ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 4 (June)
http://doi.org/10.9770/jesi.2023.10.4(8)

Publisher
http://jssidoi.org/esc/home

INNOVATION OF THE PRODUCTION PROCESS OF ENGINEERING COMPANIES IN RELATION TO BUSINESS PORTFOLIO*

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Received 18 January 2023; accepted 8 May 2023; published 30 June 2023

Abstract. The paper is aimed at the innovation process in the context of the business portfolio of micro-enterprises. This type of companies is typical of and prevalent in the southern region of the Czech Republic, and the presented conclusions have general validity. A newly developed method of assessing the innovative technological potential of enterprises called "Business technology assessment system" (BTAS), with the contribution of "Criteria analysis of systems". The research answers the question, what economic efficiency can innovations in the production process bring to SMEs dealing with custom manufacturing in the engineering sector. Technological backwardness including corporate infrastructure was proven. Companies compensate for this shortcoming by an increased focus on satisfying customer needs and a high degree of flexibility and innovation in production. From the point of view of production processes, there is a high degree of interconnectedness between individual operations and sub-processes. The business portfolio of most of these companies is disproportionately broad, and this is reflected in the negative findings in terms of the disproportionate number of methods and technologies that these companies possess, but do not fully utilize. Such behaviour of the companies can be explained by the absence of active creation and updating of business strategy. The economic evaluation of the innovative process (BTAS) proved that the very implementation of innovations did not lead to a major increase in the profit margin. The situation was different when evaluating the benefits of the digitization process, which brought an increase in sales and corporate margins. A completely new finding has been demonstrated, i.e., if a company has unused equipment which brings opportunity costs as well, it is possible to create space for innovation by removing it, and at the same time the sale of equipment can be a significant financial contributor to innovation.

Keywords: strategic management; innovation, industry; production process; BTAS.

Reference to this paper should be made as follows: Talíř, M., Straková, J. 2023. Innovation of the production process of engineering companies in relation to business portfolio. *Entrepreneurship and Sustainability Issues*, 10(4), 118-134. http://doi.org/10.9770/jesi.2023.10.4(8)

JEL Classifications: M11, M21, O14

Additional disciplines: information and communication, informatics. construction engineering

* *This paper has been prepared as a part of internal research competition at the department of management for 2022 entitled: "A new approach in the generation of corporate (business) strategy based on the parameterization of business processes". PID: IVSUPS004.*

1. Introduction

Companies are constantly interacting with the environment in which they operate. They are exposed to stimuli that require their immediate reactions. One way to respond to these stimuli is innovation. The area in which companies can improve is specific to each business with respect to its size, focus and capacity capabilities. It is possible to improve products (products, services), processes (e.g. production process by changing production technology), logistics (material flow) or areas in the organization and management of the company (choice of strategy, change of organizational structure, choice of information tool such as internal software - flow of information, soft skills of managers, etc.). Although nowadays companies are allowed to offer a range of accompanying services, the most important things for customers in the engineering industry still remain quality, price and time of implementation. This triple imperative creates constant competitive pressure and represents an opportunity for better prepared competitors. Growing competition forces companies to constantly innovate and thus respond to dynamic changes taking place especially in the external business environment. Some companies face this pressure without problems, others, less financially strong and competitive ones, may succumb to this increasing pressure. For companies to be competitive and achieve exceptional performance, it is essential to have a "good" strategy and a tailored value chain. The issue of the innovation potential of small and medium-sized engineering enterprises (SMEs) will be dealt with, with a focus on the production process, its innovation, and in connection with the business portfolio of these companies. In order to achieve the set goal, research questions were formulated. They aim to determine the economic efficiency associated with the innovation of the production process and to find what economic benefit is generated from the introduction of digitization into the production process. Following the research questions, the study captures a view of the business environment and aspects related to the innovations of both the production process and the business portfolio through the prism of the company. Therefore, the aim of the paper will be to identify and evaluate the innovation potential of small and medium-sized engineering enterprises with a focus on the production process with regard to their business portfolio. Based on the aim of this study, the following research questions were formulated:

RQ1: What economic efficiency can innovations in the production process bring to SMEs dealing with custom manufacturing in the engineering sector.
RQ2: What economic benefit does the introduction of digitization into the production process generate in SMEs dealing with custom manufacturing in the engineering sector.

