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Reengineering of production processes and its impact on the financial situation and business performance of the company

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ABSTRACT

The current competitive environment is only favourable to those companies that can cope with changes and use them to their advantage. The innovation of business processes is required to improve financial performance. Scientific works have not yet offered an effective solution to the monitoring of the impact made by process reengineering on corporate financial results. This work presents the case of a business process reengineering in a particular company to improve its performance. The results of implemented reengineering are analysed from the point of view of the impact made on the financial situation of the company. The paper aims to demonstrate the implementation of reengineering and evaluate its impact on the financial standing of a company and its performance. The practical application of reengineering was made according to Hammer and Champy methodology, which is based on the analysis of production processes in the company, the implementation of selected reengineered production processes and the evaluation of the reengineering impact on the corporate financial situation and performance. During the evaluation, the selected indicators of financial performance, activity indicators, the indebtedness indicator, business performance indicators as a cash flow to measure financial flows and the economic value-added (indicator EVA) were calculated and analysed. Subsequent to financial analyses and based on the selected indicators, the authors concluded that the implemented reengineering of the production process increased the performance and value of the company, which had a positive impact on the company's financial situation. The funds spent on the proper implementation of the reengineering steps were effectively used, and the reengineering process was also timed. This contribution to the body of theoretic knowledge links the implementation of reengineering and the part of the financial analysis, which is related to the preparation, implementation and reengineering results.

KEY WORDS

process, process management, reengineering, business performance, business performance indicators

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Introduction

Processes exist in every organisation and are managed in different ways. Process management applies to repeated and the same processes. On the other hand, project management is used for unique processes, such as, for example, the process for the implementation of a new information system. An organisation, enterprise or company is an organised set of processes and activities arranged in a sequence. Efficient and effective process management is required to achieve a set of goals. The analysis, understanding, management and improvement of processes as well as their performance have become a daily job of all employees of an organisation and, especially, managers. The current approach to business management focuses on the improvement of business pro-

cesses. Therefore, companies are increasingly shifting their attention to the performance of internal business processes to improve corporate performance (Sujová et al., 2016). Production has a decisive influence on the operation of a company, its position in the market and the competitiveness of the manufactured products. Effective manufacturing processes are, therefore, essential for financial performance. Several options are available for the improvement of processes, but two approaches are considered the main, namely, process optimisation as continuous improvement and radical change through reengineering.

Companies use reengineering in the case of ineffective processes and when in need of a radical change. According to this approach, a company needs to focus on key processes with high added value and eliminate insignificant minor processes with minimal added value. Reorganised key processes lead to smooth operation and elimination of bottlenecks, which should have a positive impact on business performance and, consequently, on the company's financial standing.

Process reengineering is a methodology developed by Hammer and Champy (2000) and modified by many other authors. However, insufficient information is available in the case of economically effective reengineering of processes. This is one of the reasons why companies are afraid of radical changes and redesign of processes. Most scientific works and research focus on the reengineering methodology and anticipated effects. However, no solution has been offered yet for linking the implementation part of reengineering and the monitoring of its impact on the financial results of the company. Consequently, the authors of this article decided to focus on the economic impacts of process reengineering using one case in a chosen company.

The paper aims to demonstrate the implementation process of a production process reengineering and to pinpoint its impact on financial results and performance of the company through an analysis of traditional and modern financial indicators.

The first section of the paper is dedicated to the review of the literature regarding the issues of reengineering and financial analysis. The second part describes the methodology of the work, and the third part presents the achieved results, which are then discussed in the fourth part. At the end of the article, conclusions are offered.

1. Literature review

In their definitions of a process, Ciencala (2011), Grasseová et al. (2008), Svozilová (2011), Marcineková and Sujová (2015) indicated that it must have inputs and outputs, logical continuity, added value, an internal or external customer, a process owner and must be repeatable and measurable.

A process is closely related to process management, which has been defined by various authors. Business Process Management is a scientific discipline that explains how work is performed in businesses or organisations to ensure consistent outputs and to take advantage of opportunities brought by improved procedures and processes (Homzová, 2012).

