10.31341/jios.47.2.8
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UDC 004:005.2:334(437.3)
Original Scientific Paper

Digital transformation of strategic management of SMEs in the Czech Republic

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Abstract

Strategic management of SMEs is perceived as crucial backbone of their business, as it impacts their business models and internal processes all the way up to digital innovation measured by the level of digital maturity. How do the strategic management factors influence the digital maturity? Through quantitative analysis of 76 respondents representing SMEs in the Czech Republic, the research data was collected and statistically tested. Results imply that strategic management factors affect the level of digital maturity. This paper contributes to prior literature by practical implementation of modified digital maturity model and by addressing the correlation of strategic management factors and the level of digital maturity. Limitations springing from sample site and environment are addressed and discussion on the results is conducted. Author proposes a conclusion that strategic management factors can be perceived as a driver of digital transformation, emphasizing the need for future research and practical discussion.

Keywords: strategic management, digital transformation, digital maturity, strategic management factors

1. Introduction and literature review

Digital innovation is one of the key attributes in business administration and other substantial fields and can be seen as one of the primary elements of entrepreneurship (Schumpeter & Backhaus, 2003 [1]; Davidsson, 2016 [2]).

As globalized market is a competitive environment, we can perceive high pressure on process efficiency (Nawanir et al., 2016 [3]). As companies need to achieve higher performance to attract new customers and retain current customers by achieving long-term customer satisfaction (Aguwa et al., 2012 [4]), they are ought to continuously improve and innovate mainly by improving their production quality, costs, and flexibility (Singh & Singh, 2015 [5]). Fitzgerald et al. (2014 [6]) define the digital transformation as an enabler of major business improvements such as creating new business models, raising performance, and enhancing customer experience. Therefore, digital transformation leads to gaining advantage in competitive environment. As digital transformation is clearly an imperative to strategic management, and business model innovation is a solution for firms to survive a thrive

in nowadays competitive markets (Kim & Mauborgne, 2015 [7]), it is vital to search for the best ways of harnessing the innovation potential. Entrepreneurial success can be derived from identification of innovative products or service, processes, and business models.

The digital innovation perspective changes the nature of business models and firm management, as we can draw from information system literature (Yoo et al., 2010 [8]; Yoo et al., 2012 [9]; Nambisan et al., 2017 [10]; Tilson et al., 2010 [11]). The role of digital technology on firms' strategies was examined during past years (Hess et al., 2016 [12]; Bharadwaj et al., 2013 [13]), regarding the possible disruptive impact on business models and organizations. As Sing & Hess (2020) [14], imply, the holistic approach must be projected in connection to the strategic management, overall strategy, and digital transformation to compensate for disruptive impact of digital innovation of organizations (El Sawy and Pereira, 2013 [15]).

In order to innovate, companies are ought to take up digital transformation to open new paths to gaining competitive edge. Although there are many different approaches to digital transformation, digital maturity is one of the cornerstones of its success.

As can be drawn on (Sommer, 2015) [16] the research regarding the SMEs in Germany, digital transformation, and industry 4.0 approach can be perceived as a challenge, mainly from the point of view of knowledge, readiness, and capability to face unexpected challenges. It can be established that the capability and adaptability depend on either size or revenue, but also on deriving factors such as strategic management, financial and human capital, and internal compatibility of embracing change, which originates from digital maturity and level of necessary competencies (Werner & Wäger, 2019) [17]. Motivation, capability of adaptation to change and level of digital maturity is vital in for reaching success in complicated and costly process of digital transformation (Ghobakhloo & Iranmanesh, 2021) [18].

Maturity refers to a state of readiness and perfection (Simpson & Weiner, 1989) [19] and provides an insight to the level of development of a system. Maturity can be measured quantitatively and qualitatively in different manners (Kohlegger et al., 2009) [20]. by using different models. Maturity models dealing with the digital maturity are used to evaluate the starting point of a company and help to set up the pace and plan of digital transformation and innovation process, e.g., PriceWaterhouseCoopers Digital Operations Self-Assessment or Deloitte maturity model (2018) [21]. Yet, how do the SMEs perceive their strategic management approach and its impact on the level of digital maturity? Can the digital maturity be coherent with the strategic management approach?

