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ENTERPRISE RISK ANALYSIS IN AN ENGINEERING COMPANY WITH A FOCUS ON CUSTOM MANUFACTURING*

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Abstract. The study details the outcomes of a scientific experiment analyzing enterprise risks in business processes. Examining and getting rid of enterprise risks is one of the most important management tools when it comes to reaching corporate goals. The new proposed strategy is based on the idea of process risk as a part of putting business processes or operations into action to get results that add value. The actual solution algorithm consists of the quantification of the difference between the level of risk and the enterprise's cost, the development of added value, and the operating profit. The experiment focused on a medium-sized engineering company that specializes in piece production. The principal outcomes of the technique are the realization that a smaller proportion of value added connected with the process results in a reduced degree of risk that is proportional to the cost ratio of the various production process activities. The hypothesis that manufacturing automation reduces risk has not been confirmed. It is advised that businesses document and review the time and cost components of each process on a regular basis. The outputs obtained from the solution demonstrate the suitability of the proposed process, with the outputs' validity demonstrated by repeating the analytical activities and comparing them to the actual occurrence of process risks identified by the model enterprise's managers during the execution of a real contract. The newly proposed method is expected to be appropriate for mass production.

Keywords: production process; business objectives; business process; process risks; risk prediction; risk analysis; added value

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1. Introduction

Risk management is a vital aspect of the daily job and the strategic management and decision-making of managers (Rahman, Adnan 2020; Wei et al., 2021; Shipanga, Roux & Dubihlela, 2022). This topic will become even more important during an economic downturn exacerbated by the coronavirus pandemic. Strategic risk management is one of the activities permanently performed in an enterprise as a part of its process management (Giraldo & Nunez 2020). The need for risk analysis is not limited to production processes or service processes (Szalucki & Fryca-Knop 2017), but it is important also for other corporate activities, such as administration, financial management, marketing, human resources management, etc. From the above, in addition to monitoring risks in production, i.e., productive processes, it is also necessary to monitor risks in supporting processes, without which effective and efficient processes would not be productive (Nasteckiene 2021). This means that analyzed risks should include all areas of the enterprise that need to be addressed comprehensively in an integrated organizational and management corporate system. The importance of this topic is emphasized by the very character of corporate risks: one part of them are predictable risks, which can be effectively prevented, and the other part are unpredictable risks, which need to be monitored, signaled, identified, analyzed, and evaluated with subsequent proposals of measures for their elimination (Ghaeli 2018). This study presents a scientific experiment that focuses on the systematic daily control of production hazards by managers. The article consists of two primary parts. In the theoretical part, the main attributes devoted to enterprise risk analysis in relation to value added are presented along with the paper's objective. In the second part of the article, the source of information and the methodology of the established calculations for determining the riskiness of the production process are presented. The results and their discussion are presented in the third section. The report finishes with business advice based on the experimental findings and a suggestion for future research.

2. Theoretical background

The current business environment, which can be described as highly turbulent, changing, and volatile, means increasing requirements for the management of enterprises (Raghunath, Devi 2018). Haviernikova, Okreglicka and Lemanska-Majdzik (2016) and Kumar et al. (2018) note that more attention should be paid to the management of risks, proper risk identification and evaluation; their articles focus particularly on production risks and related supplier risks, which may strongly interfere with and influence the production process of an enterprise. Strategic risk analysis is addressed in the global business environment, while in the national context, the perceived risks and their probabilities differ in the individual production processes and in the individual enterprises (Olie, Rao-Nicholson 2018; Trypolska et al. 2022). Knowledge and management of strategic risks are two of the critical factors that make it possible for the enterprise to keep its competitive advantage (Dang & Yeo 2017). An important component of the strategic risk analysis is a strategic economic analysis, which evaluates the performance or prosperity of business entities and the effect of risks on invested financial means (Sotnyk et al. 2022; Prodanova et al. 2019). Management of enterprises should be able to monitor and identify risks with potential negative effects, concentrate on them, and based on an analysis, specify the severity of their impacts on the production process or on the company (Senova et al. 2017; Kumar, Park 2019). It is necessary to realize that without knowing the risks, it is not possible to develop a strategic plan (Wallis 2020). Analysis of strategic risks works only if it is supported by strategic management; a properly performed analysis improves management of corporate processes and minimizes negative effects on labor efficiency and other corporate activities (Walaszczyk 2016; Virglerova et al. 2020; Godany, Mura 2021). Man, Radu and Tabor (2015) and Pour et al. (2019) state that there are many factors affecting strategic risk analysis, and they believe that factors associated with the highest risk include particularly human resources. Blocisz and Hadas (2019) see the highest risk in the very preparation of the production process. In the context of identifying risks associated with the manufacturing process, Pakocs and Lupulescu (2017) highlight risks associated with trademarks, patents, production know-how, falsification risks, disclosure of business secrets, and so on. Identification of risks in the production process is supported by structuring the risks into ISO categories, such as occupational safety, work quality, production process continuity,

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etc. (Jaime et al. 2016; Stanik, Kiedrowicz, Waszkowski 2019). Other risk factors in the production include injuries caused by an incorrectly implemented system of occupational safety or incorrect use of PPE (Chi et al. 2015). Also, the value chain contributes to correct strategic risk analysis as one of the basic tools for the formulation of a successful competitive strategy (Straková et al. 2020). An analysis of strategic risks and their elimination also depends on the size categorization of enterprises and on a specific industrial branch because the intensity of the production process and the related risks are highly differentiated according to the mentioned categorizations (size and sector) (Váchal, Pártlová & Straková 2017).

As mentioned above, risk management depends on the management of enterprises, which indicates the directions to be followed by the enterprise. The directions will depend on risk aversion in strategic decision making (Benischke, Martin & Glaser 2019). When analyzing strategic risks, it is necessary to achieve an effective interaction between the internal and external environments of the enterprise because it may ensure the sustainable development of the enterprise (Kasych & Vochozka 2017). If managers of an enterprise do not perceive potential risks, they will fail to adapt to future risks (Meinel & Schüle 2018). Soon, the elimination of risks may be supported by the use of artificial intelligence, particularly in the production processes associated with digitalization; some enterprises have already been using AI, which significantly reduces their risks in the production process (Vrbka & Rowland 2020). Efficient enterprises manage their risks to ensure the needed production output and reliable operations (Klober-Koch, Braunreuther & Reinhart 2017; Shobayo 2017).

The objective of this paper is to perform a risk analysis for a selected production enterprise in the context of ongoing corporate processes, to identify and evaluate the risks, and to propose their elimination.

We've come up with two hypotheses based on the literature review we've already done and the main focus of our research:
H1: A lower share of process value generates a lower level of risk.
H2: Partially automated activities in the production process generate a lower level of risk.

It is assumed that these hypotheses should be valid for both manufacturing and services, as well as for all size categories of enterprises.

