

Impact of digital procurement on economic resilience of enterprises during COVID-19

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Abstract. The main objective of this paper was to determine whether digital procurement positively affected the economic resilience of firms in the manufacturing industry during the COVID-19 pandemic. Hence, qualitative research was conducted in Czech industrial enterprises by means of a questionnaire survey in 2021. Based on the research question, 3 hypotheses were formed, which focused on the impact that investing in digital procurement had on the economic resilience of enterprises in selected industries. The parametric two sample one-factor ANOVA and Pearson's Chi-squared test were used to test the hypotheses. The findings rejected the association between investment in digital procurement and the economic performance of the firm during the

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pandemic. They also failed to confirm the association between digital purchasing and economic resilience of businesses during the pandemic. Another important result was also that digitization of purchasing did not have a greater impact on the economic resilience of firms in the manufacturing industry compared to firms in the construction and agriculture sectors. The research results can be practically implemented in determining the expected benefits of digitizing procurement. The research implications are limited by the fact that it only investigates companies from the manufacturing industry in the Czech Republic and focuses exclusively on the period of the COVID-19 pandemic.

Keywords: enterprise procurement, global value chain, digitalization

JEL Classification: M21, L14, L26

1. INTRODUCTION

The modern age brings with it new challenges for all business actors (Duong et al., 2022). The post-Covidian "weakening" has been proven to affect both individual business actors (Li et al., 2022) and the global economy as a whole (Gómez et al., 2021). The global economic recession has been caused, *inter alia*, by the slowdown and restriction of material flows due to the COVID-19 pandemic (Priya et al, 2021; Pollák et al., 2021). This implies that even more importance should be placed on the efficiency of individual processes for corporate practice. The Global Value Chain (GVC), as a conceptual framework for corporate and inter-company processes, is constantly changing in an effort to withstand turbulent times (Ersoy & Camgoz Akdag, 2022) and adapt to new shifting conditions (Ha, 2022). At the same time, the evolution of GVCs is closely linked to technological advances (Zagashvili, 2022), which can change the structure and architecture of GVCs (Cherkas & Chekh, n.d.). Input logistics (including purchasing) is one of the links in the value chain. According to Porter's definition, it falls under the activities of the so-called core business (Jensen, 2019; Ližbetinová et al., 2017). Purchasing is increasingly regarded as one of the most important processes in creating competitive advantage within the value chain (Jääskeläinen & Heikkilä, 2019). Munien & Telukdarie (2021) state that ensuring the resilience of value chains is a way to achieve efficiency and eliminate system vulnerabilities.

Digitalization, as one of the main aspects of the Industry 4.0 concept (Baştuğ et al., 2020), is an effective tool for reducing process time and minimizing costs (Denysenko et al., 2022). It can be concluded that digitalization has set the direction of development for supply chains in the COVID-19 period (Rokicki et al., 2022). An enterprise should invest in digitizing its own processes to achieve competitive advantage and efficiency (Zighan, 2022), as digitization is a key factor in achieving enterprise resilience to external influences (Munien & Telukdarie, 2021). Yu et al. (2021) concluded that digitization can positively affect the financial efficiency of an enterprise. However, it is necessary to determine whether digitisation of each link in the value chain actually has an inherent effect on ensuring the economic resilience and financial efficiency of the firm from external influences in the Covid (and subsequently postcovid) period. In the literature, studies can be found confirming the positive impact of digitalization of production (Pekarcikova et al., 2021) or digital marketing (Rehman Khan et al., 2022, Sulkowski et al., 2021) on the efficiency of a firm during a pandemic. *The main objective of this paper is to determine whether digitization of purchasing positively affected the economic resilience of manufacturing firms during the COVID-19 pandemic.* Economic resilience in this case means the ability of the company to withstand negative external influences without a significant decrease in profit/increase in loss.

This main objective can be divided into sub-objectives:

1. Compiling an overview of the current state of scientific knowledge on the impact of digital purchasing on the economic resilience of the enterprise,
2. Establishing basic parameters for evaluating the truth of the claims,
3. Compiling the requirements and structure of the primary research and its implementation (in the form of a questionnaire survey),
4. Evaluation of results.

To achieve the main objective, the following research question was set:

RQ: Has the digitalisation of procurement had a positive impact on the economic resilience of manufacturing companies in the COVID-19 period?

A quantitative survey using a questionnaire will be conducted to answer the defined RQ. The questionnaire survey will focus on finding out the economic result before and during the pandemic, the level of investment in digital procurement before the pandemic. The hypotheses testing will be realized using one-factor ANOVA and Chi-square test. The structure of the paper is as follows. The first two chapters Theoretical background and Literature review present the current state of scientific knowledge in the field and determines research gap. The third chapter, methodology, focuses on the description of the data collection and data processing methods, and the determination of hypotheses. The fourth chapter summarizes the relevant hypothesis with help results testing, which are then discussed in the fifth chapter. The sixth and final section of the paper summarizes the conclusions of the study and sets limits and directions for future work.