2. Theoretical background

With the beginning of the 21st century, issues of efficiency, stability and growth are coming to the fore in the corporate sphere, including SMEs. There are a lot of financial techniques and indicators that address this issue in this setting (Horák et al., 2020). Growing supply is a key element of today's market, which implies that supply frequently surpasses demand in many areas. As a result, firms confront intense competition in their daily operations (Kollmann and Dobrovič, 2022; Soltes & Gavurova, 2015). This trend is reflected in the works of both domestic and foreign authors (Heekyung, 2015; Civelek et. al. 2020; Krajcik, 2021). One of the main tools to fulfil the above-mentioned goals is to ensure permanent and effective innovation of business processes (Krugman, Obstfeld and Melitz, 2015; Heekyung, 2015). In general, the innovation process can be anchored in the business environment in two levels. The first can be characterized as an operation-process area, the second is a management and organizational area. Despite extensive research on innovation performance relationships, previous studies have focused mainly on technological innovation, leaving the effects of organizational innovation relatively unexplored (Azar a Ciabuschi, 2017; Al-Omoush et al., 2022; Skare and Porada Rochon, 2022). It is always necessary to look at innovations not only from the point of view of what they essentially relate

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to, but it is also important to perceive the links to the overall business system (Sternad et al., 2019; Owalla et al., 2021). According to Ghezzi et al. (2020) innovation begins with the discovery of problems and the search for innovation opportunities through the acquisition and classification of knowledge. The authors state that based on this knowledge, companies subsequently determine the direction, goal and approach to innovation. In the context of unpredictable changes (e.g., the Covid-19 pandemic), not only customer behaviour changes (see Sagapova and Dušek, 2021; Dušek and Sagapova, 2022; Konečný, Kostiuk and Ruschak, 2022; Pollák et al., 2022; Pollák et al., 2021; Xiao et al., 2022; Wang et al., 2022; Skare and Riberio Soriano, 2022), but as Ashrafi et al. (2019) also state, only such companies that are innovative and at the same time strategically oriented and managed have increased resistance to crisis phenomena and are looking for new ways to achieve permanent economic prosperity. The introduction of a mechanism for regular evaluation of the company's position will make it possible to identify potential problems in business activity already in the initial stages, which will allow the companies to develop and implement a set of innovative measures to solve problems and to neutralize them (Tyukhtenko et al., 2021; Phadermrod, Crowder and Wills, 2019). As reported by Wu et al. (2022), the company's human resources play an irreplaceable role in the innovation process, and the application of the principles of socially responsible behaviour is increasingly relevant. For industrial production companies, especially SMEs, the business portfolio and distribution channels are an essential pro-growth factor. Foroudi et al., (2022) claim that corporate strategy and the area of innovation processes form the development base of an enterprise and positively influence the process of corporate margin and building the corporate image, including the corporate brand. Weber and Müßig (2022) state that the company's business strategy, the basis of which is the business portfolio, is a determining factor for both the quantity and quality of information from the perspective of risk factors. Henry et al., (2020) present the concept of a company's absorptive capacity as the ability to recognize the value of new external information, to adopt it and use it for business purposes, including changing the business portfolio. Companies with an innovation-oriented strategy report more about their risk factors than companies with a defensive efficiency-oriented strategy (Putro et al., 2021; Soltes & Gavurova, 2014; Gavurova et al. 2016). Weber and Müßig (2022) mention that business strategy influences coverage of major risk topics and creates a framework for innovation activities.

Effective innovations require taking into account the shared values of participants in innovation processes, whereby values are understood as subjective ideas about what is desirable (Breuer and Luedeke-Freund, 2017). To improve the quality and efficiency of business processes with a focus on production, Zuhaira and Ahmad (2021) recommend distinguishing the production process itself from the process of seeking changes and from the process of very change of the production process (Ližbětinová et al., 2017). Continuous process improvement begins with a description of its current state. This is followed by determination of monitored metrics, monitoring of process operation, measurement of process operation. The final point is the design and implementation of an improvement, which is then again a source for new improvements (Sjodin et al., 2020; Kljucnikov, et. al., 2021). In the case of business model innovations, Bocken, Nancy and Geradts (2020) and Podshivalova and Almrshed (2021) mention that business model innovations are extremely important, yet very difficult to achieve. Anshari and Almunawar (2021) hypothesize that there is a positive relationship between company digital ecosystem readiness and SME adoption of open innovations. The fourth industrial revolution refers to innovation and transformation of production processes (Domanižová, Janíčková and Milichovský, 2021). Veile et al. (2019) state that in order to innovate in the sense of the gradual implementation of Industry 4.0 elements, it is necessary for the organizational structure to be characterized by a flat hierarchy and decentralized decision-making, and agility needs to be supported as well. At the same time, the corporate culture should be characterized by flexibility, openness, a willingness to learn as well as entrepreneurial spirit and attitudes. Frank et al. (2019) mention a growing trend in the innovation process of servitization. In today's era of high competition, manufacturing companies are increasingly offering important services as part of their processes that support customer satisfaction with the product itself or the result of the previous service. Servitization includes, for example, training, maintenance, overhaul or customer support. Frank et al. (2019) note that the very change of production organization towards the use of servitization is a challenge. Sjodin et al. (2020) state that in response to customer

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2023 Volume 10 Number 4 (June)
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demands for ever better products and services, and in response to preventing the customers from leaving for the competition, companies continuously work to improve their processes using mutual harmony. Knowing the processes and documenting the changes is essential for their improvement (Sjodin et al., 2020; Korshunov, Kabanov and Cehlar, 2020).