3. Research objective and methodology

The strategic risk analysis will be done on a made-up medium-sized engineering company that focuses mostly on making things to order. This company now evaluates risks based on the error rate of specific tasks. The newly presented method implies the analysis of risks inside the business processes (operations) in relation to the production of value addition. Actual risk analysis presupposes that the production process be subdivided into several sub-operations. Two metrics will be monitored: cost ratio and value added to the process. On the basis of the proportion of production operations in the production process, the two selected parameters will be disproportionally diversified. The process value added will be derived from the sub-processes using a customer card that defines all internal production process information. This covers the product's invoice price, the materials used, and the production or non-production time required by the sub-activities in the process (sales, planning, logistics, purchasing, cooperation, and production).

On a single order, the relevant process only adds value if the invoice price of the order is higher than the total operating costs of the order. To figure out how much value the process adds, it will be necessary to know how much each part of the process costs. By adding up the costs of each step in the process and the length of time it takes to complete it, one can calculate the overall costs of manufacturing processes that are time-based. For tasks that can't be measured in time, only the reported costs should be used. This is an entirely novel procedure with a novel theoretical foundation. According to the exhaustive investigation, this novel procedure has never been discussed.

The analysis of strategic risks shown in this paper hasn't been used in business before, so it's a new method that's being proposed. From a theoretical point of view, it is used to look at the relationship between value added, or the creation of value, and the cost and time of the business process in question. According to the research conducted, this principle has not been applied so far.

The calculation of total costs for the processes that cannot be measured with time:

$$\sum_{C_{work(other)}} = Process\ A + Process\ B + \cdots Process\ Z \tag{1}$$

For data protection reasons, the calculation of total costs of processes that can be measured with time based on a price list of processes or operations has been multiplied by a corrective coefficient.

Table 1. Price list of partial working operations in the enterprise

Machine	Price (Cost price)	Machine	Price (Cost price)
Laser	2400	Saw	838
Scissors	1130	Drill	838
Press brake	1232	Press Dunkes	838
Milling machine CNC	953	Welding non-certified	838
Milling machine Horizontal	1803	Welding robot	838
Lathe classical	838	Painting shop	838
Lathe CNC	838	Installation other	838
Lathe CNC ecoturm	1308	Dispatching	838
Fitter	838		

Source: Own

The calculation of total costs of work for the processes measured with time:

$$\Sigma_{C_{work\ (manufacturing)}} = Process\ in\ CZK\ (A \to Z)\ \times\ number\ of\ hours\ (i)_{A \to Z} \tag{2}$$

$$\sum_{C_{work\ (manufacturing)}} = [Process\ in\ CZK\ (A) \times\ i_{(A)}] + [Process\ in\ CZK\ (B) \times\ i_{(B)}]\ +\ ...[Procesd\ in\ CZK(Z) \times\ i_{(Z)}] \tag{3}$$

Total costs of the production process:

$$\sum_{Total\ costs\ of\ processes} = C_{work(other)} +\ C_{work(manufacturing)} \tag{4}$$

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The calculation of the process added value for the partial production operations:

$$Process\ added\ value_{\ partial\ process} = \left[\left(\frac{Cost\ price}{Sum\ for\ manufacturing} + \frac{Hours\ worked}{Total\ hours\ worked}\right) \div 2\right] \times \left(\frac{Sum\ for\ manufacturing}{Total\ sum}\right) \times Planned\ operating\ profit \quad (5)$$

The calculation of the share on the process added value for partial production operations:

$$Share\ on\ the\ process\ added\ value_{partial\ process} = \left[\left(\frac{Cost\ price}{Sum\ for\ manufacturing} + \frac{Hours\ worked}{Total\ hours\ worked}\right) \div 2\right] \times \left(\frac{Sum\ for\ manufacturing}{Total\ sum}\right) \quad (6)$$

The level of risk associated with the production process will be determined based on the planned job card and the implemented job card received after the production is complete. The level of risk of the processes will be monitored for the operations as follows:
The level of risk in the production process will be monitored from two viewpoints (cost ratio of operations and profit).

Cost ratios are used to figure out how risky each manufacturing operation is:

$$Level\ of\ process\ risk\ (cost\ ratio)_{(A \to Z)} = \frac{Costs\ of\ a\ partial\ process}{Total\ costs} \times 100 \quad (7)$$

Determination of the level of risk for the individual production operations from the viewpoint of process added value:

$$Risk\ level\ of\ the\ process\ (process\ added\ value\ )_{(A \to Z)} = \frac{Process\ added\ value_{(A \to Z)}}{Total\ sum\ of\ the\ process\ added\ value} \times 100 \quad (8)$$

Subsequently, the level of risk will be evaluated (based on Table 2 below) while respecting the determined level of risk of the manufacturing operation. The level of risk of the individual production operation will be monitored based on the difference between the levels of risk of the process added value and the risk of the cost ratio:

$$Level\ of\ risk\ = Level\ of\ risk\ of\ the\ process\ (process\ added\ value) - Level\ of\ risk\ of\ the\ process\ (cost\ ratio) \quad (9)$$

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Table 2. Classification of the level of risk for the production process

Risk size	Interval of values (in %)
Small risk	From 1.01 to 100
Medium small	From 0.01 to 1.00
Medium risk	From -1.00 to 0.00
Medium big risk	From -2.00 to -1.01
Big risk	From -100 to -2.01

Source: Own

Based on the acquired results, it will be possible to determine which production operations contribute most to the level of risk of the entire production process. This will create an effective tool for the indication of risks in the production process of the selected enterprise.

The analysis used data from a one-off job card. Initially, an analysis of the total costs of the production process was performed for the partial production operations. This was followed by an analysis of the process value of the production process. These two analyses were used for an analysis of the level of risk of partial production operations.

4. Results and discussion

Table 3 contains calculated data imported from MS Excel. Table 3 includes the calculated cost ratio of partial processes based on the planned job card and the operations created based on the card that characterize the planned and implemented job. The numbers of hours worked on the partial production operations were obtained from the information system of the enterprise (completed work).

Table 3 defines the partial operations of the production process and their cost ratio, showing a comparison of the planned and the actual profit. This table shows that the company's most expensive production operation within the measurable production processes is "Laser" with a value of CZK 28,800 when the plan is created, and the most expensive production operation when the order is realized is "Scissors" with a value of CZK 16,950. Within the non-measurable production operations is the item 'Technical preparations', which is the costliest both in the plan created, in which it reaches a value of CZK 5,000, and in the execution of the order, in which it reaches a value of CZK 7,050. Table 3, in agreement with Table 1, also demonstrates that automated activities in the production process, such as "laser, press brake, milling machine CNC, milling machine horizontal, lathe CNC ecoturm," carry higher costs than the remaining processes that are mostly non-automated, e.g., "fitter, saw, drill, weld, installation, dispatching, etc."