Nearly two-thirds of manufacturing CEOs claim that agility, in hand with strategic innovation is the new currency of business. Being slow leads to the bankruptcy. Yet, one third points out that their organization is struggling to keep the pace with technological and digital innovation (KPMG, 2018) [22].

Drawn from the Tech Pro survey (The Tech Pro Research, 2019) [23], 70% of business leaders claim to be investing more time and resources into digital strategy and digital transformation. It can be stated that businesses seek digital transformation to harness innovative potential and achieve sustainable growth and competitive

advantage. General public opinion sees greater promise in smaller firms investing heavily in strategic approach rather than large incumbents (Lee & Chen, 2009) [24]. It can be stated that SMEs are prone to conclusion that strategic business model innovation is a means to achieve success, and new normal is to make the most of digital transformation. Without digital maturity, transformation is more likely to fail or to be rather costly experiment. So how does the strategic management help to evolve the level of digital maturity? More than a hundred different maturity models have been created (de Bruin et al., 2005) [25] , and new ones are constantly being published. But the authors rarely reveal the development of their model and the results of evaluation, as it is usually contained in their knowhow and a part of a business product. For the purpose of this research, modified maturity model was drawn from the pivots of Deloitte maturity model to assess the SMEs participating in the survey. Aim of this paper is to find out if there is a correlation between the level of SME's digital maturity and the strategic management factors including business model innovations and to explore and measure the influence of strategic management factors on the level of digital maturity in the SMEs in the Czech Republic.

2. Methods

As a member of digital transformation projects, the author observed the connection between the digital maturity and the strategic management approach. Therefore, the author used quantitative methods to collect and analyze the data to address the main aim of this study. In terms of the aim stated above, following research questions were proposed:

RQ1: Does the strategic management factors affects the level of digital maturity in SME's?

RQ2: Do the SMEs managers evaluate their strategic management factors as strongly positioned?

Following zero hypothesis were formulated:

H0A: The factors of strategic management do not affect the level of digital maturity.

H0B: More than 50% of SME's managers evaluate their strategic management factors as strongly positioned.

Following alternative hypothesis were formulated:

HAA: The factors of strategic management affect the level of digital maturity.

HAB: Less than 50% of SME's managers evaluate their strategic management factors as strongly positioned.

A research project based on conducting a quantitative study to address the research problem was carried out in selected SMEs in the Czech Republic. To obtain the necessary data, a structured survey was performed. Closed question survey contained basic questions regarding the company stats as revenue, number of employees. Auto evaluation assessing the level of digital maturity followed, closing with the questions regarding the approach to strategic management and perceived influence of strategic management on digital maturity.

2.1. Structure of the survey sample

Research survey contained 76 responses. The number of respondents was evaluated using the G-power programme through power sample analysis proportion sign binomial test with effect size 0,2 (deriving from 70% expected result minus 50% zero hypothesis starting point) on with error probability 0,05, with the result of 67 total sample size, as can be seen in Fig. 1.

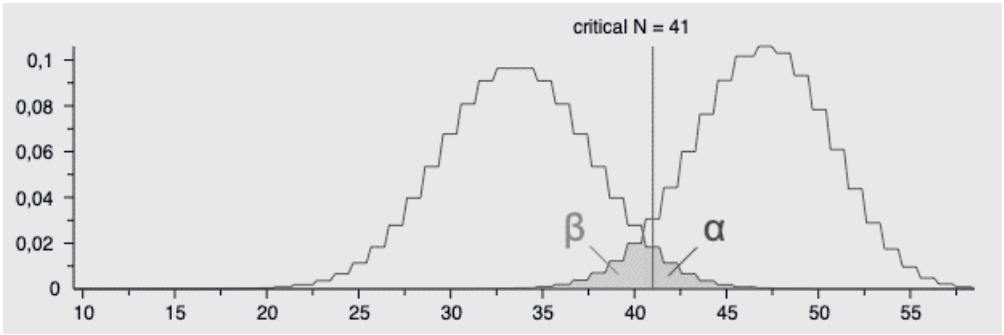

Figure 1. Power analysis

In terms of stated above, the number of participants was deemed sufficient.