Gejdoš (2006), Závadský and Kovaľová (2011), Papulová et al. (2014), Sujová and Čierna (2018) agreed that process-driven organisations are customer-centred and, therefore, thy create higher value for the customer, focus on process management through analyses and metrics, use concepts, methods and approaches to improve processes as well as optimise and model them to make more radical changes and improve their performance.

Various authors (Řepa, 2007; Hammer and Champy, 2000; Manganelli and Klein, 1994; Davenport, 1993) agree that reengineering as a permanent process improvement must be a part of a corporate strategy to help companies achieve leading positions on local or global markets. The greatest possible efficiency of a system can only be achieved by optimising each subsystem operating within its framework (Suchánek et al., 2015). In process reengineering, the emphasis is on making business processes as simple and economical as feasible, and servicing a customer order in the shortest possible time (Rašner and Rajnoha, 2006).

There is a number of reengineering methodologies that differ in scope, focus, and also practical and theoretical orientation. Řepa (2007) and Kovář et al. (2007) suggest that in addition to the selected methodologies listed in Tab. 1, there is another DoD methodology that was developed for the radical cost reduction, called Aris, which does not have a defined procedure, but provides a number of perspectives and tools to model individual aspects of the business existence, the PPP (Participatory Processes Prototyping) methodology combining new methods with traditional and supporting interconnected development of processes, technology and human potential.

BPR (Business Process Reengineering) is defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, and service. In fact, a BPR effort changes practically everything in the organisation, including people, jobs, managers and values, because these aspects are linked together (Hammer and Champy, 2000).

Every change should be evaluated from an economic and financial points of view. Varcholová et al. (2007), Brealey (2000), Ručková (2010), Dubovická (2007), Neumaierová and Neumaier (2002), Mařík and Maříková (2005), Kotulič et al. (2010), Knápková et al. (2013), Hajdúchová (2000, 2011), Zalai et al. (2010), Tóthová et al. (2012) agree that financial indicators allow for a rapid and inexpensive picture of the company's financial performance. Evans (2018)

Tab. 1. Comparison of selected process reengineering methods

PROCEDURE	METHODOLOGY BY HAMMER AND CHAMPY	METHODOLOGY BY DAVENPORT	METHODOLOGY BY MANGANELLI AND KLEIN	METHODOLOGY BY KODAK
Project preparation	Introduction to reengineering	Vision and goals	Preparation of project	Initiation of a project
	Identification of business processes	Identification of business processes	Identification of project	
	Choosing business processes for reengineering			
Process reconstruction	Knowledge of selected business processes	Knowledge and measurement of processes	Vision	Knowledge of processes
	Redesign of selected business processes	Information technologies	Redesign - technical - personnel	Design of new processes
Implementation	Implementation of new business processes	Prototyping processes	Transformation	Transformation of the business
		Implementation processes		Change management

Tab. 2. Six phases of the Hammer and Champy methodology

PHASE	OBJECTIVE
Introduction into business reengineering	The "case for action" is a description of the organisation's business problem and current situation; it justifies the need for change. The "vision statement" describes how the organisation is going to operate and outlines the kind of results it must achieve. The top management should inform other employees about the visions
Identification of business processes	In this step, the most important business processes are identified and are described from a global perspective using a set of process maps. Process maps give a picture of the workflows through the company. The output of this phase is a number of process maps reflecting how these high-level processes interact within the company and in relation to the outside world
Selection of business processes	Candidates for reengineering are the most problematic processes, those with great impact on customers, processes with more chances to be successfully re-engineered or processes that contribute to the organisation's objectives. According to an organisation's strategic objectives, more criteria could be defined for selecting processes for redesign, such as increased customer value
Understanding of selected business process	The reengineering team needs to gain a better understanding of the existing selected processes. The objective is the provision of a high-level view of the process under consideration, for the team members to have the intuition and insight required to create a totally new and superior design
Redesign of the selected business processes	This is the most creative phase of the methodology because new rules and new ways of work should be invented. Imagination and inductive thinking should characterise this phase. Redesigning a process is not algorithmic or routine
Implementation of redesigned business processes	The last phase covers the implementation phase of the BPR project. Hammer and Champy believe that the success of the implementation depends on whether the five previous phases have been properly performed

Source: elaborated by the authors according to (Hammer and Champy, 2000).

points to the fact that a favourable financial result in the profit indicator may not necessarily mean operational efficiency evaluated by ratio indicators. The analysis of financial performance development can be made on the basis of financial ratio indicators and enable the prediction of future performance (Kiseľáková et al., 2018). Most authors recommend the ratio indicators for profitability analysis, activity indicators, indebtedness indicators, cash flow indicators, market value indicators of the enterprise, and the economic value-added (EVA) indicator.