1. LITERATURE REVIEW

The new capabilities of DT (digital transformation) require more careful monitoring of the main directions of corporate development (Zinder, 2018; Sagapova et al., 2022). Sahut et al. (2020) conclude that most empirical research on digital innovation provides too precise empirical explanations of digital innovation without reaching a certain generalization. This results in fragmented research results that lack homogeneity. Methods and researches thematically related to the research question of this paper are listed below. To investigate the impact of localization and digitalization on employment (and subsequently firm efficiency) in the dairy industry in Africa, a series of experiments, simulations and a system dynamics model were conducted to validate the quantitative data (Munien & Telukdarie, 2021). Miller et al. (2022) focus on the dynamic measurement of the customer-firm relationship. Two longitudinal datasets were used for this purpose: These observations suggest that customers' past decisions to "upgrade" or "downgrade" provide a hint of how they will behave in future purchases. The importance of digitization in pandemic times on AML scenarios for public administration purposes is the object of research (Vasilyeva et al., 2021). According to the conclusions of the study, among the most important indicators in the implementation of AML scenarios related to the pandemic and the impact of digitalization is, for example, an indicator showing actual changes in the use of e-commerce to purchase products commonly purchased in stores (Vasilyeva et al., 2021).

The aim of Szalavetz (2019)'s research was, among other things, to explore the impact of digitalization on the overall transformation of value chain activities. A qualitative approach based on a multi-method study in the context of the Hungarian industrial sector was chosen for data collection and processing. Barton et al. (2022) seek to answer the research question what specific technologies do SMEs need to adopt to get to a level close to the Smart Factory level? Multi-context methods, cumulative prospect theory and VIKOR were used to address the technology level. Kohli & Melville (2019) focus on determining the current state of the science in digital innovation. Scientometric and systematic literature review methodologies were used to answer the set VOs. Findings include, for example, that the literature on digital innovation is diverse and dispersed. Issues of digital innovation performance are also discussed by Alsufyani & Gill (2022).

Through a systematic literature search, the framework of "adaptive enterprise architecture" was defined, among others. The study by Duan et al. (2022) investigates the impact of business interactions on economic resilience using the Lotka-Volterra comprehensive theoretical approach based on FDI data from the OECD Daatbase and Fxtop. The study by N. Dormady et al. (2019) provides definitions of key resilience concepts, including their measurement, based on a literature search and a questionnaire survey and document analysis to identify the economic impact on firms from different sectors when natural disasters strike externally. For data processing, methods of comparison, regression modelling between two classes of resilience tactics (inherent and adaptive) were used. The study by Dormady et al. (2022) focuses on establishing the equivalence between economic and supply chain resilience tactics. Operational metrics and descriptive statistics methods were used in the empirical analysis. Gupta et al. (2022) focus on the barriers to digital technology adoption and based on interviews with top executives in India using a multi-case study, they conduct data processing using Bayesian Best Worst Worst Method (BBWM). The study by Shi et al. (2022) tried to find out how much supply chain integration (SCI-Supply Chain Integration), digital technology (DT-digital technology) and supply chain resilience (SCR-Supply Chain Resilience) are interacted. The data collection was conducted in the form of a questionnaire for managers of Chin enterprises. Data processing was done using SPSS version 26, AMOS version 26 (for data testing), exponential factor analysis (EFA). The results were evaluated using Cronbach's α coefficient. Interestingly, *the primary positive effect of digital technology on chain resilience has not been confirmed (there is no significant relationship)*. Research suggests that digitization in the supply chain promotes better understanding, which is necessary to initiate and implement SCI practices (Shi et al., 2022). Thus, there is a certain contradiction within the current state of scientific knowledge. On the one hand, digitalization is counted among the prerequisites for a company's success and procurement is ranked among the key processes ensuring competitiveness. On the other hand, the direct link between digitalization of procurement and chain resilience has not been confirmed. The economic benefits are mentioned in the study in relation to the digitalization of either other processes (production, marketing, customer relations, HR) or for all internal processes. Thus, there is a lack of a primary comparison of the direct impact of digital procurement on the economic resilience of the company. The latter research is closest to the topic of this paper. Therefore, questionnaire (for data collection) and correlation (for data processing) methods will be used to answer the research question.

Gereffi (2019) argues that value chain analysis is valuable because of its ability to assess which of the links in the GVC (Global Value Chain) and to what extent it contributes to value creation. A number of studies can be found in the literature that focus on defining and measuring performance and resilience at both the GVC and individual firm level. For example, an exploration of the impact of COVID-19 on supply chains is explored in a study by Zighan (2022). Data collection in this case was conducted through online interviews with SCM experts and a Gibbs approach to qualitative data analysis was adopted to process the data. Chase (2021) notes that sudden fluctuations in demand (which also occurred during a pandemic) can lead to the so-called bullwhip effect. To identify the drivers of the bullwhip effect in closed supply chains, Braz et al. (2018) conducted a systematic literature review. The research resulted in a comprehensive review of the current state of scientific knowledge in this area. Hu (2019) argues that a balance of the firm against other links in the chain is necessary to eliminate the whiplash effect. The traditional approach to measuring corporate performance focuses on monetary terms (Dyckhoff & Souren, 2020). Shepherd (2022) in his study focuses, among others, on exploring the drivers of trade within GVCs and their impact on the performance of the whole chain, using descriptive analysis with Trade Facilitation Indicators (TFI) and statistics from the OECD. Gregory et al. (2019) focused on identifying the impact of e-commerce on firms' export performance using exploratory research (in the form of interviews), a comparison of firm surveys and statistical comparison of secondary data on exporter (exporter) characteristics from the Australian Bureau of Statistics (ABS). The study then resulted in a range of nine strategic e-commerce objectives for