SMEs respondents' structure was identified followingly:

- As for the size of companies included:
  - 0 – 9 employees – 21 % of the research sample.
  - 10 – 49 employees – 34 % of the research sample
  - 50 – 249 employees – 45% of the research sample.
- As for the revenue value proportion:
  - 2 mil. Euro – 30 % of the research sample.
  - 2 – 10 mil. Euro – 57 % of the research sample.
  - 10 – 50 mil. Euro – 13 % of the research sample.

2.2. Evaluation of digital maturity

As for the digital maturity evaluation, research drew on the Deloitte maturity model (2018) [21], and modified version of the assessment was prepared. Following pivots were evaluated:

- Flexible, secure infrastructure – implementing technology that balance security and privacy.
- Complex data management – aggregating and activating of data embedded into products, services, and operations to increase efficiency and revenue growth.
- Digital excellency support – training programs and empowering talents with focus on digital competencies.

- Ecosystem engagement – external business partners, universities, tech incubators.
- Intelligent workflows – continuous improvement and calibration of processes to produce positive outcomes.
- Customer experience – digital coordination and interaction with customers to deliver fast and transparent experience.
- Business model adaptability – change and expansion of business models and revenue streams through optimization and agility in changing markets.

Evaluation was based on 1-10 scale, where value 1 stood for minimum level, and value 10 for maximum level. Pivots were marked ad variable x_i, (i= <1;7>). Results were collected from top-management of SME's. To ensure the reliability of data collected, the same set of questionnaires was used. Addressing the ethical rules of research, full anonymity was guaranteed to each participant and organization.

For the purpose of categorizing the respondents, digital maturity index (DMI) was used. Digital maturity index (DMI) was calculated thusly:

$$DMI = \frac{\sum x_i}{n} * 100 \ (1),$$

Where x_i represents variable, whereas n represents the value of maximum sum of variables (n=7*10). The classification of the results was based on summary score of the responses:

Intervals	Evaluations
LDMI (0; 0.3)	Low digital maturity index
MDMI (0.3;0.7)	Medium digital maturity index
HDMI (0.7; 1)	High digital maturity index

Figure 2. Digital maturity index groups

Following intervals were used:

- LDMI = low digital maturity index
- MDMI = medium digital maturity index
- HDMI = high digital maturity index

2.3. Evaluation of influence of strategic management coefficient on the level of digital maturity

The strategic management was analysed through the following factors:

- Perceived level of strategic management (LSM).
- Shared common vision of strategic management (SCV).
- Digitalization to strategic business model (SBM) innovation (DSBM).

Strategic management factors coefficient ratio spans in interval (0;1) calculated via the summary of measured factor variables to total max sum of the variable. Average ratio (avg.SMR) for DMI categories was calculated followingly:

$$avg.SMR = \frac{avg.LSM+avg.SCV+avg.DSMB}{n} \quad (2).$$

Average strategic management ratio was examined in context to the level of digital maturity to evaluate the correlation between digital maturity and strategic management factors.

The perception of strategic management position was measured using Likert 3-point scale with 0/+2 range based on personal evaluation of the respondents, where:

- 0 = not at all/low
- +1 = moderate
- +2 = strong

Following questions were used:

- How do you perceive the level of strategic management in your organisation?
- Do you perceive the shared common vision of management in strategic management?
- How did digitalization change your approach to strategic business model innovation?

Responses were sorted to categories using DMI as main criterion with aim to analyse possible difference in responses in different DMI categories. For the purpose of hypothesis evaluation, average numbers of responses representing value +1/+2 were calculated. Relative frequency was used to express the portion of respondents opinion evaluating the influence of strategic management on the level of digital maturity.

The data acquired was analysed using 1-sample proportion test with continuity correction using following formula in the R statistical programme:

$$prop.test\ (n, x, p = 0.5, alternative = \text{greater}) \quad (3),$$

Where n (number of responses total), x (variable), p (zero hypothesis probability). Zero hypothesis was tested on three different categories divided by DMI criterion.