2. Research methods

Based on the study of theoretical knowledge, a manufacturing company was recommended the methodology of process reengineering according to Hammer and Champy (2000). In the company, the methodology was practically implemented in the production process. The methodology had six phases, which are described in Tab. 2.

The evaluation phase was aimed at assessing the impact of the implemented reengineering solution through financial and economic indicators. Based on the recommendations of most authors, the analysis used profitability ratios, activity indicators, indebtedness indicators, performance indicators, market value indicators of the enterprise, and the economic value-added indicator EVA.

Profitability ratios are a form of expression of the resource efficiency that serves as the main criterion for capital allocation in a market economy. This includes, in particular, the following indicators (Zalai et al. 2010; Hajdúchová, 2000):

Return on assets ROA, which expresses the overall efficiency of the company, its production power. The following formula is used to calculate the return on assets:

$$ROA = \frac{Net\ Income}{Total\ assets} \quad (1)$$

Return on equity ROE, which expresses the return on equity of an enterprise. The relationship for the calculation of Return on Equity:

$$ROE = \frac{Net\ Income}{Equity} \quad (2)$$

Return on net assets RONA, which is calculated by dividing the company's net income in a given period by the total value of both — its fixed assets and its working capital. An increase in RONA indicates higher levels of profitability. RONA is calculated similarly to the ROA metric. Unlike ROA, RONA considers the company's associated liabilities. The RONA indicator is calculated as follows:

$$RONA = \frac{Net\ Income}{Fixed\ Assets + Working\ Capital} \quad (3)$$

ROSC, which represents the return on share capital of the company's owners. It only measures the effect for owners whose deposits are Share Capital. It informs them about the evaluation of the funds they have put into the business. A simple relationship is used for the calculation:

$$ROSC = \frac{Profit}{Share\ Capital} \quad (4)$$

Return on sales ROS, which is a ratio widely used to evaluate the entity's operating performance. ROS indicates how much profit an entity makes after paying for variable costs of production, such as wages, raw materials, etc. (but before interest and tax). It is the return achieved from standard operations and does not include unique or one-off transactions. This indicator encompasses the profit margin aspect. ROS is usually expressed as follows:

$$ROS = \frac{EBIT\ (EAT)}{Revenue} \quad (5)$$

Profit margin (PM), which is one of the most widely used profitability ratios and helps understand the relative profitability. It represents the percentage of sales turned into profits. Margins are computed from gross profit, operating profit or net profit. All three profit margins are calculated as the profit figure divided by revenue and multiplying by 100 (Berg et al., 2018). Operating profit margins correspond to ROS in percentage expression and the formula for calculation is as follows:

$$OPM = \frac{Operating\ profit\ EBIT\ (EAT)}{Revenue}\ x\ 100\ (\%) \quad (6)$$

Activity indicators reflect the ability of an enterprise to manage its assets effectively. Activity indicators include (Ručková, 2010; Kotulič et al., 2010; Brealey, 2000): *Total asset turnover ratio*, which indicates the number of turns over a given time interval (e.g. year), i.e., how many times the assets turn. It indicates the efficiency of the use of the company's assets.

$$Total\ Assets\ Turnover\ Ratio = \frac{Total\ assets}{Sales}\ x\ 365 \quad (7)$$

Inventory turnover ratio, which indicates the intensity of the use of inventory, i.e., how many times a year, the company transforms its inventory into sales.

$$Inventory\ Turnover\ Ratio = \frac{Sales}{Inventory} \quad (8)$$

Average collection period, which indicates how many days on average it takes until the money in the receivables is collected. It indicates the payment discipline of customers.

$$Average\ Collection\ Period = \frac{Daily\ receivables}{Sales/365} \quad (9)$$

Creditor's payment period, which reports on the payment discipline of the company itself to its suppliers and indicates the duration of payment of the obligation from the moment of its occurrence in days.

$$Creditor´s\ payment\ period = \frac{Daily\ obligation}{Sales/365} \quad (10)$$

Debt indicators serve to monitor the structure of the company's financial resources. The high share of own resources makes the company stable and independent; on the other hand, if the share is low, the company is unstable; thus, market fluctuations and creditor insecurity can have serious consequences (Hajdúchová, 2011; Tóthová et al., 2012).