Table 3. Total costs of the individual work operations based on the job card

Production operations	Cost ratio			
	Plan		Actual (profit)	
	CZK	Number of hours	CZK	Number of hours
Laser	28800	12	16800	7
Scissors	2260	2	16950	15
Press brake	12320	10	8624	7
Milling machine CNC	7624	8	9530	10
Milling machine Horizontal	5409	3	3606	2
Lathe classical	5028	6	4190	5
Lathe CNC	4190	5	3352	4
Lathe CNC ecoturm	6540	5	7848	6
Fitter	10056	12	3352	4
Saw	4190	5	4190	5
Drill	4190	5	1676	2
Press Dunkes	4190	5	6704	8
Welding non-certified	8380	10	3352	4
Welding robot	3352	4	2514	3
Painting shop	4190	5	8380	10
Installation other	10056	12	6704	8
Dispatching	5866	7	10056	12
SUMA for manufacturing	126641	116	117828	112
SALES	5000	x	5000	x
COOPERATION	2500	x	3780	x
OVERHEADS	4500	x	4120	x
TECHNICAL PREPARATION	5000	x	7050	x
INSPECTION	2000	x	1100	x
TOTAL SUM	145641	x	138878	x

Source: Own

The calculation of the total costs, i.e., the cost ratio of the work for processes that cannot be measured with time, was performed as follows:

$$\sum_{C_{work\ (other)}} = Sales + Cooperation + Overheads + Technical\ preparation + Inspection \tag{10}$$

$$Plan \sum_{C_{work\ (other)}} = 5000 + 2500 + 4500 + 5000 + 2000 = 19000\ CZK \tag{11}$$

$$Actual\ (profit) \sum_{C_{work(other}} = 5000 + 3780 + 4120 + 7050 + 1100 = 21050\ CZK \tag{12}$$

In the above calculations, steps that can't be described by time are defined by the amount on the job card. The sum of the partial processes is provided as the total amount of processes that cannot be measured with time and is necessary for the total expended costs for the production process.

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The calculation of total costs of work for processes that can be measured with time was performed as follows (based on the job card and price list of the enterprise); the following is a sample calculation for "Laser":

$$\sum_{C_{work\ (manufacturing)}} = Process\ in\ CZK\ (A \rightarrow Z)\ \times\ number\ of\ hours\ (i)_{A\rightarrow Z} \tag{13}$$

$$Plan \sum_{C_{work\ (manufacturing)}} = 2400\ \times\ 12 = 28800\ CZK \tag{14}$$

$$Actual\ (profit) \sum_{C_{work\ (manufacturing)}} = 2400\ \times\ 7 = 16800\ CZK \tag{15}$$

The calculation of total costs of work for processes that can be measured with time is based on the processes provided in the price list of partial activities of the enterprise and the job card indicating the number of hours needed for a particular partial process. By multiplying, we can determine the total costs of the processes that can be measured over time.
The total costs of the production process are calculated as follows:

$$\sum_{Total\ costs\ of\ processes} = C_{work(other)} + C_{work\ (manufacturing)} \tag{16}$$

$$Plan \sum_{Total\ costs\ of\ processes} = 19000 + 126641\ = 145641\ CZK \tag{17}$$

$$Actual\ (profit) \sum_{Total\ costs\ of\ processes} = 21050 +\ 117828 = 138878\ CZK \tag{18}$$

The demonstrated calculations of the total costs (cost ratio) for the production process are a sum of both types of processes (measured and not measured with time). The sum of the total costs of the production process is then used for the calculation of the level of risk from the viewpoint of the cost ratio.

Table 4 contains data imported from MS Excel. Table 4 includes the process added values of the partial processes based on the plan and the actual result. It also shows the share of the process added value.

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Table 4. Process added value of partial processes for tested operations

Production operations	Process added value (CZK) and the share on the process added value (%)			
	Plan		Actual (profit)	
Laser	4 439 CZK	14,38 %	3 099 CZK	8,70 %
Scissors	471 CZK	1,53 %	4 198 CZK	11,78 %
Press brake	2 462 CZK	7,98 %	2 050 CZK	5,76 %
Milling machine CNC	1 733 CZK	5,62 %	2 571 CZK	7,22 %
Milling machine Horizontal	920 CZK	2,98 %	732 CZK	2,06 %
Lathe classical	1 227 CZK	3,97 %	1 212 CZK	3,40 %
Lathe CNC	1 022 CZK	3,31 %	970 CZK	2,72 %
Lathe CNC ecoturm	1 271 CZK	4,12 %	1 816 CZK	5,10 %
Fitter	2 453 CZK	7,95 %	970 CZK	2,72 %
Saw	1 022 CZK	3,31 %	1 212 CZK	3,40 %
Drill	1 022 CZK	3,31 %	485 CZK	1,36 %
Press Dunkes	1 022 CZK	3,31 %	1 939 CZK	5,44 %
Welding non-certified	2 044 CZK	6,62 %	970 CZK	2,72 %
Welding robot	818 CZK	2,65 %	727 CZK	2,04 %
Painting shop	1 022 CZK	3,31 %	2 424 CZK	6,80 %
Installation other	2 453 CZK	7,95 %	1 939 CZK	5,44 %
Dispatching	1 431 CZK	4,64 %	2 909 CZK	8,17 %
SUM for manufacturing	26 833 CZK	86,95 %	30 223 CZK	84,84 %
SALES	1 059 CZK	3,43 %	1 282 CZK	3,60 %
COOPERATION	530 CZK	1,72 %	970 CZK	2,72 %
OVERHEADS	953 CZK	3,09 %	1 057 CZK	2,97 %
TECHNICAL PREPARATION	1 059 CZK	3,43 %	1 808 CZK	5,08 %
INSPECTION	424 CZK	1,37 %	282 CZK	0,79 %
TOTAL SUM	30 859 CZK	100 %	35 622 CZK	100 %

Source: Own

This is how the process added value for the partial production steps was calculated. Here's an example calculation for the production process "Laser":

$$Process\ added\ value_{partial\ process} = \left[\left(\frac{Cost\ price}{Sum\ for\ manufacturing} + \frac{Hours\ worked}{Total\ hours\ worked}\right) \div 2\right] \times \left(\frac{Sum\ for\ manufacturing}{Total\ sum}\right) \times Planned\ operating\ profit \quad (19)$$

$$Plan \rightarrow\ Process\ added\ value\ _{partial\ process} = \left[\left(\frac{28800}{126641} + \frac{12}{116}\right) \div 2\right] \times \left(\frac{126641}{145641}\right) \times 30859 = 4439\ CZK \quad (20)$$

$$Actual\ (profit) \rightarrow\ Process\ added\ value_{partial\ process} = \left[\left(\frac{16800}{117828} + \frac{7}{112}\right) \div 2\right] \times \left(\frac{117828}{138878}\right) \times 35622 = 3099\ CZK \quad (21)$$