3. Results and discussion

After the data collection and evaluation, it was possible to comment on the fact that the level of digital maturity strongly depends on SMEs capability to assess their position. After initial collection, the data was cleared and prepared for statistical processing. Firstly, SMEs were sorted out to categories using the digital maturity index using formula (1), as stated in chapter 2.2.

3.1. Level of digital maturity

As it is shown in Fig. 2, lesser portion of the sample is represented by SME's identified with high digital maturity index. Overall number of companies was 76, from which 31 were identified with LDM index, 26 with MDM index and 19 with HDM index. Respondents evaluated their level of digital maturity in 7 categories, as stated chapter 2.2.

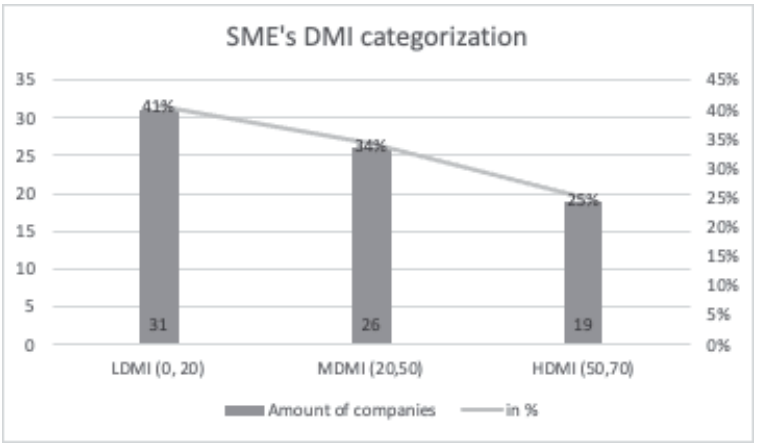

Figure 3. Categorization through DMI criterion

Fig. 2. shows declining tendency of digital maturity index in our research sample, revealing that state of digital maturity amongst SMEs is a matter of national market importance, that is to be addressed in future years in terms of rising the companies' level of digital maturity to reach competitive edge and to maximize the potential of digital transformation. As the digital transformation is an actual and important topic, SMEs are ought to continuously measure their level of digital maturity, as it is one of the key markers interlacing the journey to maximum digital readiness and successful digital transformation. Based on the processed data, it can be stated that there is still vast space for SMEs to improve and develop their digital position in internal and external environment.

3.2. Influence of strategic management factors on the level of digital maturity

In Fig. 4., a model is represented that shows the correlation of average digital maturity index to strategic factors ratio. It can be stated that higher strategic management factors ration is projected in higher digital maturity index.

Partial strategic factors ratio was measured according to chapter 2.3 and average innovation ration was calculated using formula (2), as stated in chapter 2.3. As an organisation progresses and develops strategic management approach, the influence pattern on higher digital maturity level can be perceived clearly. It can be stated that although there are many factors influencing the digital maturity level, in terms of our research sample, the relationship between the level of digital maturity and strategic management leads to consideration of the fact, that more developed and digitally advanced organisations apply more evolved strategic management approach. Thus, can be recommended that SMEs should nurture strategic management approach and invest in managerial talents and improve their employees' competencies as well as invest in appropriate technological background to rise their level of digital maturity. Based on basic frequency analysis, we can imply that zero hypothesis $H0_A$ is rejected in favour of alternative HA_A, resulting in a fact that the strategic management factors affect the level of digital maturity.

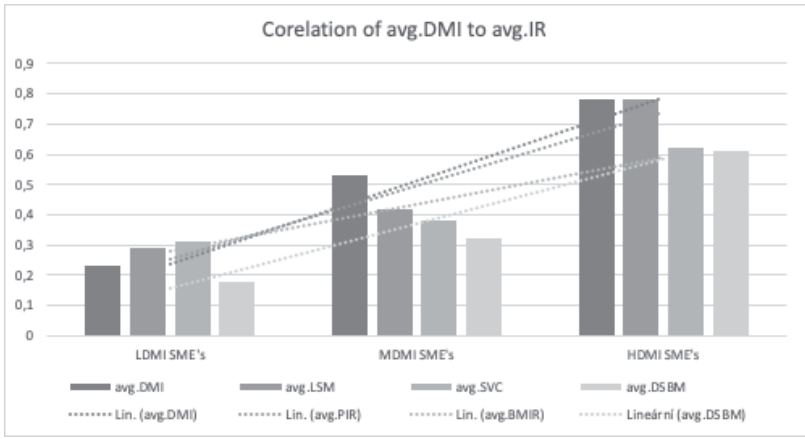

Figure 4. Correlation of average digital maturity index to average innovation ratio