Equity ratio explains the financial independence, the equity capital to meet the company needs.

$$Degree\ of\ self - financicng\ = \frac{own\ capital}{total\ capital}\ x\ 100\ \% \quad (11)$$

Total indebtedness indicates the degree of indebtedness of the business, the extent to which the debt is used to finance the company.

$$Total\ indebtedness = \frac{foreign\ capital}{total\ capital}\ x\ 100\ \% \quad (12)$$

Financial leverage shows the structure of the company's financial resources.

$$Financial\ leverage = \frac{foreign\ capital}{own\ capital} \quad (13)$$

Traditional cash-flow performance indicators are primarily financial and investment. Financial indicators deal with the financial position of the company in terms of its solvency. In contrast, investment indicators evaluate the company in terms of its future investment potential and stability for investors. The total cash-flow is measured using a direct or an indirect method. Operational Cash-Flow Calculations for Performance Evaluation were made using the indirect method and cash flow calculations from investment and financial activities by direct method according to Mařík & Maříková (2005) and Varcholová et al. (2007).

The economic value-added indicator (*EVA*) is an economic and financial indicator of business performance. Its main task is to measure the company's economic profit (Kiseľáková, 2018). The basic, most frequently used formula for calculating the EVA indicator is commonly (Ručková, 201; Knápková et al., 2013) is as follows:

$$EVA = NOPAT - WACC * NOA \quad (14)$$

where:
NOPAT — Net Operating Profit After Taxes,
NOA — Net Operating Assets,
WACC —Weighted Average Cost of Capital.

3. Research results

The following part of the paper presents the results of the reengineering process in the company and the financial analysis.

3.1. Implementation of process reengineering in the company

The implementation of process reengineering was divided into six steps.

The first step defined the objectives of reengineering — the construction of a new warehouse with a sophisticated sorting system and the automation of window production processes using a new fully automated line.

The second step was to identify business processes. To implement the reengineering process, the company used one production hall, in which all production processes were carried out. Recently, they implemented the CNC technology manufacturing process. In the process of reengineering, it was necessary to automate manufacturing operations, such as pickling, painting and drying. A map of window production processes before reengineering is shown in Fig. 1.

The third step was the selection of business processes for reengineering with the emphasis on the removal of manual labour and unproductive processes, and the more efficient storage of input materials. The biggest change due to the construction of the new hall occurred in the production processes of pickling, drying and painting, which were replaced by a new fully automated line.

The fourth step was to get to know the manufacturing processes that had a major impact on the quality of the final product. As these selected processes form a large part of the resulting quality of the