This is how the share of process added value for the partial production operations was calculated. Here's an example for the production process "Laser":

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$$Share\ of\ process\ added\ value_{\ partial\ process} = \left[\left(\frac{Cost\ price}{Sum\ for\ manufacturing} + \frac{Hours\ worked}{Total\ hours\ worked}\right) \div 2\right] \times \left(\frac{Sum\ for\ manufacturing}{Total\ sum}\right) \quad (22)$$

$$Plan \rightarrow\ Process\ added\ value_{\ partial\ process} = \left[\left(\frac{28800}{126641} + \frac{12}{116}\right) \div 2\right] \times \left(\frac{126641}{145641}\right) = 14{,}38\ \% \quad (23)$$

$$Actual\ (profit) \rightarrow\ Process\ added\ value_{\ partial\ process} = \left[\left(\frac{16800}{117828} + \frac{7}{112}\right) \div 2\right] \times \left(\frac{117828}{138878}\right) = 8{,}70\% \quad (24)$$

Table 4 contains the results of the added value and the share of added value for the planned and actual results of a particular job. The highest added value and the highest share have been found for "Laser," and this activity is on average the most significant for the production process. On the contrary, the lowest added values and their lowest shares have been found for "Drill and Inspection".

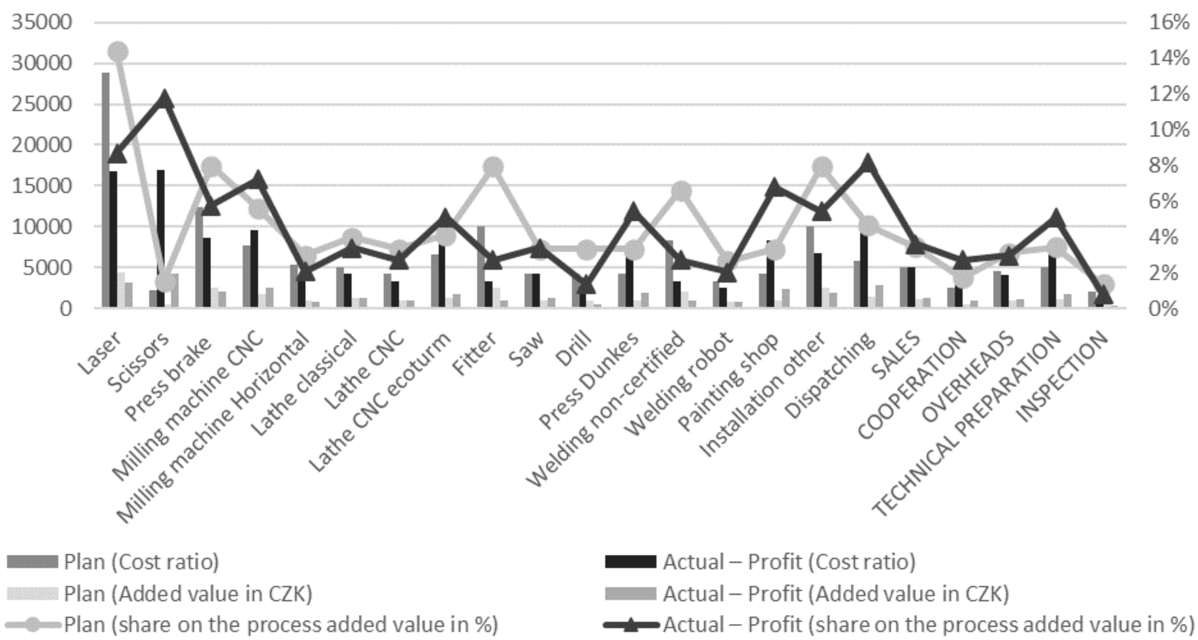

Figure 1. A graphic representation of operations comparing the planned and actual results.

Source: Own

Figure 1 compares the planned and actual profit on a one-off job. The planned share of the process added value for "Scissors" was lower than the actual result, and the difference between them was the highest for this particular activity. For "Scissors," the increase in the share of process added value was from 1,53% to 11,78%. On the contrary, a decrease compared to the plan was found for "Laser", specifically from 14,38% to 8,70%. The figure also suggests that the curve defining the actual share of the process added value is higher than the actual cost ratio of partial activities. For this reason, this job generates profit. The graphic representation in combination with Table 4 makes it possible for the enterprise to monitor and analyze partial operations from the viewpoint of cost ratio and achieved added value. Based on this information, the enterprise can optimize the production process from the viewpoint of cost ratio and achieved margin.

The calculation of the added value of partial processes determines the process added value of the individual operations. The calculations for the individual operations are based on an arithmetic average of costs and time. The presented results may be used by the enterprise to optimize the production process. Calculation of the process added value is provided here to determine all contributions of the processes necessary for calculation of the level of risk for the processes listed in tables 5 and 6.

Table 5. Process added value of partial processes for tested operations

Production operations	Level of risk from the viewpoint of cost ratio	
	Plan	Actual (profit)
Laser	19,77 %	12,10 %
Scissors	1,55 %	12,20 %
Press brake	8,46 %	6,21 %
Milling machine CNC	5,23 %	6,86 %
Milling machine Horizontal	3,71 %	2,60 %
Lathe classical	3,45 %	3,02 %
Lathe CNC	2,88 %	2,41 %
Lathe CNC ecoturm	4,49 %	5,65 %
Fitter	6,90 %	2,41 %
Saw	2,88 %	3,02 %
Drill	2,88 %	1,21 %
Press Dunkes	2,88 %	4,83 %
Welding non-certified	5,75 %	2,41 %
Welding robot	2,30 %	1,81 %
Painting shop	2,88 %	6,03 %
Installation other	6,90 %	4,83 %
Dispatching	4,03 %	7,24 %
SUMA for manufacturing	86,95 %	84,84 %
SALES	3,43 %	3,60 %
COOPERATION	1,72 %	2,72 %
OVERHEADS	3,09 %	2,97 %
TECHNICAL PREPARATION	3,43 %	5,08 %
INSPECTION	1,37 %	0,79 %
TOTAL SUM	100 %	100 %

Source: Own

Table 5 contains calculated levels of risk for the partial processes from the viewpoint of cost ratio based on the planned job card and the completed job. The calculation of the level of risk for the individual production operations from the viewpoint of cost ratio uses the following formulas, which are demonstrated on an example of the "Laser" operation:

$$Level\ of\ risk\ of\ the\ process\ (cost\ ratio)_{(Laser)} = \frac{Costs\ of\ partial\ process}{Total\ costs} \times 100 \quad (25)$$

$$Plan \rightarrow Level\ of\ risk\ of\ the\ process\ (cost\ ratio)_{(Laser)} = \frac{28800}{145641} \times 100 = 19{,}77\ \% \quad (26)$$

$$Actual\ (profit) \rightarrow Level\ of\ risk\ of\ the\ process\ (cost\ ratio)_{(Laser)} = \frac{16800}{138878} \times 100 = 12{,}10\ \% \quad (27)$$