export businesses. Grimaldi (2019) identifies the relationship between different combinations of data conditions and company performance based on fuzzy qualitative comparative analysis (QCA). The main objective of the study by Negi (2021) is to introduce metrics and measures related to supply chain efficiency. To achieve this objective, a systematic literature search was conducted. Wei et al. (2020) presents research on the impact of innovation on firm performance using qualitative (through interviews with experts, using Likert scale) and quantitative research (to test hypotheses and in the form of a questionnaire). To ensure the reliability and validity of the research in the statistical processing of quantitative data, the Mann-Whitney test and the two-sample Kolmogorov-Smirnov test were chosen). The validation of the claim that SMEs' innovation practices directly influence business model design in terms of efficiency and novelty was the objective of the study by Loon & Chik (2019). A multiple case study approach was adopted (data were collected through interviews with managers of the selected companies). Closely related to the concept of performance is the concept of (economic) resilience. The link between economic performance and resilience is highlighted, for example, by Bouloiz (2020). Economic resilience can be defined at several levels: international, national, regional, local (urban), neighbourhood and household resilience (Masik, 2020). The determination of macro-level efficiency is addressed e.g. by Cabinova et al. (2021), using Slovak spa enterprises and statistical data with the help of SMLP and the DEA model. The economic resilience of Czech regions is addressed in the study by Ženka & Slach (2018). The data processing methods used include the evaluation of CSO data according to the rurality index, the coefficient of variation of monthly registered unemployment rates and others.

The study of Bruneckiene et al. (2018) deals with the measurement of regional resilience to economic shocks in selected Lithuanian regions and develops the assessment methodology (Resindicis). The statistical data were verified using Pearson's correlation coefficient and Kendall's rank correlation coefficient. The study by Soroka et al. (2020) investigates the suitability of the QuiSource measure to determine the level of regional resilience by statistically analysing quantitative data and calculating the average, minimum and maximum QS (Quiscore) and SD (standard deviation) for a set of enterprises. At the enterprise level, "resilience" refers to the ability of a complex system to flexibly recombine its elements and resources to achieve dynamic sustainability under high uncertainty (Smorodinskaya et al., 2021). Dindial et al. (2020) test whether the bargaining power of developing country firms (DCF) is positively related to the dependence of a multinational enterprise on DCFs, which they test in two case studies. Korber & McNaughton (2018) present a systematic literature search to identify current perspectives on firm resilience. Among the main findings of this research are, for example, the claim that a larger number of small firms mitigates the impact of disruptions to socio-economic systems. Candeias Fernandes & Franco (2021) in their article focused on entrepreneurial resilience and forms of collaboration. This study was also conducted through a systematic literature search using bibliometric techniques. The research findings include, for example, the confirmation of the growing interest in this topic and the prevalence of the use of qualitative research methods. The research by Marcazzan et al. (2022) focuses on determining whether SMEs' resilience is related to the strategy of anticipating contingencies and was conducted in a quantitative form using a multinomial (multinomial) logistic regression model.

2. METHODOLOGICAL APPROACH

2.1. Methods of data collection

The research question is defined as follows: has digitalization of purchasing been able to positively affect the economic resilience of manufacturing firms in the COVID-19 period? To answer this research question, qualitative research will be conducted in Czech industrial enterprises in the form of a questionnaire

survey, in the form of a pre-survey. In doing so, the expression "was able to positively influence the economic resilience of the enterprise" from the VO will be interpreted as follows: the probability of maintaining the same (non-negative) economic result or improving it. According to CSO data, in 2019 there were a total of 486,238 active enterprises in the Czech Republic, which indicated as their main activity industry (209,878 entities), construction (190,354 entities), agriculture (86,006 entities). In this qualitative pre-survey, the sample will be defined by non-probability sampling based on voluntariness. A minimum threshold of 150 enterprises has been set for this research due to the likely return rate of the questionnaires. The sampling of enterprises for the questionnaire survey will be done by random sampling. Based on the established VO and given the above research design, the following hypotheses were established:

H0: *The digitalisation of procurement had a negative impact on the bottom line during the pandemic across sector differentiation (regardless of core business).* To test this and subsequent hypotheses, the following questionnaire questions are constructed:

- Main activity (answer options: administrative and support processes, money and insurance, education, wholesale and retail trade, manufacturing; agriculture, forestry and fishing; construction; electricity generation and distribution, mining and other)
- The company's economic result in 2019 (before the pandemic). Answer options: profit/ stagnation/ loss.
- Rate of investment in digital procurement in 2019 (pre-pandemic) (as a percentage of enterprise-wide investment),
- Economic result of the company in 2020 (during the pandemic). Answer options: profit/ stagnation/ loss.