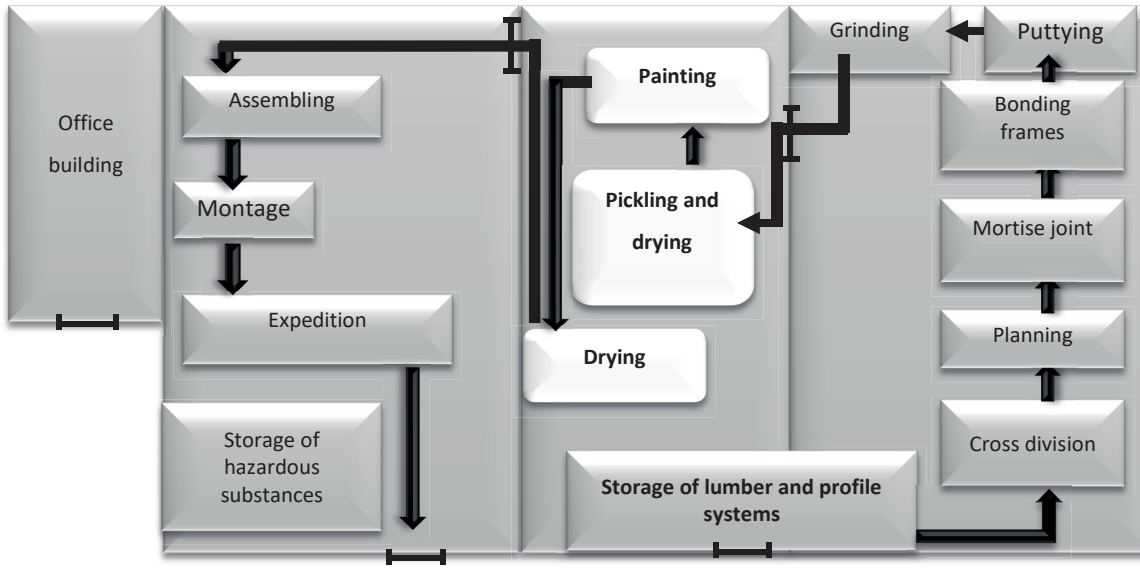

Fig. 1. Process map before reengineering

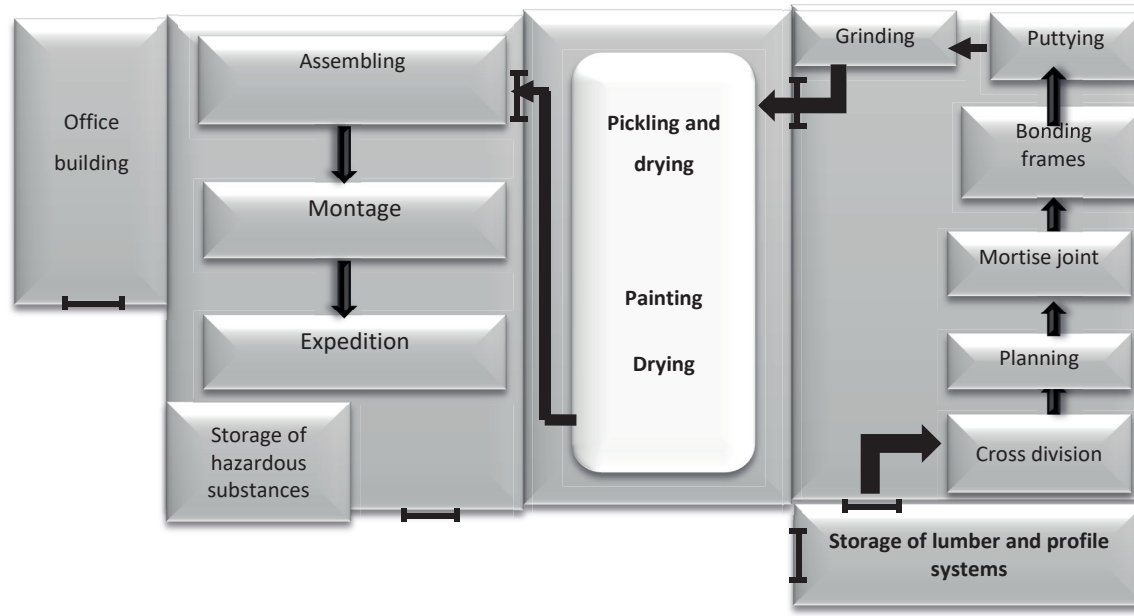

Fig. 2. Process map after reengineering

profile systems, their replacement with a fully automated line was key to the company.

The fifth step was the re-design of selected business processes. A change in the expansion of storage space with a sophisticated storage system and a change in manufacturing processes in the production of wooden windows was made to streamline the entire production process, reduce production costs, use human resources more efficiently, and improve the quality of finished products. These consequences had a positive impact on the company's financial position and performance.

Fig. 2 shows the arrangement of manufacturing and non-production processes after reengineering. New warehouse space was equipped with modern input material sorting, which also provided input inspection of raw materials. Pickling, painting and drying were replaced by a fully automated line. Completing, assembling and shipping were given more space, reducing the proportion of non-conformities due to mechanical damage.