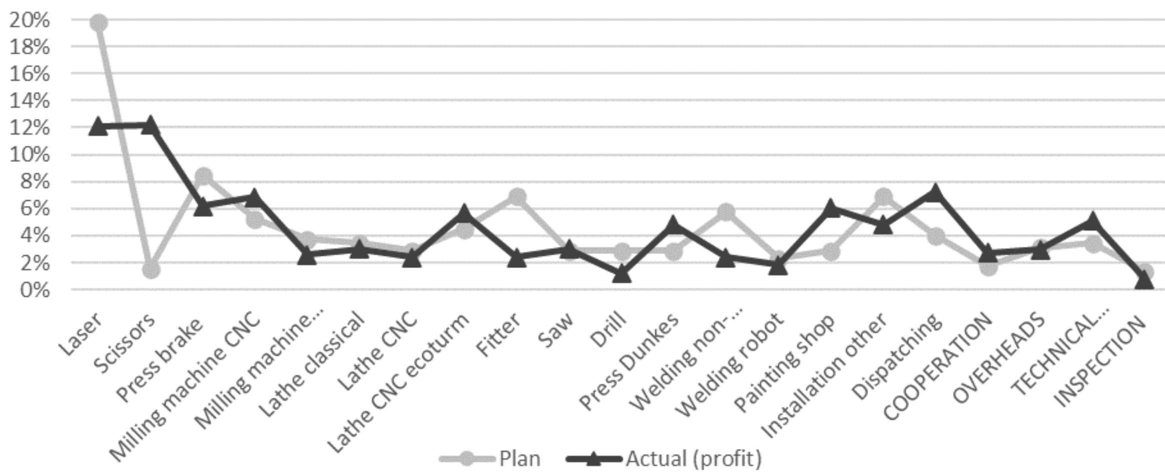

Figure 2. A graphic representation of the level of risk of partial production operations from the viewpoint of cost ratio

Source: Own

Figure 2 shows a comparison of the level of risk of partial production processes from the viewpoint of cost ratios for planned and actual jobs. The figure suggests that the most risky production processes from the viewpoint of cost ratio are "laser, scissors, press brake, milling machine CNC, welding non-certified, painting shop". The risks of partial production processes are different in the plan and in the actual result. The graphic representation in combination with Table 5 defines partial production operations and their level of risk from the viewpoint of cost ratio and thus makes it possible to optimize partial production processes or operations.

Table 6. Level of risk of partial production operations from the viewpoint of process added value

Production operation	Level of risk from the viewpoint of process added value	
	Plan	Actual (profit)
Laser	16,54 %	10,25 %
Scissors	1,76 %	13,89 %
Press brake	9,18 %	6,78 %
Milling machine CNC	6,46 %	8,51 %
Milling machine Horizontal	3,43 %	2,42 %
Lathe classical	4,57 %	4,01 %
Lathe CNC	3,81 %	3,21 %
Lathe CNC ecoturm	4,74 %	6,01 %
Fitter	9,14 %	3,21 %
Saw	3,81 %	4,01 %
Drill	3,81 %	1,60 %
Press Dunkes	3,81 %	6,42 %
Welding non-certified	7,62 %	3,21 %
Welding robot	3,05 %	2,41 %
Painting shop	3,81 %	8,02 %
Installation other	9,14 %	6,42 %
Dispatching	5,33 %	9,63 %
SUMA for manufacturing	100,00 %	100,00 %

Source: Own

Based on a comparison of the planned job card and the finished job, Table 6 shows the level of risk of partial processes from the point of view of added value. This calculation does not include processes that cannot be measured with time because this calculation method cannot be used to determine the level of risk from the viewpoint of the process added value of such processes. The calculation of the level of risk from the viewpoint of added value has been made with the formulas provided below, and the calculation is demonstrated using an example of the "Laser" operation:

$$Level\ of\ risk\ of\ the\ process\ (process\ added\ value)_{(A\rightarrow Z)} = \frac{Process\ added\ value\ _{(A\rightarrow Z)}}{Total\ sum\ of\ process\ added\ value} \times 100 \quad (27)$$

$$Plan \rightarrow Level\ of\ risk\ of\ the\ process\ (process\ added\ value)_{(Laser)} = \frac{4439}{26833} \times 100 = 16{,}54\ \% \quad (28)$$

$$Actual\ (profit) \rightarrow Level\ of\ risk\ of\ the\ process\ (process\ added\ value)_{(Laser)} = \frac{3099}{30223} \times 100 = 10{,}25\ \% \quad (29)$$

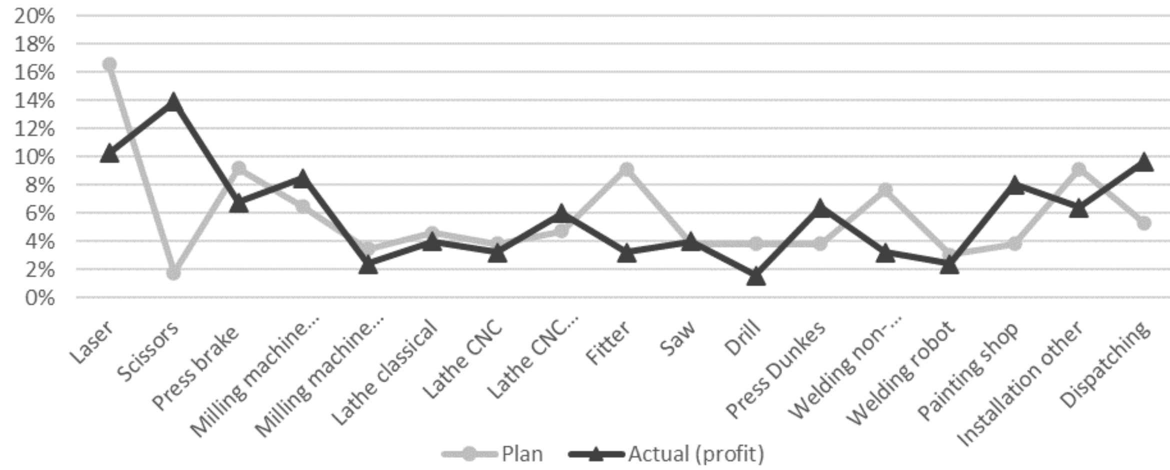

Figure 3. A graphic representation of the level of risk from the viewpoint of the process added value of individual operations

Source: Own

From the point of view of the value added by the process, figure 3 compares the levels of risk of partial production processes. The figure suggests that the most risky processes from this viewpoint are "laser, scissors, press brake, milling machine CNC, welding non-certified, painting shop". There is a difference in comparison with the level of risk from the viewpoint of cost ratio, and the differences between the plan and the actual results are higher. We can conclude that the risks are proportional to the added value. The graphic representation, in combination with Table 6, defines the partial production operations and their levels of risk from the viewpoint of process added value. This makes it possible for the enterprise to optimize production in order to reduce the level of risk associated with partial production operations and, at the same time, increase their added value. The calculated levels of risk of partial production processes from the viewpoint of cost ratio and from the viewpoint of process added value specify the percentage risk in the entire production process. The provided calculations and tables 5 and 6 indicate that the high level of risk appears already in the plan because the production plan anticipates high risks. Based on the results, the enterprise should optimize production to reduce the level of risk associated with the job and complete it with the required margin.