The very activation of innovation processes in companies largely depends on the ability of the companies to develop their intellectual potential (Kasych et al., 2021; Komang et al., 2022; Belas et al. 2023). The authors state that, paradoxically, this intellectual capital is not sufficiently appreciated by companies. Hwang and Kim (2021) find that the introduction of new Industry 4.0 technologies increases the productivity of small and medium-sized enterprises. The authors report that adoption of these technologies increases the efficiency of the manufacturing process by more than 26 % on average compared to companies that do not implement these technologies. At the same time, the authors see digital transformation as a unique opportunity to increase the productivity of small and medium-sized enterprises. However, Ferdous and Ikeda (2022) also found that, based on structural modelling of the innovation process, it can be concluded that the size of the company raises the probability of its involvement in new-to-the-market innovations. In relation to employees, Suto and Takehara (2022) state that non-monetary rewards act independently and synergistically with monetary rewards to enhance employee motivation to innovate, thereby increasing the company value. Companies that apply these principles will continue to be considered legitimate if they are perceived as socially embedded not only externally but also internally (Wu et al., 2022). A pro-growth-oriented company assumes the intersection of horizontal and vertical integration. While the vertical leads to real modernization and innovation of business processes, horizontal integration has the task of ensuring the connection of the company with educational and research institutions, which is the essence of an effective innovation process. When trying to find an answer to the question of how a company can anchor the ideas of continuous innovation among the basic company components, it is possible to use the CIPF model, the author of which is professor Milan Zelený. Zelený states that CIPF has 4 necessary and fully sufficient components: C (customer), I (innovation), P (process), F (finance), (Zelený, 2021). A number of authors, including the authors of this paper, recommend starting to connect the value chain horizontally in order to implement the elements of Industry 4.0. To optimize processes across the entire value chain, it is necessary to ensure the exchange of data from customers to suppliers and vice versa (Veile et al., 2019). In the context of digitization, Anshari and Almunawar (2021) and Kraj (2022) mention that SMEs should be protected to ensure their survival. Müller, Buliga and Voigt (2021) as well as Nagy, Zábojník and Valaskova (2022) mention that many benefits of Industry 4.0 will become available to small and medium-sized enterprises only if they not only use Industry 4.0 technologies, but also innovate their business models or business portfolio based on the opportunities brought by these innovative technologies. Fernandez-Vidal et al. (2022) and Sommer et. al (2022) state that companies in their transformation primarily choose combinations of small transformational innovation strategies to achieve their large transformational goals.

3. Research objective and methodology

Descriptive analysis – this method aims to identify the determinants of innovation potential of enterprises through observation, measuring, and interviews. There will be determined the essence of the problem and its limitations. The focus will be on analysing the causes and motivation of a company to innovate or not to innovate its processes. Furthermore, the production process and the related processes will be analysed with regard to the business portfolio of a model company. There will also be performed an analysis of the determinants influencing the innovation of a production process and business strategy of the company.

Criteria analysis of systems – extraction of data from the production process. It is a qualitative evaluation of data according to predetermined criteria. The evaluation will be carried out by assigning values -1, 0 and 1 to a given item being evaluated based on whether it meets (1) or does not meet (-1) a given criterion, or whether the information cannot be confirmed or verified (0). In the case of a zero or negative value, the given item will be penalized in fact. Another criterion of the analysis is the significance of a given parameter for a given purpose in the form of weight coefficient. Weight coefficient can be assigned the values ranging from 0.1 to1. For a clear evaluation, the result of the analysis will be also graphically represented.

Business technology assessment system – it is an assessment system created by the authors. A trial version is in MS Excel (see Table 1). The assessment is focused on the proportional use of technology in a company in relation to its full use, and its possible attractiveness for a customer. The practical application of this method consists in determining the degree of the company´s ability to use this technology, or its possible use in future. The values assigned can range from 0.1 to 1, where 0.1 corresponds to the minimum use of technology. Value 1 then refers to the maximum possible use of technology which a given company is able to ensure. The attractiveness of the technology then reflects the customer´s demand for the use of the given technology. The possible values range from 1 to 10 where 10 corresponds to the maximum demand for the given technology.