In this case, the responses will be divided into three sets depending on the economic result during the pandemic and in accordance with the mathematical-statistical condition for a relevant evaluation, i.e. with a minimum required sample of 150 enterprises, i.e. (set A0: 50 - loss during the pandemic; set B0: enterprises with stagnation during the pandemic; set C0: 50 enterprises with profit during the pandemic)

H1: *The digitalisation of purchasing did not have a negative effect on the economic performance of firms during the pandemic, e.g. sectoral differentiation (i.e. either no effect or a positive effect).* Hypothesis 1 is the opposite of H0, so testing will be done simultaneously.

H2: *The digitalisation of procurement has had a positive impact on the economic resilience of businesses in selected sectors:*

- manufacturing (including mining, electricity generation and distribution);
- agriculture, forestry and fishing, (including water distribution);
- construction industry.

When collecting data, businesses will be divided into the following sets: A2: Businesses in selected sectors that did not invest in digital purchasing before the pandemic. The research will define a randomly selected set of at least 50 enterprises without investing in digital purchasing. B2: Enterprises that invested more than 0.1 percent of total investment in digital purchasing before the pandemic. The research will define a set of randomly selected minimum 50 enterprises with the stated level of investment in digitizing purchasing. In this case, a comparison will be made between the A2 and B2 sets.

H3: *The digitalisation of purchasing had a greater impact on the economic resilience of businesses in the manufacturing industry compared to businesses in the construction and agriculture sectors.*

To test this hypothesis, the firms from the previous sample will be divided by sector of operation as follows: A3: enterprises in the manufacturing industry. To test this hypothesis, a set of at least 50 enterprises in the manufacturing industry will be identified B3: enterprises in the construction and agriculture industries. Minimum data requirement-50 enterprises from the agriculture or construction sector. In this case, both sets will contain all enterprises that meet the specified conditions and will not be sampled with equal sample

sizes. Within each set, the potential impact of pre-pandemic digital purchasing on economic resilience during the pandemic will be investigated.

2.2. Data processing methods

In the *first stage*, hypotheses H0 and H1 will be tested, i.e., the existence of a negative effect of digital purchasing before the pandemic on the economic performance of firms during the pandemic between sets A0, B0 and C0 will be tested. The significance level will be set at 3 percent due to the non-normal distribution of data when testing hypotheses 3. If H1 is confirmed, H2, H3 will be tested. To test H2, a parametric two-sample test (to compare A2 and B2 files) will be conducted in the form of a one-factor ANOVA. The effect of investment in digital purchasing on the economic resilience of the firms in the files will be investigated. Ensuring the normality of the data (data normality test) for both sets is implemented in the form of a histogram. The significance level will again be set at 5 percent. The aim of the one-factor ANOVA analysis is to demonstrate the dependence of the explained variable Y (quantitative variable) on the explanatory variables (factors) and whether the differences we have found are statistically significant or just the result of chance. The result of the analysis is the determination of the p-value. The hypothesis is confirmed if the resulting significance value for a given group is greater than 0.05 (p-value > 0.05), i.e. there is no significant difference. We reject the hypothesis if the significance is less than or equal to 0.05 (p-value ≤ 0.05), that is, there is a significant difference between the groups.

$$y_{ij} = \mu + \alpha_i + \epsilon_{ij}$$

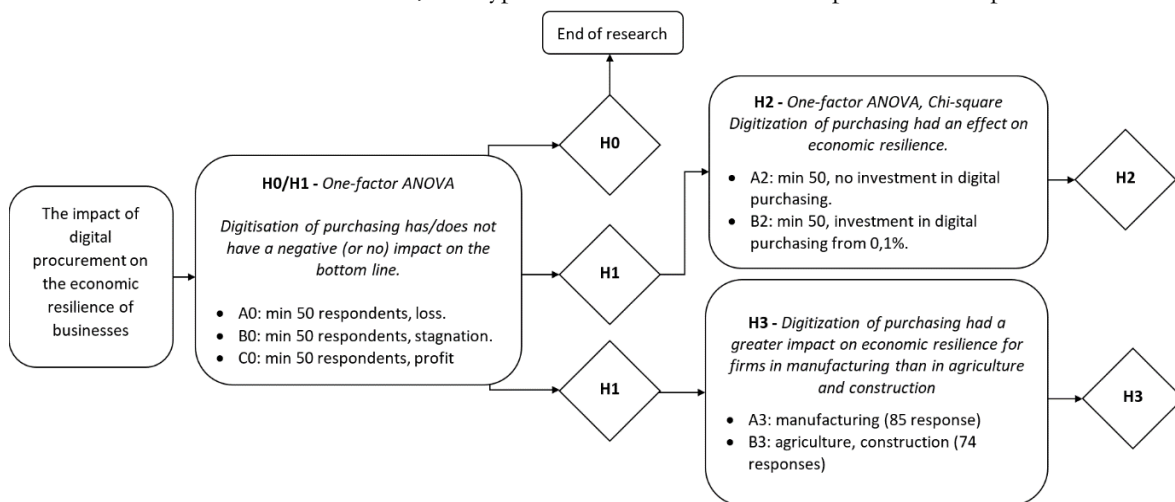
Where: y_{ij} = measured value; μ = mean value; α_i = change in measured value due to factor; ϵ_{ij} = experimental error. The testing of the hypothesis H2 will be further verified using the Chi-squared test (Pearson's Chi-squared test).

$$X^2 = \sum \frac{(O - E)^2}{E}$$

Where:

X² is the chi-square test statistic, Σ is the summation operator (it means “take the sum of”), O is the observed frequency, E is the expected frequency.