Table 2 has been used for the evaluation of the overall level of risk for the partial operations and thus the entire production process. Table 7 contains imported calculations from MS Excel. Table 7 shows the evaluated levels of risk for the partial production operations based on the difference between the planned and actual results from the viewpoint of cost ratio and from the viewpoint of process added value.

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Table 7. Level of risk of partial operations based on the difference between the cost ratio risk level and the process added value risk level.

Production operation	Level of risk	
	Plan	Actual (profit)
Laser	-3,23 %	-1,85 %
Scissors	0,21 %	1,69 %
Press brake	0,72 %	0,57 %
Milling machine CNC	1,23 %	1,65 %
Milling machine Horizontal	-0,28 %	-0,18 %
Lathe classical	1,12 %	0,99 %
Lathe CNC	0,93 %	0,80 %
Lathe CNC ecoturm	0,25 %	0,36 %
Fitter	2,24 %	0,80 %
Saw	0,93 %	0,99 %
Drill	0,93 %	0,39 %
Press Dunkes	0,93 %	1,59 %
Welding non-certified	1,87 %	0,80 %
Welding robot	0,75 %	0,60 %
Painting shop	0,93 %	1,99 %
Installation other	2,24 %	1,59 %
Dispatching	1,30 %	2,39 %

Source: Own

The calculation of the level of risk for the individual production operations from the viewpoint of process added value and cost ratio was performed using the following formula, which is demonstrated on an example of the "Laser" operation:

$$Level\ of\ risk\ = Level\ of\ risk\ of\ the\ process\ (process\ added\ value) - Level\ of\ risk\ of\ the\ process\ (cost\ ratio) \tag{30}$$

$$Plan \rightarrow Level\ of\ risk\ = 16{,}54\ \% - 19{,}77\% = -5{,}39\ \% \tag{31}$$

$$Actual\ (profit) \rightarrow Level\ of\ risk = 10{,}25\ \% - 8{,}70\% = -3{,}40\ \% \tag{32}$$

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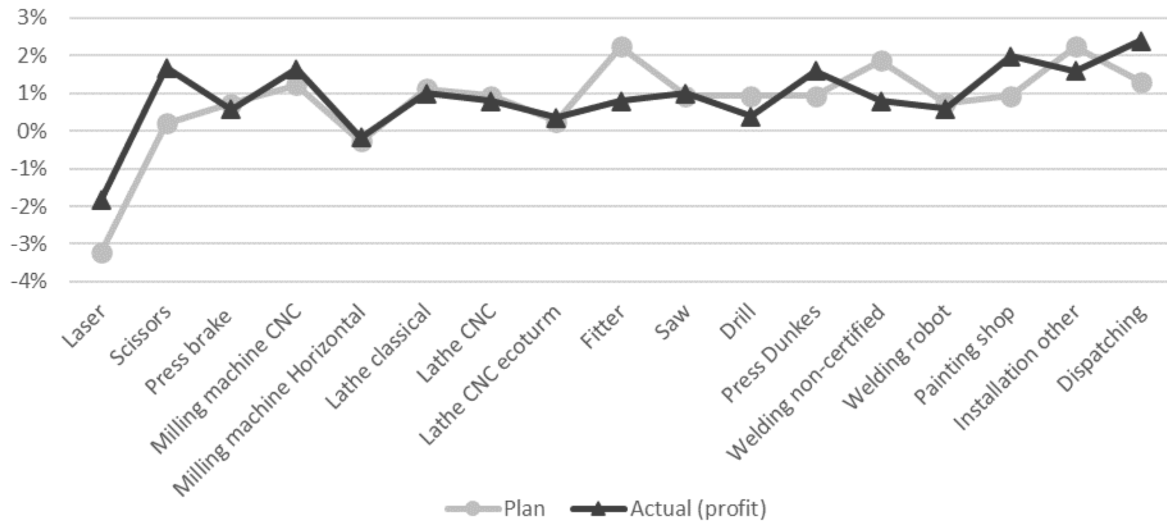

Figure 4. A graphic representation of the level of risk for partial operations in a one-off job

Source: Own

The calculations shown above in combination with figure 4 and table 7 indicate the levels of risk of individual partial operations. The calculation is based on the difference between the level of risk from the viewpoint of added value and the level of risk from the viewpoint of cost ratio. Based on table 2, which defines the risks, the riskiest process is "laser" because it demonstrates the highest risk in all the monitored situations; the medium level of risk has been found for "milling machine horizontal". On the contrary, the least risky processes are the operations "Milling machine CNC", "Fitter", "Dispatching" and "Installation other". The remaining operations can be classified as operations with medium to low risks.

The study showed that value added can be used as a way to measure risk in business processes, operations, and the production process as a whole (Panjehfouladgaran, Lim, 2020). The solution outputs demonstrated the validity of the first hypothesis, namely, that a lower proportion of value added in an operation results in a lower risk level. This is in direct opposition to the core aim of business, which requires organizations to concentrate on procedures and operations that provide the greatest amount of added value while addressing the possibility of increased risk (Bodnar et al. 2019). The solution for businesses is to establish consistency between the projected value-added level, cost pricing, and production process time limit. Clearly, processes that are less expensive and require less time generate lower levels of risk. As stated by Senova et al. (2017), it is crucial to identify and monitor the risks associated with time – and cost-intensive activities in the production process and to minimize errors that might negatively impact the flow and performance of business processes.

Using the pricing list items for the actual contract, it was determined that the most expensive activities involve automation, such as "laser, scissors, press brake, CNC milling machine, horizontal milling machine, CNC lathe ecoturm." This can be explained by the fact that the operation and maintenance of these tasks are time-consuming. Their activity is irreplaceable and one-of-a-kind in terms of value added, constituting a considerable cost item for the organization. The second hypothesis, which sought to determine whether automated activities contribute to a decrease in profitability, was not confirmed. This is evidenced by the fact that the "laser" operation generates the highest level of risk, whereas "shears, press brake, horizontal milling machine, CNC lathe ecoturm" operations generate a moderate level of risk. The remaining automated tasks have a reduced danger threshold.