Table 1. General (methodical) application of the business technology assessment system (BTAS)

	Current status			Estimated future status				
Machine	**Usage**	**Attractivity**	**Proposal**	**Usage**	**Attractivity**	**Proposal**	**Rating**	**Intensity and direction of change**
A	0,6	6	⍟	0,9	8	⍟	⍟	Without change
B	0,4	6	+	0,5	9	+	+	Without change
C	0,6	3	?	0,6	3	?	?	Without change
D	0,1	2	⊗	0,2	1	⊗	⊗	Without change
E	0,1	1	⊗	0,6	2	?	⤮	Positive change
F	0,2	3	⊗	0,5	6	+	⤮	Strongly positive change
G	0,2	3	⊗	0,9	6	⍟	⤮	Extremely positive change

Legend of recommendation

Cancel	Consider cancelling	Expand	Main activity	Change
⊗	?	+	⍟	⤮

Source: Authors

To obtain relevant results, the values were symmetrically divided into two parts. There can thus be four alternative outputs: 1. To stop using the given technology *(usage < 0.55, attractiveness < 5.5)*; 2. Consider future elimination or increase interest of Tu customers to use the technology *(usage > 0.55, attractiveness < 5.5)*; 3. To develop the technology, strive for its increased usage, i.e., to increase machine hourly rate, work with the active demand for a given service – focus on technology *(usage < 0.55, attractiveness >= 5.5)*; 4. To maintain and work with the technology within the main activity of the company (rate growth) – focus on technology (usage > 0.55, attractiveness > 5.5).

Table 2. Intervals of values for making recommendations in a given area

Cancel	**Usage** < 0,55 ⇔ **Attractivity** < 5,5
Consider cancelling	**Usage** > 0,55 ⇔ **Attractivity** < 5,5
Expand	**Usage** < 0,55 ⇔ **Attractivity** > 5,5
Main activity	**Usage** > 0,55 ⇔ **Attractivity** > 5,5
Change	In case of difference in recommendations

Source: Authors

The concurrence of current recommendations with the future ones enables to formulate the resulting evaluation. If there is a difference, *change* is recommended, which can be evaluated as follows: *extremely negative, strongly negative, negative, positive, strongly positive, extremely positive.* It shall be also noted that even negative evaluation of a given technology may open new innovative opportunities for the company.

Economic analysis – economic analysis will be used for the financial evaluation of the innovations implemented. For its evaluation, the average payback period will be used, as stated by Kislingerová (2007). Average payback period indicates the time in which the investment should be paid off considering average cash flows arising from the implementation of the investment.

$$t = \frac{C_0}{\varnothing\ \mathrm{CF}}$$

where: C0 is the capital invested
⌀ CF is the average flow of funds arising from investment for its planned economic life
By inverting average payback period in percentage, it is possible to obtain average percentage return. The value indicates the average annual percentage return on the amount invested.

$$\varnothing\ \mathrm{r} = \frac{\varnothing\ \mathrm{CF}}{C_0}$$

A simplified form of payback period not including the discount coefficient will be used because the discount coefficient is always difficult to determine precisely for a small engineering company. Moreover, the economic analysis shall include a process to evaluate the change in margin and volume of sales. This evaluation will be carried out by means of the ratio and percentage increase in given parameters in relation to their individual initial values.

4. Results and Discussion

Specifics and uniqueness of the transformation process

Prior to the actual analysis of relationship between the company´s business portfolio and the innovation process, the specifics and uniqueness of the corporate transformation process were identified. Part of the company´s success is its specific approach to customers and a well-functioning order creation process (see Table 3) where customer awareness and acceptance of future technological process is decisive for the production process and pricing.

Table 3. Diagram of order creation process in a company

Requirement	1. Customer requirement	✔ Can be accommodated ✖ Can't be accommodated	
Process steps (time)	2. Difficulty assessment	✔ Can be accommodated ✖ Can't be accommodated	
	3. Notify customer	✔ Offer accepted ✖ Offer rejected	
	4. Receive the product		
	5. Model diagnosis	✔ Can be realized ✖ Can't be realizet = end	**Invoicing**
	6. Notify customer (price etc.)	✔ Proceed ✖ Annulment = end	**Invoicing**
	7. Manufacturing process		
	8. Product completion		
	9. Product delivery		
Satisfaction of requirement	10. Invoicing	✔ Paid ✖ Unpaid	

Source: Authors

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The standard production process takes place at point 7 or point 5. Given that it is a unique micro-enterprise, a high degree of interdependence of individual operations and subprocesses have been identified. This means that individual elements, such as logistics, control, or construction design (if carried out directly at the workplace) are inseparable parts of the production process.