The *third stage* of the research consists of testing H3. Hypothesis testing will be conducted in the form of a one-factor ANOVA. In this case, the hypothesis will be confirmed if p-value A3 < p-value B3.

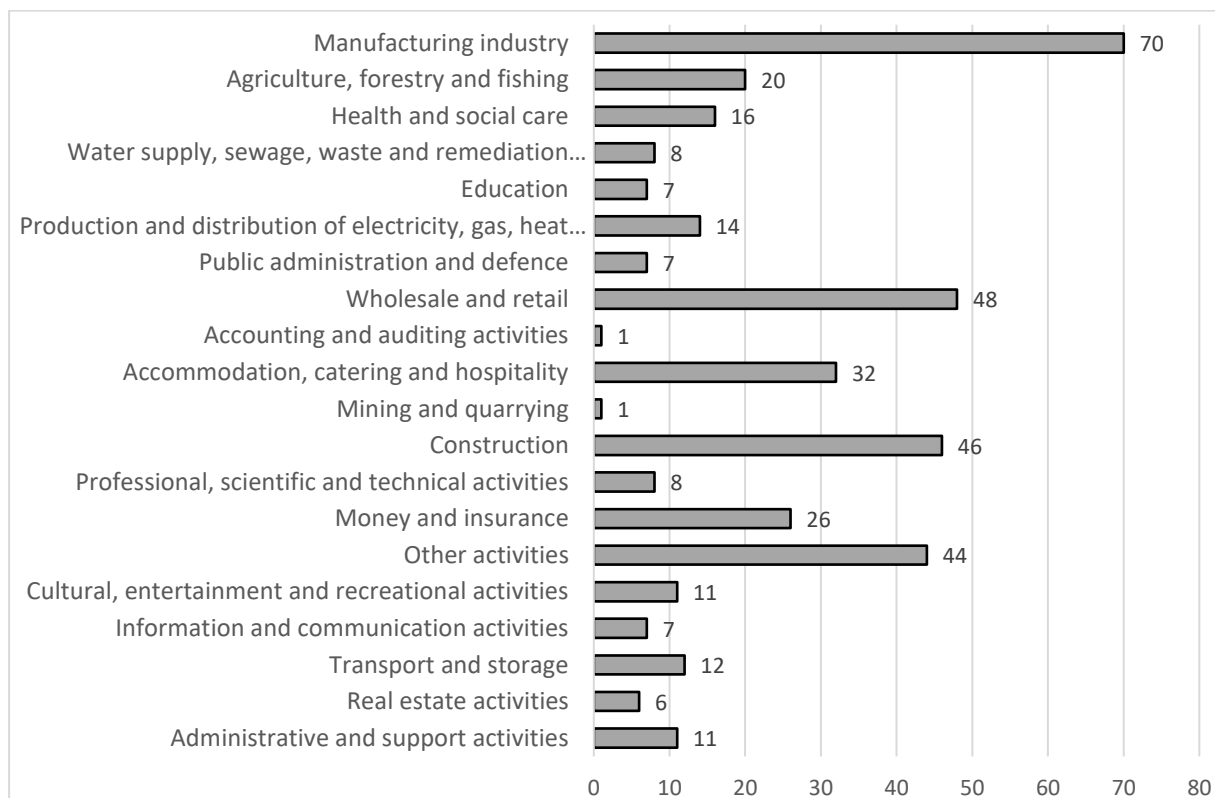


Graph 1: Research methodology diagram

Source: own compilation

3. CONDUCTING RESEARCH AND RESULTS

A total of 395 enterprises from different sectors participated in the survey. The number of enterprises belonging to the selected sectors (manufacturing, agriculture, forestry and fishing, construction, electricity generation and distribution, mining) was 159 enterprises. The composition by sector, size of enterprises and number of respondents in each category within this sample is presented below (Chart 1):