In step six, new business processes were implemented. Preparation and implementation of project documentation preceded the construction of a new warehouse, the purchase of warehouse equipment and a new automated line. Funds for the construction of the hall were secured using a bank loan of EUR 170 000. The received subsidy funded the purchase of

a fully automated line. Currently, the operation is running under a new mode, and employees were provided with the necessary training to operate the new production line.

3.2. Evaluation of the impact of reengineering on the company's financial standing

The analysis of the financial situation in the company was carried out using profitability indicators, activity indicators, indebtedness indicators, cash flow ratios to measure financial flows and the EVA performance indicator. The profit margin, as one of the most important profitability indicators, was considered for the ROS indicator. Tab. 3 shows the profitability indicators aimed at monitoring business efficiency.

The results in Tab. 3 show that the return on assets increased in 2018 compared to 2015 by about 60%. The return on equity of 2018, when the results of the introduced reengineering were already known, increased from 8.11 to 43.73, which is of great value to both the business owner and in terms of the competition. The company achieved the highest return on assets in 2016 and 2017, which resulted from the higher NOPAT value. Return on equity reached its peak after the implementation of reengineering. The lowest level of return on sales was reached in 2016. Once the changes were made, and the results were evaluated, the profitability of sales increased by more than 80%.

Tab. 3. Profitability ratios

PROFITABILITY RATIOS	2015	2016	2017	2018
Return on assets ROA	1.36	1.24	1.17	2.26
Return on equity ROE	17.80	17.48	8.11	43.73
Return on net assets RONA	0.63	0.84	0.82	0.71
Return on share capital ROSC	1.36	1.12	1.10	1.76
Return on sales ROS	1.07	0.72	0.78	1.31

Tab. 4. Activity indicators

ACTIVITY INDICATORS	2015	2016	2017	2018
Total Assets Turnover [year]	1.04	1.39	1.22	1.40
Inventory turnover [days]	223.30	224.70	245.30	254.40

Tab. 5. Debt indicators

DEBT INDICATORS	2015	2016	2017	2018
Degree of self-financing	4.10	4.03	7.66	2.29
Total indebtedness	95.90	95.97	92.35	97.71
Financial leverage	16.10	17.36	8.52	23.89

Activity indicators express the efficiency of asset management in an enterprise. Based on the results presented in Tab. 4, activity indicators are increasing. Inventory turnover values were high due to high inventory levels for custom manufacturing.

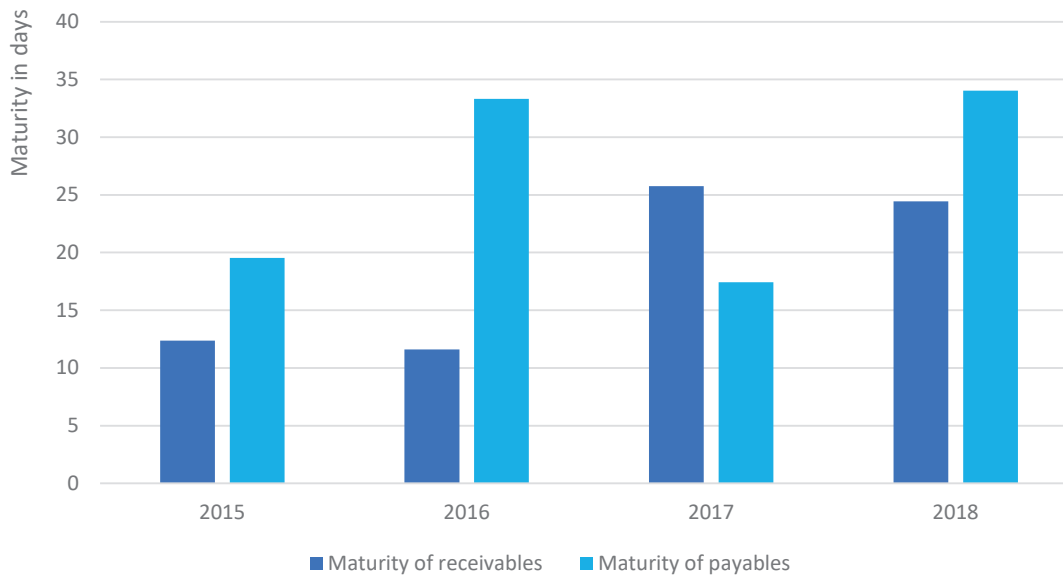

Fig. 3. Maturity of receivables and payables

Fig. 3 shows the difference in the maturity of receivables and payables. In addition to 2017, the repayment period of receivables is lower than the repayment period of payables. This was an advantage for the company and proved that the company had collected rather than paid. Also, based on the results achieved in the activity indicators, authors can state a positive impact on the financial situation of the company.