Risks of transformation process as a framework of innovation process

In the context of the production processes, risks could be identified that affect this process. The most significant business risk is considered to be associated with the improper communication of information. Within the solution processes, the management of the company was proposed to replace manual information recording with digital software. Part of the innovations in the model micro-enterprise was thus the implementation of software for order management and extraction of data from the production process. Within the analysis of software suitable for the company, an initial list of systems was compiled. The mapping of possible software solutions was preceded by determining 15 parameters that further specified the suitability of the systems for their possible implementation in the model company. The observed parameters were recording orders, recording employee work on orders, recording of employee attendance, recording material consumption in orders, possibility of data export and import (this is particularly suitable for stock and non-stock items), invoicing options, price setting of different hourly rates of employees and/or machines, basic financial tools for evaluation of cost and profitability of orders, the possibility to rent or purchase a licence (a permanent licence), whether support is provided and whether it is free, possibility to obtain hardware from the system supplier, and the possibility to connect to other systems through API. Based on these parameters, the data were graphically processed (see Graph 1) to be able to clearly assess the suitability of a specific proposed solution. The evaluation was based on assigning values -1, 0 and 1 to given software according to whether a give parameter meets (1), does not meet (-1) the set criteria or whether the information on the software function is not available (0). This implies that even negative values are important for the evaluation. The evaluation also included the weight coefficient (0.1 - 1), which determines the significance of individual observed criteria for the selected model company. Here, 1 indicates the highest weight, while 0.1 the lowest one. In the case of the most observed parameter such as recording orders, employee attendance, material consumption, and possibility of data export and import, the assigned weight of these functions was 1. When comparing the software, the latest commercial version with add-ons was considered, except for the eMistr system, where add-ons go beyond the monitored areas.

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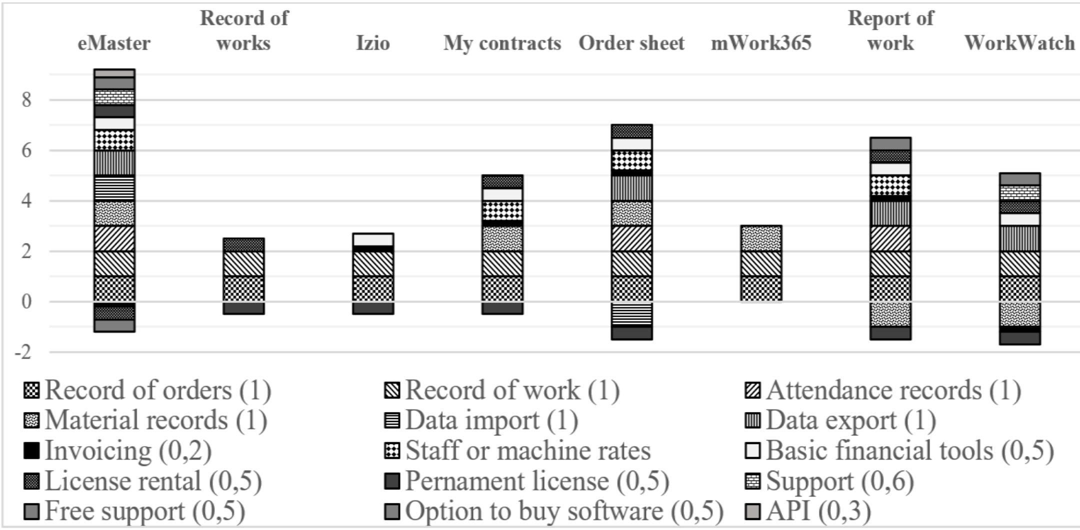

Figure 1. Results of comparative criteria analysis

Source: Authors (assessed on the basis of publicly available information)

As seen from the above graph, all systems can perform the function of work recording. The only system that meets all 6 weight criteria is eMistr. The second most suitable system was “Zakázkovník”, which, unlike eMistr, does not have the function of data import, which represents its biggest advantage for its application in the model company. For implementation, the eMistr system was thus selected, as it enables nearly 100% transition of an industrial company from manual data management to the digital form, and thus reduces the necessary administration.

Solution for harmonization of business portfolio with business technologies

As mentioned above, the company is characterized by a wide range of production technologies and the corresponding business portfolio. This brings along a risk of their full use, and it can thus be very complicated to determine the benefits of individual technologies for the given company. Table 4 below shows the input values, output recommendations, and resulting evaluation on a representative sample of technologies in the model company.