Graph 2. Distribution of respondent enterprises by sector

Source: own calculation

Table 1

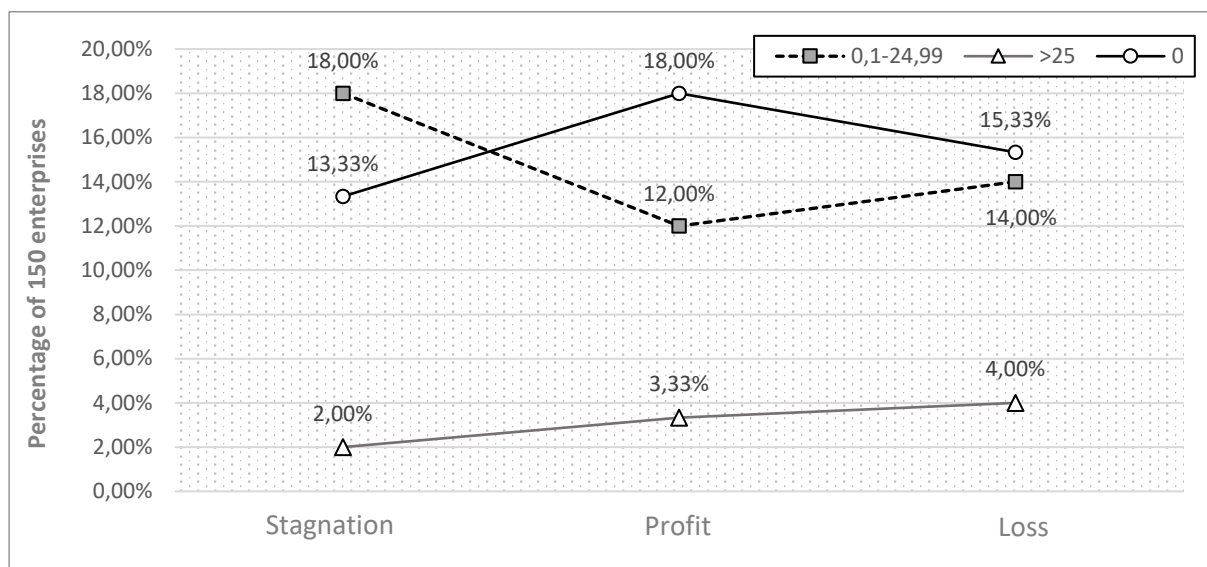
Distribution of respondent enterprises by size

| Size of enterprises | Number of enterprises in the category |
|--|---------------------------------------|
| micro-enterprise (up to 10 employees) | 29 |
| small enterprise (less than 50 employees) | 43 |
| medium-sized enterprise (50-249 employees) | 40 |
| large enterprise (250 or more) | 46 |
| national | 1 |
| total | 159 |

Source: own calculation

Results of testing hypotheses H0 and H1:

To test H0 and H1, 3 sets (A0, B0, C0) were created to evaluate the impact of investing in digital procurement on the bottom line during the pandemic. The total set contained 150 companies, 50 in each group. The composition of the data within each group is presented in Chart 2.



Graph 3. Level of investment in digital procurement across the distribution of companies by economic performance during the pandemic

Source: own calculation

The following table shows the results of testing using the One way, ANOVA tool in Recommender (R)

Table2

Testing the impact of pre-pandemic digital purchasing on business performance during a pandemic

| One-criteria ANOVA test | | | | | |
|---|---|-------------|-----------|---------|---------------|
| test H0 | Investment in digi_purchase_before (without filter 0-100) | | | | |
| | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
| Economic result after | 2 | 11 | 5,5 | 0,045 | 0,956 |
| Residuals | 147 | 18100 | 123,1 | | |
| | | mean | sd | | Data:n |
| Loss | | 8.1816 | 11.784328 | | 50 |
| Stagnation | | 7.8100 | 8.924222 | | 50 |
| Profit | | 7.5200 | 12.282790 | | 50 |
| test H0 | Investments in digi_purchase_before (with 3 groups categorization filter) | | | | |
| | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
| Economic result after | 2 | 0,33 | 0,1667 | 0,39 | 0,678 |
| Residuals | 147 | 62,76 | 0,4269 | | |
| | | mean | sd | | Data:n |
| Loss | | 1,66 | 0,6883876 | | 50 |
| Stagnation | | 1,66 | 0.5928141 | | 50 |
| Profit | | 1,56 | 0,6749150 | | 50 |
| Legenda signification of p-value: Legend: [Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1] | | | | | |

Source: own calculation

Testing hypotheses H0 and H1 by univariate analysis showed that investments in digital purchasing did not have a negative effect on the economic performance of firms. Thus, H0 was rejected and H1 was confirmed.

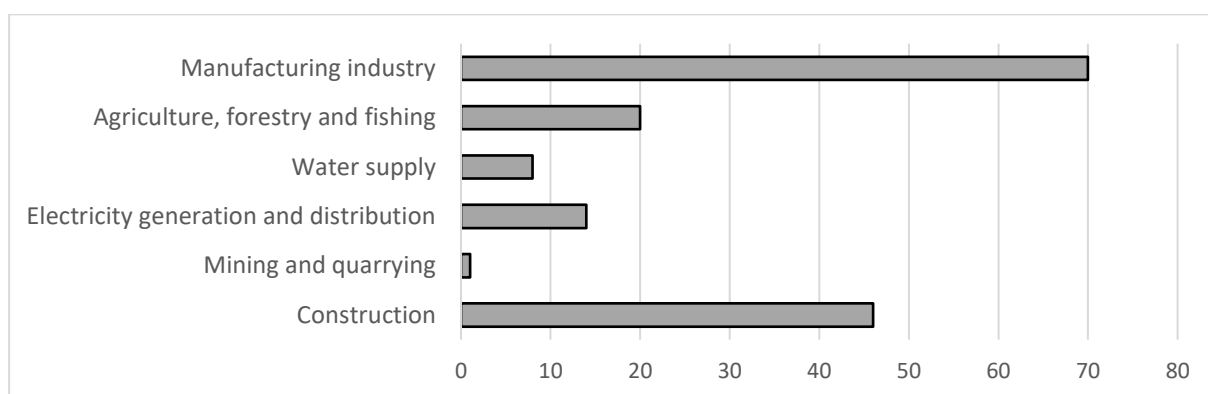
Results of testing hypothesis H2:

H2 focused on demonstrating the economic resilience as a result of digital purchasing for businesses in the following sectors:

- **Construction,**
- Mining and quarrying (moved to Manufacturing for research purposes),
- Electricity generation and distribution (moved to Manufacturing for research purposes),
- **Agriculture (including water distribution),**
- **Manufacturing industry.**

A total of 159 respondents were selected from these sectors. Of these, 60 respondents had zero investment in digital purchasing. To ensure normality of the data, 60 enterprises with investment greater than 0 were randomly selected.

The original composition of enterprises by sector is presented in Chart 3 below.



Graph 4. Distribution of enterprises from selected sectors

Source: own calculation

A one-factor ANOVA test was performed using Recommender (R). The following table (Table 3) shows the results of this test.

Table3

Testing the effect of investment in digital purchasing on the economic resilience of firms (H2), one-factor ANOVA

| One-criteria ANOVA test | | | | | |
|---|---------------------|-------------|-----------|---------|---------------|
| test H2 | Economic resistance | | | | |
| | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
| <i>Investing in digitalisation</i> | 1 | 0,133 | 0,1333 | 0,882 | 0,35 |
| <i>Residuals</i> | 118 | 17,833 | 0,1511 | | |
| | | mean | sd | | Data:n |
| <i>Without investment in digitalisation</i> | | 0,850 | 0,360 | | 60 |
| <i>Investing in digitalisation</i> | | 0,783 | 0,415 | | 60 |
| <i>Legend signification of p-value: Legend: [Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1]</i> | | | | | |

Source: own calculation

When comparing A2 and B2 sets, a p-value of 0.35 was found, indicating that there is no direct relationship between the level of digitization of purchasing and the economic resilience achieved during a

pandemic for businesses in the selected sectors. To verify the results of testing the second hypothesis, Pearson's Chi-squared test was conducted and the results are presented in Table 4.

Table 4
Testing the impact of investment in digital purchasing on the economic resilience of firms (H2), Pearson's Chi-squared test

| Pearson's Chi-squared test | | |
|----------------------------|----|---------|
| X-squared | df | p-value |
| 0,89054 | 1 | 0,3453 |

Source: *own calculation*

The p-value parameter is 0.3453, which means that the association was not proven. Therefore, Hypothesis 2 is rejected, i.e., digital purchasing did not affect the economic resilience of firms during the pandemic.

Results of testing hypothesis H3:

For H3 testing, all businesses in the manufacturing industry (A3 - 85 respondents in total) and all businesses in the construction and agriculture sectors (B3 - 74 respondents in total) were selected. Then, a single-factor ANOVA was used to investigate the impact of digital procurement on economic resilience during a pandemic in each set.

The results are presented in Tables 5 and 6 below.

Table 5
Testing the impact of investments in digital procurement on the economic resilience of enterprises in manufacturing (File A3)

| One-criteria ANOVA test | | | | | |
|---|---------------------|--------|-----------|---------|---------|
| test H3 – File “A” | Economic resistance | | | | |
| | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
| <i>Digitization</i> | 1 | 0,004 | 0,00433 | 0,025 | 0,874 |
| <i>Residuals</i> | 83 | 14,184 | 0,17089 | | |
| | mean | | sd | | Data:n |
| <i>Without digitalisation</i> | 0,777778 | | 0,4236593 | | 27 |
| <i>More than 0</i> | 0,7931034 | | 0,4086186 | | 58 |
| <i>Legend signification of p-value: Legend: [Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1]</i> | | | | | |

Table 6
Testing the impact of investments in digital procurement on the economic resilience of enterprises in the construction and agriculture sectors

| One-criteria ANOVA test | | | | | |
|---|---------------------|--------|-----------|---------|---------|
| test H3 – File “B” | Economic resistance | | | | |
| | Df | Sum Sq | Mean Sq | F value | Pr (>F) |
| <i>Digitization</i> | 1 | 0,056 | 0,05618 | 0,515 | 0,475 |
| <i>Residuals</i> | 72 | 7,849 | 0,10902 | | |
| | mean | | sd | | Data:n |
| <i>Without digitalisation</i> | 0,9090909 | | 0,2919371 | | 33 |
| <i>More than 0</i> | 0,8536585 | | 0,3578390 | | 41 |
| <i>Legend signification of p-value: Legend: [Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1]</i> | | | | | |

The main result of the evaluation is $P\text{-value } A3 < P\text{-value } B3$. It can be concluded that hypothesis 3 is rejected. Thus, digitization of purchasing did not have a greater impact on the economic resilience of firms in the manufacturing industry compared to firms in the construction and agriculture sectors.

The research question was defined as follows: Has digitalisation of purchasing been able to positively influence the economic resilience of manufacturing firms in the COVID-19 period?