3.3. The perceived position of strategic management of SMEs managers

The position of strategic management was measured according to the methods stated in chapter 2.3. For the purpose of distinction of categories with different digital maturity index, data was divided into three different groups. Results were statistically tested using the formula (3) with focus on the responses marked as **b** and **c**, as it is represented in Fig. 5., standing for the variable value evaluated in the calculations.

LDMI responses overview						
Question	**Variable meaning**	**variable marker**	**variable value x**	**relative frequency**	**relative frequency x(b+c)**	**p value**
How do you perceive the level of strategic management in your organisation?	low	1a	19	61,29%		
	moderate	1b	8	25,81%		
	high	1c	4	12,90%		
	x(b+c)		12		38,71%	
Do you perceive the shared common vision of management in strategic management?	not at all	2a	21	67,74%		
	moderately	2b	6	19,35%		
	strongly	2c	4	12,90%		
	x(b+c)		10		32,26%	
How did digitalization change your approach to strategic business model innovation?	not at all	3a	20	64,52%		
	moderately	3b	7	22,58%		
	strongly	3c	4	12,90%		
	x(b+c)		11		35,48%	
	avg.value x(b+c)		**33**			
	n.total		**93**			
	avg.relative frequency x(b+c)				**35,48%**	**0,9965**

Figure 5. LDMI SMEs evaluation of influence of digital maturity on innovation process

As can be seen in Fig. 4., companies categorized with low digital maturity index don't evaluate their strategic management factors as high or moderate.

MDMI responses overview						
Question	**Variable meaning**	**variable marker**	**variable value x**	**relative frequency**	**relative frequency x(b+c)**	**p value**
How do you perceive the level of strategic management in your organisation?	low	1a	11	35,48%		
	moderate	1b	8	25,81%		
	high	1c	7	22,58%		
	x(b+c)		15		60,00%	
Do you perceive the common vision of management in strategic management?	not at all	2a	13	41,94%		
	moderately	2b	7	22,58%		
	strongly	2c	6	19,35%		
	x(b+c)		13		52,00%	
How did digitalization change your approach to strategic business model innovation?	not at all	3a	13	41,94%		
	moderately	3b	7	22,58%		
	strongly	3c	6	19,35%		
	x(b+c)		13		52,00%	
	avg.value x(b+c)		**41**			
	n.total		**78**			
	avg.relative frequency x(b+c)				**54,67%**	**0,367**

Figure 6. MDMI SMEs evaluation of influence of digital maturity on innovation process

It can be stated that those companies are on the brink of implementation of digital environment, struggling with many pitfalls on the way to reach at least an average level of digitalization.

On the contrary, data in Fig. 6 shows that with rising level of digital maturity, the perception shifts to more firm position of strategic management and the companies are prawn to see the pattern between strategic management and digital maturity.

As for the companies listed in category with high digital maturity index, as represented in Fig. **7**., the results are clear and can lead to confirmation of the assumption, that companies with developed strategic management approach, high level of digital competencies and in the state of advanced development are much likely to connect their position in the digital world with their strong strategic approach.

HDMI responses overview						
Question	**Variable meaning**	**variable marker**	**variable value x**	**relative frequency**	**relative frequency x(b+c)**	**p value**
How do you perceive the level of strategic management in your organisation?	low	1a	4	12,90%		
	moderate	1b	8	25,81%		
	high	1c	7	22,58%		
	x(b+c)		15		88,24%	
Do you perceive the common vision of management in strategic management?	not at all	2a	6	19,35%		
	moderately	2b	9	29,03%		
	strongly	2c	4	12,90%		
	x(b+c)		13		76,47%	
How did digitalization change your approach to strategic business model innovation?	not at all	3a	3	9,68%		
	moderately	3b	11	35,48%		
	strongly	3c	5	16,13%		
	x(b+c)		16		94,12%	
	avg.value x(b+c)		**44**			
	n.total		**57**			
	avg.relative frequency				**86,27%**	**<0,01**

Figure 7. HDMI SMEs evaluation of influence of digital maturity on innovation process

The zero hypothesis was tested secluded for each category. As can be seen in Fig. 8., the zero hypothesis is rejected in LDMI and MDMI SMEs in favour of alternative hypothesis. On the contrary, in category HDMI the zero hypothesis is accepted.