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The results were compared to those of other authors to figure out how important they were. Their findings are generally consistent with those of numerous other authors, including Blocisz and Hadas (2019). These writers found that the biggest risks happen during the planning phase of production, when the production schedule is made. The results of the authors' past scientific research, or at least some of the results, match the results of this work. Also, the field of sales and marketing, which is all about meeting customer needs, was found to be the most dangerous. These locations are anticipated to increase in significance. In the context of fluctuating prices, especially for energy and raw materials, input and output logistics are proving to be an additional high-risk aspect of the production process. As a consequence, it's natural that firms are looking for methods to significantly reduce expenses and rely heavily on outsourcing, for example (Hira, 2019). These subjects will be the focus of future study efforts.

The new method looks good, but it needs to be tweaked and tested in more corporate settings. A portion of the proposed procedure's benefits can be found in the field of creating estimates for prospective clients. The data can also be used to re-plan orders for potential customers, since knowing the risk level of previous orders will make the company's sales operations much more responsible and specific. This is in line with the results of Wallis (2020), who says that a company can't make its strategic plan or production plan without knowing what risks are involved in the process. Regardless of the technology or environment, company owners and managers must put in place strategies and procedures to guarantee a successful change management framework (Keengwe, Kidd, Kyei-Blankson, 2009). Regarding the relationship between the amount of value added by a process and the degree of risk, it is essential to identify and monitor the risks connected with the time and expense of the production process's operations. As stated by Senova et al. (2017), understanding the riskiness of operations is a necessity for avoiding repetition of past errors and determining the appropriate production process development strategies.

Conclusions

Even though the outputs and theoretical knowledge were judged to be good, it is important to evaluate them as a first approximation of the research goal. Risk analysis and assessment in the enterprise need to be looked at in more depth from an analytical and methodological point of view. As a next step, the newly established method needs to be tested on a group of test firms that are typical of different types and sizes of businesses.

The model company's approach was implemented with continual consultation and disagreement from its management. The management respected several comments during the solution's development. The production masters' remarks were extremely important since they represent a key factor in the analysis and removal of hazards. Another positive aspect of the solution was that in the model company, a process of new setup of the production process management and sub-operations, with concurrent validation of the system for the evaluation of value added in the production processes of the company in selected processes of the company, was in progress.

The COVID pandemic proved that the scientific study set was right, and it is expected that this problem will get worse in the business world. Already at this point in research, it is possible to assert that process risks can be removed in an integrated production process comprised of sub-operations, including the production planning and execution phases. This approach to risk will make it feasible to change the cost and overhead parameters, as well as the time aspects of production, while minimizing the amount of risk throughout the entire production process and its components. From this perspective, the research objective stated in this paper has been achieved; nonetheless, the results need to be modified, validated, and in some cases supplemented with extra information that the results suggest.

References

Benischke, M. H., Martin, G. P., & Glaser, L. (2019). CEO equity risk bearing and strategic risk taking: The moderating effect of CEO personality. *Strategic Management Journal*, 40(1), 153-177. https://doi.org/10.1002/smj.2974

Blocisz, R., & Hadas, L. (2019). Risk assessment for potential during process implementation using production process preparation. *Advances in Intelligent Systems and Computing*, 835, 285-295. https://doi.org/10.1007/978-3-319-97490-3_28

Bodnar, G. M., Giambona, E., Graham, J. R. & Harvey, C. R. (2019). A View Inside Corporate Risk Management. *Management Science*, 65(11), 5001-5026. https://doi.org/10.1287/mnsc.2018.3081

Chi, S., et al. (2015). Accident risk identification and its impact analyses for strategic construction safety management. *Journal of Civil Engineering and Management*, 21(4), 524-538. https://doi.org/10.3846/13923730.2014.890662

Dang, V. L., & Yeo, G. T. (2017). A competitive strategic position analysis of major container ports in Southeast Asia. *Asian Journal of Shipping and Logistics*, 33(1), 19-25. https://doi.org/10.1016/j.ajsl.2017.03.003

Ghaeli, M. R. (2018). The Advantage of Project Risk Management Tools. *Journal of Project Management*, 3(2), 121-124. https://doi.org/10.5267/j.jpm.2018.1.002

Giraldo, A. L. P., & Nunez, M. A. (2020). Strategic risk management in some large Colombian private companies. *Ad-Minester*, 36, 69-96. https://doi.org/10.17230/Ad-minister.36.4

Godany, Z., Mura, L. (2021). Success from the perspective of female entrepreneurs. *Entrepreneurship and Sustainability Issues*, 9(2), 521-534. http://doi.org/10.9770/jesi.2021.9.2(34)

Gong, Q., Rong, L., & Wang, H. (2019). China´s manufacturing strategy choice: An integrated strategic analysis framework combining SWOT and logical growth models. *Asian Economic and Financial Review*, 9(11), 1290-1305. https://doi.org/10.18488/journal.aefr.2019.911.1290.1305

Haviernikova, K., Okreglicka, M., & Lemanska-Majdzik, A. (2016). Cluster Cooperation and Risk Level in Small and Medium-Sized Enterprises. *Polish Journal of Management Studies*, 14(2), 82-92. https://doi.org/10.17512/pjms.2016.14.2.08

Hira, R. (2019). Outsourcing STEM Jobs: What STEM Educators Should Know. *Journal of Science Education and Technology*, 28(1), 41-51. https://doi.org/10.1007/s10956-018-9747-z

Horak, J. (2020). Bankruptcy prediction of small and medium-sized industrial companies in Czechia. *7th International Conference on Education and Social Sciences (INTCESS 2020)*. 1206-1212. ISBN 978-605-82433-8-5.

Jaime, A., Blanco, M. J., Domíguez, C., Sánchez, A., Heras, J. & Usandizaga, I. (2016). Spiral and Project-Based Learning with Peer Assessment in a Computer Science Project Management Course. *Journal of Science Education and Technology*, 25(3), 439-449. https://doi.org/10.1007/s10956-016-9604-x

Kasych, A., & Vochozka, M. (2017). Theoretical and methodical principles of managing enterprise sustainable development. *Marketing and Management Innovations*, 2, 298-305. https://doi.org/10.21272/mmi.2017.2-28

Keengwe, J., Kidd, T. & Kyei-Blankson, L. (2009). Faculty and Technology: Implications for Faculty Training and Technology Leadership. *Journal of Science Education and Technology*, 18(1), 23-28. https://doi.org/10.1007/s10956-008-9126-2

Khashei, V., et. al. (2019). International strategic alliances in the Iranian hoe appliance industry: A model of the perceived risks for foreign partners. *Iranian Journal of Management Studies*, 12(4), 677-701. https://doi.org/10.22059/ijms.2019.273512.673470

Klober-Koch, J., Braunreuther, S., & Reinhart, G. (2017). Predictive production planning considering the operative risk in a manufacturing system. *Manufacturing Systems 4.0*, 63, 360-365. https://doi.org/10.1016/j.procir.2017.03.118