Debt indicators are used to monitor the company's financial resources. The share of own and foreign financial resources affects the financial stability of the company. As demonstrated in Tab. 5, the high share of foreign resources is cheaper for the company but represents less stability. In 2018, the debt was up to 97.71%. By increasing the value of the leverage, the company increased the share of foreign resources and, thus, the degree of debt.

Cash flow is a term that indicates the difference between cash and cash outflows over the reporting period. The overview of cash-flows, which are important for liquidity management, is presented in Tab. 6.

The results of the operative cash-flow calculated by the indirect method show that in 2017, ta radical decrease occurred compared to 2016, which was due to the decrease in inventories. Cash flow values from investment activity show that their amount was related to reengineering in the company. In 2018, after reengineering, the company managed to increase its cash-flow by more than 78%. The low cash-flow from investment activity in 2017 had an impact on the value of cash-flow from financial operations. The negative value was due to an increase in equity and changes in the structure of long-term foreign capital. The situation in 2016 reflects the company's readiness for the high level of investment that was actually accomplished in 2017. Undoubtedly, the investment had a positive effect on the cash flow from investment activity for the next period. Total cash flow values show that the company managed to generate its own financial resources. The values of the indicators provided a clear statement about the timely reengineering and its positive impact on the future financial standing.

Aiming to calculate the economic value-added EVA, it was necessary to define the profit from the main operating activity after NOPAT taxation, which is also listed in Tab. 7.

The company achieved the highest value in 2017. By implementing reengineering in 2016, the company increased its assets by EUR 133712. The value of tied capital in the main activity was approximately at the same level. Again, the reengineering had a positive impact on the economic results of the company as a whole. The cost of foreign capital ranged from 3.59% to 3.69% over the years. The average cost of capital for 2015, 2016, 2017 tended to grow and only dropped by more than 35% to 0.66 in the last reporting year, once again positively affecting the company's financial situation. The negative EVA in 2017 was due to the high average cost of capital, which was 1.02%. In 2017, the company also recorded the highest total capital for the entire period under review and, therefore, EVA was negative. By decreasing the average cost of capital by 35%, the company managed to increase its business performance by over 250% in 2018, which is high positive impact on the company's financial position.

Tab. 6. Cash-flow indicators

CASH FLOW INDICATORS [€]	2015	2016	2017	2018
Operating Cash-Flow	-73 272.00	179 586.45	65 968.79	54 562.31
Cash-Flow from investment activities	42 104.36	449 178.38	7 594.80	13 604.33
Cash-Flow from financial activities	46 120.45	519 247.68	- 30 752.48	64 534.17
Total-Cash Flow	14 952.81	1 148 012.51	42 811.11	132 700.81

Tab. 7. EVA indicator, net working capital and cost of foreign capital

EVA INDICATOR [€]	2015	2016	2017	2018
Net operating profit after tax NOPAT	9 402.77	12 380.59	13 189.21	9 933.77
Net working capital	565 865.00	643 429.00	739 108.00	678 921.00
Net Operating Assets NOA	1 395 870.00	1 187 149.00	1 340 456.00	1 320 861.00
Cost of foreign capital	3.60	3.69	3.60	3.59
Weighted Average Cost of Capital WACC	0.41	0.42	1.02	0.66
EVA	3 676.00	7 558.00	-508.00	1 281.00