SME category	p H0	p -value	confidence interval	evaluation
LDMI SME's	0,5	0,9965	0,95	H0 rejected
MDMI SME's	0,5	0,367	0,95	H0 rejected
HDMI SME's	0,5	3.54e-05	0,95	H0 accepted

Figure 8. Results of zero hypothesis prop.test

From the data presented in Fig. 8., we can draw a conclusion, that zero hypothesis stating that more than 50% of SMEs managers perceive that their strategic management is strongly positioned is only viable in more evolved and advanced enterprises, that already reached the necessary breakpoint of digital maturity to be able to assess its influence on innovation processes.

4. Conclusion

The aim of the paper was to examine the influence of strategic management factors on the level of the digital maturity in SMEs and the perception of said factors of SME's managers in order to conceptualize the approach to strategic management and the digital maturity in the process of gaining a competitive edge in the ongoing thrive for sustainability and competitiveness. According to the obtained data and discussed results, number of conclusions can be drawn regarding the research questions.

It has been found that level of digital maturity and its connection to strategic management is a matter of importance for included SMEs, and the influence can be perceived as measurable. More developed strategic management serves as an accelerator of digital transformation process and contributes to a higher level of digital maturity. As last years were somewhat turbulent and SMEs had to deal with the perplexity caused by covid19 pandemic, strategic management could be their means to survive in the difficult times and evolve and gain competitive advantage.

SMEs with lower digital maturity index do not report the same level of strategic management as more digitally advanced enterprises. As for the number of SMEs and its division into categories according to the digital maturity index, higher number of respondents was categorized as lowly digitally mature. It opens space for both scholarly and practical discussion about SMEs journey to digital maturity. It can be stated that there are still future goals to reach in terms of digital maturity and digital transformation process for SMEs in the Czech Republic.

Through raising the level of digital competencies and building up viable technological environment based on the firm's strategic approach, SMEs can maximise the effect of digital transformation process, helping the enterprises to reach sustainable revenue growth and competitive edge.

As one of the limitations of this research we can state that strategic management factors are not the only thing affecting the digital maturity level, although this fact

opens space for future research on the topic of factors influencing the innovations ratio and describing the position of strategic management among them.

It can be stated that digital maturity index has risen, as the SMEs reported more developed strategic management approach and shared vision, as well as the perception of their strategic management firmness and position. Thus, results of the study recommend that SMEs build up their strategic management approach to reach higher level of digital maturity if they strive for more digitalized and innovative company. As the digital maturity evaluation can vary depending on the point of view of respondents, the author aims to develop more detailed evaluation protocols for digital maturity in future research.

This research contributes to prior literature and practical digital maturity models via application of modified digital maturity model used to measure level of digital maturity and linking its impact to the amount of innovation ratio and innovation processes.

As this study has an exploratory character with limited sample, there are natural limitations. Yet, those limitations provide impulses a create possibility for future research.

As responses often depend on time and conditions (Baxter & Jack, 2008) [26], it can be stated that one limitation is the impossibility to control the environment. By executing multiple studies with larger samples, this limitation could be addressed by future researchers. Future research could also explore the position of strategic management among other factors with impact on the level of digital maturity and innovation processes, and the means of building up the digital maturity and training necessary competencies needed to successful digital transformation (Zhou et al., 2021) [27]. Another research gap can be seen in comparison between various SME divided by fields of business, size, revenue, and other performance indicators, concerning their role and purpose in building dynamic capabilities for digital transformation (Barreto, 2010) [28].

Acknowledgements

The author would like to express his gratitude to the organizations involved, as well as to the Tomas Bata University in Zlin and Faculty of management and economy for providing the support and research background.

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