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Table 4. Technology evaluation system in the model company (representative sample)

	Current status			Estimated future status				
Rate [Kč/h]	**Usage**	**Attractivity**	**Proposal**	**Usage**	**Attractivity**	**Proposal**	**Rating**	**Change**
550	**Machining – Horizontal boring mill 1**							
	0,7	8	✪	0,7	8	✪	✪	
550	**Machining – Spindle lathe 2**							
	0,7	8	✪	0,7	8	✪	✪	
550	**Welding + heating – Automatic welding machine Castolin**							
	0,3	8	+	0,6	8	✪	⤮	Positive change
550	**Other – Truck lift**							
	0,2	2	⊗	0,1	2	⊗	⊗	

Legend of recommendation

Cancel	Consider cancelling	Expand	Main activity	Change
⊗	?	+	✪	⤮

Source: Authors

The table shows which technologies were recommended to be phased out from the business portfolio (Other – Truck lift).

Economic evaluation of innovations in technology

Economic evaluation of the innovation proposal for changes was carried out in relation to the technology evaluation system proposed by researchers for the implementation of digitization in the model company. Table 5 shows the balance of costs of innovation and income from the sales of discarded machines and stock

Table 5. Balance of costs of innovation and income from the sale of discarded machinery and stock

Item	Price [CZK]
Costs of implementation of technology changes (purchase of machinery and software)	517 550
Sale of stock not related to the new business portfolio	-20 000
Sale of equipment not related to the new business portfolio	-183 500
Total costs [CZK]	**314 050**

Source: Authors

The assessment of return on investment was performed using the average payback period (t) where the difference between the annual amount of labour cost savings at the same volume of production and annual fixed costs was used as the cash flow of investment repayment (CF):

$$t = \frac{C_0}{\varnothing\ \mathrm{CF}} = \frac{314\ 050}{81\ 328 - 15\ 000} = 4.73\ [years]$$

Where: 81 328 CZK is the sum of the constant annual cost savings arising from implemented innovations.

15 000 CZK are annual fixed costs associated with innovation (costs of machinery and equipment maintenance)

The average percentage return that indicates the percentage return in the model company resulting from the innovation implemented is determined as follows:

$$\varnothing\ \mathrm{r} = \frac{\varnothing\ \mathrm{CF}}{C_0} = \frac{81\ 328 - 15\ 000}{314\ 050} = 0.2112 \Longrightarrow 21.12\ [\%]$$

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Further calculation considered 230 effective days on which the employees actually work. Four employees in production work a total of 7 360 hours for an 8-hour working day. In the model company, the innovations can save about 413 hours per year. These are hours of inefficient time when the company pays the workers their wage and at the same time charges this time to its customers. The following calculations are based on the proportional increase in sales, which is generated from the time servings in the execution of orders. The calculation below represents the conversion of sales per employee at the point of higher time efficiency. By analogy, it can be said that thanks to a more efficient production process, the employees now need less time to achieve the same sales.

$$Share\ of\ sales\ per\ employee\ and\ hour = \frac{7\,908\,532}{(7360 - 413)} = 1\,138\ [CZK\ /hour]$$

where: 7360 – annual hours worked by all employees
413 – time saved thanks to innovations

The calculation below determines higher sales generated thanks to a more efficient production process with all other factors being equal.

$$Sales\ at\ more\ efficient\ production\ process = 1\,138 \cdot 7360 = 8\,375\,680\ [CZK]$$

The increase in labour efficiency in the production process increases sales by 467 147 CZK, which accounts for 5.91 %. The above calculation applies to total sales regardless of whether it is only sales for labour or for products or goods. Depending on the way the company operates, it can be assumed that the increase in the volume of sales of own products, services and goods grows linearly with the volume of hours worked. The calculation of margin was based on the size of changes brought by the innovation in the monitored period. Let´s say that the average annual cost of innovation is 77 810 CZK and the saving resulting from innovation is 81 328 CZK. The annual difference is 3 518 CZK. When dividing this difference by the aforementioned volume of hours worked (7 360), the cost saving is nearly 0.48 CZK for every hour worked. In the calculations, the model company works with average hourly costs of 392 CZK. The company thus achieved the following average margins:

$$Current\ margin = 550 - 392 = 158\ [CZK]$$

$$New\ margin = 550 - (392 - 0.48) = 158.48\ [CZK]$$

The percentage increase in margin resulting from the innovations implemented are calculated as follows:

$$Increased\ margin = \frac{158.48 - 158}{158} = 0.003\ \Rightarrow 0.3\ [\%]$$

As can be seen above, the implementation of innovations did not result in a substantial increase in the case of business margin.

