companies
Mainly or exclusively financial	36%	53%
Mainly non-financial	14%	5%
Both financial and non-financial	46%	33%
None of the methods of measurement are used	4%	10%

Financial measures are expressed in monetary units or a something related to monetary units. They are generally treated as objective because they come from an accounting system and therefore generally represent a reliable assessment of the company. This may be the reason for the large number of companies that have indicated that they predominantly use such performance measures. Due to the specificity of logistics companies, the use of financial indicators dominates. Non-financial measures are often expressed in physical units and represent complex issues that often require a personalized approach. The use of non-financial indicators is challenging as it requires interaction between the accounting department and other organizational units of the company and the integration of existing information systems with other departments into coherent unit. Non-financial indicators are more frequently used by manufacturing companies. However, the most common solution for manufacturing companies is to use both financial and non-financial performance measures.

The conducted survey made it possible to identify a list of indicators most frequently used within the enterprises. The allowed for a significant reduction in the number of KPIs which need to be considered and that facilitated further analyses. Table 3 identified KPIs within the framework from such perspectives as: customers, finances, processes and development and the number of measures used in assessing of individual KPIs.

Table 3. Level of use of KPIs by IT systems in manufacturing and logistics companies

KPI meter	Production companies	Logistics companies
Customer perspective		
Number of newly acquired customers in specific periods of time.	93.5%	89.7%
Number and value of lost orders broken down by customers and time periods.	64.5%	72.4%
Total and detailed value of orders from individual customers in the given reporting periods.	71.0%	75.9%
Customer Value Coefficient (necessary to introduce customer segmentation).	61.3%	82.8%
Customer satisfaction rate for services or goods supplied.	90.3%	86.2%

Table 3 (cont.). Level of use of KPIs by IT systems in manufacturing and logistics companies

KPI meter	Production companies	Logistics companies
Financial perspective		
Average cost of order processing.	74.2%	89.7%
Amount of losses incurred due to lost orders.	58.1%	72.4%
Comparison of revenue and costs by department and the entire company.	100.0%	96.6%
Value of overdue receivables.	48.4%	62.1%
Cash flow.	96.8%	100.0%
Financial result of the company.	100.0%	100.0%
Process perspective		
Number of employees involved in order processing.	71.0%	65.5%
Order processing time from the moment of placing an order to the moment of confirmation of receipt by the customer.	87.1%	86.2%
Waiting time for implementation at individual stages of the order being processed by the company.	90.3%	41.4%
Average waiting time for deliveries.	87.1%	51.7%
Value of deviations from confirmed prices and delivery dates.	80.6%	79.3%
The rate of rotation of goods in the warehouse in correlation with the demand for goods generated by the company.	83.9%	82.8%
Development perspective		
Numbers of newly acquired foreign customers in specific time frames.	90,3%	96,6%
Differences in the labour intensity of departments, processes, production operations as a result of implementing new technologies and equipment.	77.4%	34.5%
Costs of importing products/goods.	74.2%	86.2%
Standardisation of the company's position concerning its competitors, based on industry rankings and independent comparative studies.	67.7%	72.4%
Cost-benefit ratio of conducted market campaigns.	80.6%	86.2%

When analysing the data (level of use of KPI) obtained from the customer perspective, comparable values can be found among manufacturing and logistics companies. Only indications of the customer value ratio, which is needed to introduce customer segmentation, turned out to be smaller among manufacturing companies (21.5% difference). From a financial perspective, all the measures indicated in the survey are more popular among logistics companies, while the opposite trend has been observed in the case of the measures singled out under the process perspective. This trend may result from the specificity of the studied groups of enterprises. As far as the development perspective is concerned, the level of use of the surveyed measures can be considered comparable. The exception is a measure indicating differences in labour intensity of departments, processes, production operations as a result of the implementation of new technologies and equipment, which is more applicable to production companies.

The third stage of the research was direct interviews conducted in thirty-one manufacturing companies and twenty-nine logistics companies. The persons participating in the face-to-face interviews were specialists within specific departments. They were operational positions in companies. At this stage, the study aimed to assess the effectiveness of the use of KPIs concerning specific objectives of the enterprises.

The level of effectiveness is defined in a 5-step scale, where 1 means lowest effectiveness and 5 means highest effectiveness.

Table 4. Evaluation of the effectiveness of the KPIs

Perspective	**General objective of the company**	**Average assessment of the effectiveness of KPIs compared to objectives**	
		Production companies	**Logistics companies**
Customer perspective	New customers.	4.54	4.41
	Improving the quality of service for existing customers (extending the offer, improving the speed of distribution of goods to customers and from suppliers, after-sales services).		
	Reducing customer service costs.		
Financial perspective	Analysis of the profitability of orders.	4.93	4.87
	Identification of the goods and customers with the highest profits and losses.		
	Increase in the company's capital.		
	Increasing the company's profitability.		
Process perspective	Improving information flow.	4.67	4.03
	Optimization of internal processes related to customer service and delivery service.		
	Optimization of internal processes related to product manufacturing.		
	Stock optimisation.		
Develop-ment perspective	Extension of the territorial coverage of the service.	4.29	4.16
	Expansion into foreign markets.		
	Increasing work efficiency by investing in modern technologies and equipment.		
	Increasing the company's market advantage.		
	Effective human resources management. Attracting new and retaining qualified employees.		

In terms of the effectiveness of the application of KPIs, the respondents assess the usefulness of the examined perspectives at a high or very high level. According to the respondents from manufacturing and logistics companies, the most effective indicators are financial indicators.

5. CONCLUSION

The KPIs implemented and used in enterprises should be periodically evaluated. Identifying and analyzing them is an important element of management. Employees should have knowledge of their use and the actions to be taken on the basis of the information provided by the indicators. The KPIs allow to determine if the company is on the right track to achieve its objectives and strategy. They also help to identify what is changing in the company and assess the direction of these changes.

The aim of the study was to analyse the degree of use of the Key Performance Indicators (KPIs) in information technology (IT) systems in logistics companies and manufacturing companies and to examine possible differences in the scope of knowledge and use of KPIs between logistics and manufacturing companies.

According to the KPI classification, financial and non-financial measures can be distinguished. On the basis of the pilot studies, it can be concluded that production companies tend to use both types of indicators, while logistics companies mainly use financial indicators.

Employing a strategy of measuring implemented KPIs means a conscious approach of the company to investigate the causes of bad or good business practices and results. Respondents in the survey indicated a high or very high level of effectiveness of use KPIs related to general objectives of enterprises within the perspective of customers, finances, processes and development. However, it should be remembered that KPI do not guarantee a success. Considering the experience and knowledge within the organization combined with the conscious use of the KPIs, increase the chance of choosing a strategy with positive results.

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