The results of the research can be summarized as follows:

- 1) The digitization of purchasing had neither a positive nor a negative effect on the economic performance of companies during the pandemic, e.g. sectoral differentiation.

The findings of the study Redek et al. (2022) confirm that slower implementation of new technologies (including digitalization) has a negative impact on the competitiveness of the company.

The result of our own research is also consistent with the output of Yu et al. (2021), which highlights that the effect of digitalization on firm performance is in an inverted U-shape. This output supports the idea of the so-called *digitalization paradox* defined by Gebauer et al. (2020). The digitization paradox is that companies do not achieve projected revenues through the use of digital technologies when they invest at a larger scale.

Thus, there was no direct link between pre-pandemic digital purchasing and business performance during the pandemic.

- 2) Digitalization of purchasing did not have a positive impact on the economic resilience of the company in the selected sectors:
 - manufacturing (including mining, electricity generation and distribution);
 - agriculture, forestry and fishing, (including water distribution);
 - construction.

Thus, based on the primary data, it can be concluded that the investment in digital procurement has not affected the economic resilience of firms. This result is, in essence, a validation of the claim (Shi et al., 2022). Indeed, research by (Shi et al., 2022) suggests that there is no primary link between digital technology implementation and supply chain resilience.

Even though several studies confirm the relationship between digitalization and firm efficiency (e.g. Szalavetz, (2019) or Alsufyani & Gill, (2022)), investments in digitalization of purchasing alone do not affect the level of economic resilience of a firm.

- 3) The digitalisation of purchasing did not have a greater impact on the economic resilience of businesses in the manufacturing industry compared to businesses in the construction and agriculture sectors.

More specifically, in none of these sectors was the link between investment in digital purchasing and the existence of economic resilience during a pandemic confirmed.

The findings of previous studies have focused on the impact of digitisation in general (or digitisation of other business processes along the value chain) on individual sectors.

For example, (Donaldson, 2022) concluded that in general, digitalization in agriculture should help to achieve greater connectivity, which should be reflected in the competitiveness of businesses. Furthermore, (Silverio-Fernández et al., 2021), for example, highlights the positive impact of the use of modern technologies (including digitalization) on the efficiency of firms in the construction sector. One of the results of research (Szalavetz, 2022; Jurczuk & Florea, 2022) is the claim that industrial enterprises use elements of digitalization in order to diversify technologically and thus achieve competitiveness.

The high uncertainty on the part of customers and suppliers during the COVID-19 pandemic, as reported for example in (Zighan, 2022), is one potential reason why the defined link between digital procurement and economic resilience has not been confirmed.

Although the digitisation of procurement did not have a primary impact on economic resilience in selected sectors during the COVID-19 pandemic, it can be assumed that the digitisation of other processes along the value chain can have a positive impact on business efficiency. The comparison of companies that have invested in digital procurement (set A2 described in chapter Methodological approach) with companies that have invested in digital procurement (set B2 described in chapter Methodological approach) allows us to confirm the validity of the conclusion about the relationship between digital purchasing and economic resilience

CONCLUSION

The main objective of this paper was to determine whether digitization of purchasing positively affected the economic resilience of firms in the manufacturing industry during the COVID-19 pandemic. This objective was met using primary quantitative research; the association between digitization of purchasing and firm economic resilience was not confirmed. Recommendations for the target segment are mainly related to a comprehensive assessment of the benefits of digitalization of purchasing on the one hand, but on the other hand to an effort to differentiate the measurement of the impact of digitalization of individual processes along the value chain. It is therefore not possible to dismiss digitalisation of purchasing or to consider it as an ineffective tool for building the economic resilience of a company. The benefit of digitising purchasing lies, among other things, in the overall development of corporate efficiency, even in its absence it will not be possible to ensure a sufficient degree of corporate flexibility. On the flip side, it is essential to avoid "change for change's sake". In accordance with the basic laws of cost-effectiveness, investments in digital purchasing must be properly evaluated and their benefits must be transparent and measurable. Research results have limitations. The research itself focuses mainly on companies in the manufacturing industry in the Czech Republic, so the results cannot be fully applied to other sectors (especially service provision) or other territories. The degree of digitisation of purchasing was measured by investment in this area. A different measurement of the level of digitisation of purchasing may yield different results. The absence of an association between digital purchasing and economic resilience during COVID-19 does not necessarily imply the absence of this association in non-pandemic time periods or in periods of other global abrupt change. The results of the study suggest some directions for future research. The first direction is to verify the absence of an association between digital procurement and firm economic resilience outside the COVID-19 pandemic period. Another important direction for potential future research can be defined as the construction of a new modelling tool to measure the effectiveness of investments in the digitization of intra- and inter-firm processes more accurately and transparently. Another direction for potential future work is to focus on a more comprehensive assessment of cost-effectiveness (e.g., speed of innovation adoption, adaptation to changing conditions, sustainability) and then to investigate the impact of digitalization of procurement on individual areas of cost-effectiveness. Finally, research on identifying the impact of digitalization of purchasing on the efficiency of individual intra-firm processes and the efficiency of the value chain may be of potential interest.

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