Economic evaluation of innovations in the area of digitization

The evaluation of the benefits of digitization was based on the assumption of benefits resulting from the introduction of this new form of recording, evaluation and reporting. The actual value invested in digitization after deducting the revenues from the sale of equipment is 190 467 CZK. For the purposes of the basic evaluation of return, the calculation of average payback period was selected. In this case, CF was the difference between the annual cost savings from the implementation of the software ad annual costs associated with its operation:

$$t = \frac{C_0}{\varnothing\ \mathrm{CF}} = \frac{190\,467}{27\,830 - 9\,000} = 10.12\ [years]$$

where: 27 830 CZK is the constant annual cost saving resulting from the implementation of the software
9 000 CZK expresses the fixed costs associated with the software use

The average percentage of return resulting from the implementation of the software for the management of orders is as follows:

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$$\varnothing\, r = \frac{\varnothing\, CF}{C_0} = \frac{27\,830 - 9\,000}{190\,467} = 0.0989 \implies 9.89\ [\%]$$

The use of the software enables saving 107 hours per year. The current sales generated by 4 employees are again 7 908 532 CZK. The increase in sales resulting from the savings generated by the implementation of the software was determined based on the conversion of sales per employee at the point of higher time efficiency. The calculation is presented below:

$$Share\ of\ sales\ per\ employee\ and\ hour = \frac{7\,908\,532}{(7360 - 107)} = 1\,090\ [CZK/hour]$$

Sales generated during the more efficient production process are as follows:

$$Sales\ generated\ with\ higher\ efficiency\ of\ the\ production\ process = 1\,090 \cdot 7360 = 8\,022\,400\ [CZK]$$

In this case, digitization enables an increase in sales of goods, services and products by 1.44 %. In absolute value, it is 113 868 CZK.

The calculation of the margin was again based on the savings that the given innovation brings in the monitored period.

$$Savings = benefits - costs = 27\,830\ - 47\,093\ = -19\,263\ [CZK]$$

The above calculation was based on the assumption that the implementation of the software will generate savings. However, this has not been confirmed for the model company. When dividing the above result by 7 360, the resulting share is -2,62 CZK/hour. A higher hourly cost thus brings a lower margin for the company:

$$New\ margin = 550 - (392 + 2.62) = 155.38\ [CZK]$$

where: 392 is the current hourly cost in the model company

In percentage terms, digitization generates the following increase in margin:

$$Increased\ margin = \frac{155.38 - 158}{158} = -0.0166 \implies -1.66\ [\%]$$

where: 158 is the current margin

It follows from the above outputs that if a company has equipment that is not used and does not bring opportunity costs, its removal can create space for innovations. Moreover, selling the equipment can bring significant funds for further innovations. Although the benefits of innovations are not reflected in a significant increase in margin, the resulting effect of the innovations can have much more significant effect in the technical, time, and organizational aspects of the operation and the related increase in total sales. At the same time, it has been confirmed that mere innovations do not significantly increase the margin, and companies can thus proceed to increasing the hourly rate charged to customers, if it is possible from the perspective of price sensitivity of customers. This statement is of general validity, especially for SMEs.

The presented technology assessment system was created for the area of companies where there are no data or overview of using individual technologies. By setting the range of values and thresholds between individual recommendations, it is possible to achieve different sensitivity of the evaluation. Furthermore, it shall be stated that the created system of business technology assessment does not necessarily bring the desired benefit to larger digitized companies. Therefore, the authors propose further research on the system of technology assessment in order to create a more sophisticated software environment, that, as the authors believe, should be implemented in a suitable commercially available ERP system. Small and medium-sized enterprises, except high-tech companies, typically have many inefficiencies in their production processes, which are usually caused by accompanying administrative processes. SMEs usually respond to this burden with low activity in data recording. Such companies usually have a very low number of administrative staff, if any. In such a case, the introduction of the software can very positively influence the performance of the whole company. Based on the results presented in this paper, several conclusions can be drawn and it is possible to answer the research questions. The first research question was formulated as follows: What economic efficiency can innovations in the production process bring to SMEs dealing with custom manufacturing in the engineering sector? Following this research question, it can be stated that innovations in the production process can significantly rationalize and streamline the whole process from the organizational and technical point of view. However, in the case of small and medium-sized enterprises, even a relatively significant reorganization of the processes may have only a small effect on the margin. In the model company under review, the confirmed increase in margin was 0.3 %. Nevertheless, the innovations implemented in the company resulted in the desired effect, i.e., a more logical system of operation was implemented and the production capacity of the company was achieved, which will result in a year-on-year increase in sales of almost 6 %. The horizon of the average payback period of the investment in this case was 4.73 years.