Kumar, et al. (2018). An empirical analysis of supply and manufacturing risk and business performance: a Chinese manufacturing supply chain perspective. *Supply Chain Management-An International Journal*, 23(6), 461-479. https://doi.org/10.1108/SCM-10-2017-0319

Kumar, R. L. & Park, S. (2019). A Portfolio Approach to Supply Chain Risk Management. *Decision Sciences*, 50(2), 210-244. https://doi.org/10.1111/deci.12332

Man, M., Radu, S. M., & Tabor, J., 2015. The Risk Management Organizational Entities. *Polish Journal of Management Studies*, 11(2), 115-126. ISSN: 2081-7452

Meinel, U., & Schüle, R. (2018). The difficulty of climate change adaptation in manufacturing firms: Developing and acton-theoretical perspective on the causality of adaptive inaction. *Sustainability*, 10(2). https://doi.org/10.3390/su10020569

Nasteckiene, V. (2021). Empirical Investigation of Risk Management Practices. *Management-Journal of Contemporary Management Issues*, 26(3), 79-98. https://doi.org/10.30924/mjcmi.26.2.5

Olie, R., & Rao-Nicholson, R. (2018). Examining the role of institutions in strategic leadership structures using configurational analysis. *78th Annual Meeting of the Academy of Management, AOM 2018*. https://doi.org/10.5465/AMBPP.2018.102

Pakocs, R., & Lupulescu, N. B. (2017). Investigations regarding the lowering of specific intellectual property risks identified in the production process. *MATEC Web of Conferences*, 94. https://doi.org/10.1051/matecconf/20179406014

Panjehfouladgaran, H. & Lim, S. F. W. T. (2020). Reverse logistics risk management: identification, clustering and risk mitigation strategies. *Management Decision*, 58(7), 1449-1474. https://doi.org/10.1108/MD-01-2018-0010

Pour, M. J., et al. (2019). A comprehensive investigation of the critical factors influencing knowledge management strategic alignment. *Knowledge Management and E-Learning*, 11(2), 215-232. https://doi.org/10.34105/j.kmel.2019.11.011

Prodanova, N. A., et al. (2019). Methodological approaches for strategic economic analysis. *International Journal of Economics and Business Administration*. 7(3), 305-316. https://doi.org/10.35808/ijeba/327

Raghunath, K. M. K. & Devi, S. L. T. (2018). Supply Chain Risk Management: An Invigorating Outlook. *International Journal of Information Systems and Supply Chain Management,* 11(3), 87-104. https://doi.org/10.4018/IJISSCM.2018070105

Rahman, M. S. & Adnan, T. M. (2020). Risk management and risk management performance measurement in the construction projects of *Finland. Journal of Project Management*, 5(3), 167-178. https://doi.org/10.5267/j.jpm.2020.5.001

Senova, A., et al. (2017). The evaluation process of production risks in the manufacturing plant. *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM.* 17(53), 919-926. https://doi.org/10.5593/sgem2017/53/S21.112

Shipanga, U., Le Roux, S., & Dubihlela, J. (2022). Operational risk factors and the sustainability of small and medium manufacturing enterprises in South Africa. *Insights into Regional Developmen*t, 4(4), 126-139. http://doi.org/10.9770/IRD.2022.4.4(7)

Shobayo, P. B. (2017). Supply Chain Management and Operational Performance in Nigeria: A Panel Regression Model Approach. *International Journal of Entrepreneurial Knowledge*, 5(2). https://doi.org/10.1515/ijek-2017-0012

Sotnyk, I., Kurbatova, T., Romaniuk, Y., Prokopenko, O., Gonchar, V., Sayenko, Y., Prause, G., Sapinski, A. (2022). Determining the Optimal Directions of Investment in Regional Renewable Energy Development. *Energies*, 15, 3646. https://doi.org/10.3390/en15103646

Stanik, J., Kiedrowicz, M., & Waszkowski, R. (2019). Security and risk as a primary feature of the production process. *Intelligent Systems in Production Engineering and Maintenance*, 835, 701-709. https://doi.org/10.1007/978-3-319-97490-3_66

Straková, J., et al. (2020). Use of the value chain in the process of generating a sustainable business strategy on the example of manufacturing and industrial enterprises in the Czech Republic. *Sustainability*, 12(4). https://doi.org/10.3390/su12041520

Szalucki, K., & Fryca-Knop, J. (2017). Strategic analysis of risk of employing in public utility transport enterprises. *Sustainable Transport Development, Innovation and Technology*, 151-163. https://doi.org/10.1007/978-3-319-51427-7_13

Trypolska, G., Kurbatova, T., Prokopenko, O., Howaniec, H., Klapkiv, Y. (2022). Wind and Solar Power Plant End-of-Life Equipment: Prospects for Management in Ukraine. *Energies*, 15, 1662. https://doi.org/10.3390/en15051662

Ukil, M. I., & Akkas, M. A. (2017). Determining success factors for effective strategic change: Role of middle managers´ strategic involvement. *Serbian Journal of Management*, 12(1), 29-40. https://doi.org/10.5937/sjm12-11430

Váchal, J., Pártlová, P., & Straková, J. (2017). Business process projection in relation to the internationalization of the external environment of industrial companies. Innovative Economic Symposium 2017 (IES 2017): *Strategic Partnership in International trade*. 39. https://doi.org/10.1051/shsconf/20173901027

Virglerova, Z., Conte, F., Amoah, J., & Massaro, M. R. (2020). The Perception of Legal Risk and Its Impact on the Business of SMEs. *International Journal of Entrepreneurial Knowledge*, 8(2), 1-13. https://doi.org/10.37335/ijek.v8i2.115

Vochozka, M., & Machová, V. (2017). Enterprise value generators in the building industry. Innovative Economic Symposium 2017 (IES 2017): *Strategic Partnership in International Trade*, 39. https://doi.org/10.1051/shsconf/20173901029

Vrbka, J., & Rowland, Z. (2020). Using artificial intelligence in company management. Sustainable Growth and Development of Economic Systems: Contradictions in the Era of Digitalization and Globalization. *Contributions to Economics*, 84, 422-429. https://doi.org/10.1007/978-3-030-27015-5_51

Walaszczyk, L. (2016). Strategic research programs in the area of technical innovations – case study analyses. *Foundations of Management*, 8(1), 139-150. https://doi.org/10.1515/fman-2016-0011

Wallis, S. E. (2020). Integrative propositional analysis for developing capacity in an academic research institution by improving strategic planning. *Systems Research and Behavioral Science*, 37(1), 56-67. https://doi.org/10.1002/sres.2599

Wei, L., Dou, Z.J., Li, J., Zhu, B.W. (2021). Impact of Institutional Investors on Enterprise Risk-taking. *Transformations in Business & Economics*, Vol. 20, No 2B (53B), pp.886-904.

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