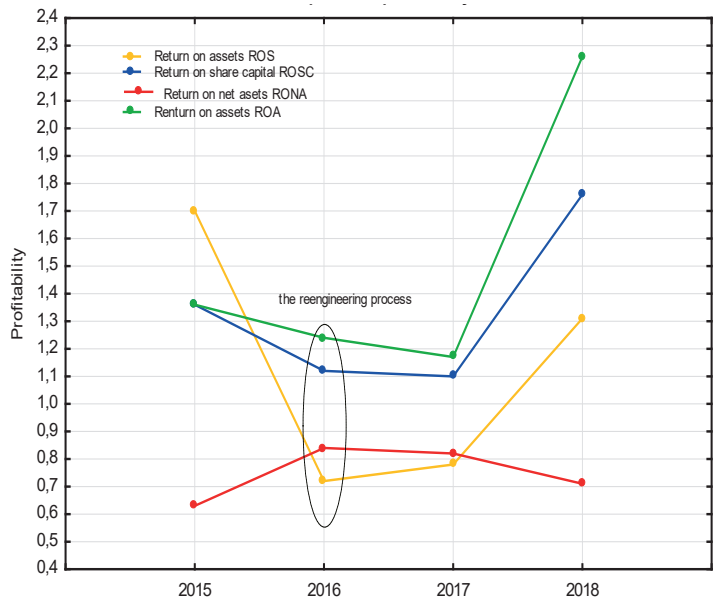

Fig. 4. Development of profitability indicators

4. Discussion of research results

The results demonstrated that reengineering of manufacturing processes could be implemented successfully using the methodology offered by Hammer and Champy (2000). The comparison of the financial situation of the company before and after the reengineering shows that this radical change was well-timed. Even though the decision to construct a new production hall and buy a fully automated production line seemed radical, it was actually the right thing to do.

The comparison of the results of the company's financial indicators showed a positive impact received from the implementation of the reengineering on the financial performance of the company (Fig. 4). Although the statistical validation was not made, the dependence between reengineering and change of profitability indicators is apparent.

As recommended by various authors (Varcholová et al., 2007; Brealey, 2000; Růčková, 2010; Dubovická 2007; Neumaierová and Neumaier, 2002; Marik and Mariková, 2005; Kotulič et al., 2010; Knapková et al., 2013; Hajduchová, 2000; Zalai et al., 2010; Toth et al., 2012), the selected financial indicators, namely, profitability ratios, activity indicators, debt indicators, traditional cash-flow performance indicators and the economic value-added indicator EVA, were suitable for evaluating the impact of reengineering on the financial performance of the company.

On this basis, as well as the presented example of their use in the assessment of the financial performance of the company that implemented the reengineering process according to the Hammer and Champy methodology, it can be stated that the selected financial indicators have a good predictive impact on the financial situation of the company in terms of sales, profit margin, inventories, equity and foreign capital, as well as capital costs. They can also be recommended for the evaluation of the reengineering process of other companies.

Conclusions

The impact achieved by reengineering of a manufacturing process in the chosen company was monitoring using financial indicators and proved that the reengineering was successful from the economic point of view. The overall efficiency of the company expressed in profitability indicators reached the highest values in 2017 and 2018, as a result of the implemented reengineering. Over the monitored period of four years, all activity indicators developed favourably in the upward trend. Foreign financial sources went up to 97%. This option was cheaper for the company but also meant less stability. The reengineering was financed from foreign sources, which was also reflected in the highest indebtedness in 2018 for the entire period under review. The leverage ratio was also confirmed by the financial leverage ratio. The results of the total cash flow showed that in each reporting year, the company was able to generate its

own financial resources. Average costs tended to grow, with a decline of more than 35% in 2018. The decrease was attributed to favourable credit terms in all years except 2017. Negative EVA in the year, in which reengineering was introduced, was attributed to high capital costs.

Based on financial analyses and the results of selected indicators, the authors of this article conclude that the introduction of reengineering in the production process was well-timed. At the same time, the results of the analyses showed that reengineering resulted in the improved company's performance and value, which had a positive impact on the company's financial situation. This was confirmed by the comparison of indicator values before and after the reengineering. The resources spent in the process of reengineering were effectively used, and the company's further functioning was set for future prosperity.

The analysis concerned only one company, which is the limitation of the paper. The validation of findings through statistical tests is, therefore, complicated and almost impossible. The evaluation and validation of reengineering effects through statistical analysis can be carried out on a larger research sample of more companies. This issue will be solved in the next research.

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