The second research question was focused specifically on the area of digitization: What economic benefit does the introduction of digitization into the production process generate in SMEs dealing with custom manufacturing in the engineering sector? The response concerning the digitization benefits for SMEs provides partially contradictory results. As for the effects on the operation of the company, digitization was definitely beneficial. On the other hand, the economic benefits of digitization may not be reflected positively in all parameters. This is partly due to the primary traceability of all effects the digitization has for the company. However, the difficulty of predicting the future growth in the volume of data used also plays a role. In the model company, digitization has led to increased labour efficiency, but due to the cost of the solution, this has not led to an increase in margin but even to its reduction by 1.66 %. Nevertheless, higher labour efficiency has resulted in a year-on-year increase in sales by 1.44 %. The payback period of the investment is 10,12 years. Some of the negative effects were due to the fact that the model company is currently not able to fully use the digitization potential. It is mainly the size limitation of the model company. Furthermore, it was possible to present the reduction of financial burden of innovation by selling rather than just scrapping the equipment of the enterprise. The paper has several limitations that limit the validity of its generally applicable results. The first limitation is that the paper uses the model of a profitable company, which may not always be fully met in practice. In the results, the paper presents conclusions from a case study focused on streamlining the production process and the change in the concept of business strategy following the selected micro-enterprise oriented to service and production. The model company is unique in the structure of its business portfolio; therefore, some of the assumptions associated with the business environment is limited only to this or similar companies. Another limitation is that the paper uses a very limited quantity of information due to the lack of systematic collection of operational data by the model company. This condition was anticipated because many small and medium-sized enterprises report these shortcomings when analyzing their processes.

Conclusions

The selected engineering micro-enterprise, i.e., a company with a maximum of 25 employees, is a typical representative of engineering companies in the South Bohemian region. It can be stated that the presented conclusions have general validity for this size category and sector. In terms of their specifics, characteristics, trends, and sustainability, the following factors and parameters can be specified. The fundamental production feature of these companies is an average, often obsolete technological equipment, including the corporate infrastructure. This clearly negative parameter is compensated by increased focus on satisfying customer needs and high degree of flexibility and innovations in production. For this, the pragmatic knowledge and skills of the majority of managers in these companies are necessary. In terms of production processes, there is a high degree of interdependence between individual operations and subprocesses. This means that logistics, control, or construction and design activities are inseparable parts of the production process. The area of business risks is also very specific, for example the flow and communication of relevant information. This has recently been

ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 4 (June)
http://doi.org/10.9770/jesi.2023.10.4(8)

addressed by the advancement of digitization in this category of companies. The result of the qualitative testing of the selected parameters of the transformation process was the finding that the most functional and effective system is eMistr, which enables the transition of the company to digital data management.

The business portfolio was also subjected to the research. It has been confirmed that too broad a business portfolio and too many processes and technologies in a company bring a risk of not being fully used and it can thus be very difficult to determine the benefits of individual technologies for a given company. The data collection showed that SMEs, or micro-enterprises dealing with production and services in engineering tend to purchase technologies that are not related to their business portfolio and are thus not actively used by the companies. This can be explained by the absence of active creation and updating of business strategies. Innovation process takes place even in this size category of companies. Economic evaluation of the innovative process shows that the mere implementation of innovations has not resulted in a significant increase in margin. This was not the case for the evaluation of benefits of the digitization process, which has resulted in an increase in sales and business margin. A completely new finding is that if a company has equipment that is not used and which incurs opportunity costs, its removal may create space for innovations and its selling can represent additional funds that can be used for innovations. Although the benefit of innovations is not reflected in a significant increase in margin, the resulting effect can be much more pronounced in the technical, time, and organizational aspect of the operation. Some of the above new findings can be considered essential in terms of the sustainability of this category of companies, but they are continuously addressed by the managers. The relevance of these findings is gaining momentum in relation to the increasing existential risk of engineering companies in general. At the time of conducting this research and preparation of this paper, which has a character of a generalized case study, the authors did not know how relevant the information found will be and how the increasing ecocritical situations will threaten the very existence of this size category in the engineering sector.

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Funding: This paper has been prepared as a part of internal research competition at the department of management for 2022 entitled: "A new approach in the generation of corporate (business) strategy based on the parameterization of business processes". PID: IVSUPS004.

Author Contributions: Conceptualization: *Talíř, Straková*; methodology: *Talíř*; data analysis: *Talíř*, writing—original draft preparation: *Talíř*, writing; review and editing: *Talíř, Straková*; visualization: *Talíř*. All authors have read and agreed to the published version of the manuscript.

ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES
ISSN 2345-0282 (online) http://jssidoi.org/jesi/
2023 Volume 10 Number 4 (June)
http://doi.org/10.9770/jesi.2023.10.4(8)

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