

## Supplier Performance Management in Context of Size and Sector Characteristics of Enterprises

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Martin Pech, Drahoš Vaněček

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### ABSTRACT

**Purpose:** The paper deals with the differences of supplier performance management characteristics by different size of the enterprises and sectors of industry.

**Methodology/Approach:** The research is based on a questionnaire survey carried out in 2016-2019 in 366 enterprises. Four hypotheses were formulated, focused on supplier selection preferences, frequency of supply evaluation, providing feedback to the suppliers about their performance and quality control. The results are analyzed by the tests of Chi-square statistics.

**Findings:** The results show that the enterprises differ in the criteria of the selection of the supplier, frequency of supply evaluation and providing feedback to the suppliers about their performance according to their sector industry. In terms of the size of the enterprises, differences were found only in the evaluation of suppliers and evaluation feedback. Enterprises did not differ in quality control of the deliveries.

**Research Limitation/implication:** The results show that quality is the most evaluated criterion in the selection of the suppliers. In the future, the importance of other environmental and Industry 4.0 criteria will grow. It is recommended combining supplier evaluation and reviews with the feedback to the suppliers to improve the performance of the suppliers.

**Originality/Value of paper:** The study compares the enterprises in terms of their size and industries in the area of supplier performance management characteristics. These criteria are often not mentioned nor compared in other publications.

**Category:** Research paper

**Keywords:** quality; suppliers evaluation; quality control; preferences

## 1 INTRODUCTION

In recent years, the enterprises have had to compete in the magic quadrilateral – time, cost, quality and service, and continually fought for their market place. Quality plays a major role in this area, in terms of criteria relating to the selection and evaluation of the suppliers, relations with the suppliers, quality control and quality improvements resulting from long-term cooperation. By Shalygin (2018), the enterprises prefer to choose a supplier because of the possibility to reduce product costs and to improve product quality. The aim of the enterprises is to establish long-term cooperation, beneficial for both partners and improving the operational processes.

The selection of reliable suppliers is a prerequisite for the successful management of the production process and therefore it is necessary to pay increased attention to it. Today, the enterprises tend to place the reliability first, encouraging the emergence of partnerships. The enterprise must be able to “foster and educate” good suppliers. It means conducting regular evaluations of contracts concluded during the year, at least once a year. The question of the frequency of such evaluation is also closely related to the evaluation of suppliers. The evaluation is based primarily on control of the quality of supplies. Suppliers should be informed about the outcome and results of the evaluation in various ways. The paper deals with the supplier performance management in context of size and sector characteristics of the enterprises.

## 2 STATEMENT OF A PROBLEM

This section outlines an overview of literature related to the supplier performance management (SPM). Supplier performance management is “the process of evaluating, measuring, and monitoring supplier performance and suppliers’ business processes and practices for the purposes of reducing costs, mitigating risk, and driving continuous improvement” (Gordon, 2008, pp.4). SPM include delivery, cost and quality performance measurement (Monczka et al., 2015). We define SPM as a process in which supplier performance is improved by ensuring quality of selection, evaluation, feedback, quality control and other processes to achieve the benefits of business relations.

### 2.1 Preferences for Selecting Suppliers

The selection of suppliers is one of the most important purchasing management process for many enterprises within the supply chain, including small and medium sized enterprises (Yadav, Sharma and Singh, 2018). Traditional supplier selection process covers the requirements of a single enterprise only. However, from strategic perspective, the whole supply chain needs and the long-term supplier relations should be considered (Araz and Ozkarahan, 2007).

Historically, the most important factors considered in supplier selection process are related to quality, delivery and price. Dicksons’ study (Dickson, 1966) stated

that quality, delivery, performance history, warranties and production facilities and capacity are the most important five criteria. Based on his study, Weber, Current and Benton (1991) later compared the selection criteria. Price was the highest-ranked factor, followed by delivery, quality, production facilities and capacity and geographic location. Sonmez (2006) examined the relative importance of the criteria for supplier selection in different industries in the literature that appeared between 1985 and 2005 and concluded that the private sector enterprises do not base their selection decisions solely on the price, and also other criteria are considered. Deshmukh and Chaudhari (2011) compared the supplier selection criteria with older findings and concluded that price, quality, delivery, production facility and capacity and technical capability are still the most ranked. Similarly, Pal, Gupta and Garg (2013) notice that the basic criteria typically utilized for selecting the suppliers include pricing structure, delivery, product quality, and service.

Tahriri et al. (2008) state that after 2003 more attention is given to the qualitative criteria. Zeydan, Colpan and Cobanoglu (2011) prefer combination of both qualitative and quantitative indicators. Kar (2014) pointed out that with the increased complexity more qualitative criteria are popular. Recent studies (Yildiz and Yayla, 2015) show that quality, delivery, cost, price and service were the most important supplier selection criteria. According Mwadulo and Munialo (2019), criteria of selecting suppliers changed over time, but some of the criteria such as cost, quality and delivery performance remain important. Nowadays, the importance of ability to integrate IT systems in context of Industry 4.0 (Vrchota and Pech, 2019) are gradually increasing.

Based on the research, the authors planned to analyze supplier selection preferences by sector industry and enterprise size. Working hypotheses are the following:

*H1a: The enterprises differ in preferences for selecting the suppliers according to the sector.*

*H1b: The enterprises differ in preferences for selecting the suppliers according to the size.*

## **2.2 Frequency of Evaluation of the Suppliers**

There are different procedures for evaluating the suppliers in each enterprise, which usually differ in criteria and methods used. Some enterprises evaluate their supplies and manage their performance in a simple way – they just find the right metrics to put on the scorecards (Gordon, 2008). To evaluate the suppliers and the supply chain performance, various metrics are used, such as the SCOR® model (Lima and Carpinetti, 2016), sustainable supplier selection and evaluation framework (Luthra et al., 2017), benchmarking methods (Souliotis, Giazitzi and Boskou, 2017), key performance indicators (Parmenter, 2010) and the evaluation based on balanced scorecard (Thanaraksakul and Phruksaphanrat, 2009). The main objective of supplier evaluation is to anticipate such events that could result

in future quality problems. According to ISO 9001:2015 (ISO, 2015) selected suppliers must be evaluated regularly and the frequency of the evaluation determined. The frequency is usually performed once a year, but sometimes it more frequent monitoring may be required. The problem of frequency of suppliers evaluation analyzed Simpson, Siguaw and White (2002).

Frequency of supplier evaluation is the second topic of the research. Our hypotheses are to confirm that there are differences by sector industry and size:

*H2a: The enterprises differ in suppliers evaluation frequency according to the sector.*

*H2b: The enterprises differ in suppliers evaluation frequency according to the size.*

### **2.3 Providing Feedback to the Suppliers about Their Performance**

Reporting the evaluation results provide useful information and feedback to the suppliers. By ISO 9001:2015 (ISO, 2015), communication to the suppliers should include controlling and monitoring of suppliers performance. It means that the enterprises obtain feedback relating to quality of products, services and results of supplier evaluation. Periodic in-depth performance reviews are the key long-term activities, especially when the enterprise implement the JIT method. These reviews are typically conducted quarterly and monthly (Giunipero, 1990). The suppliers should be provided feedback related to the results of the evaluation, either negative or positive. To avoid the financial and operational issues, the problems with poor supplier performance should be addressed as soon as possible (Monczka et al., 2015). Many enterprises, however, usually only inform their suppliers of negative results or communicate only when they decide to replace the supplier. The inspections of the enterprises are appropriate. Replacement of the inferior suppliers is usually not a solution because the new ones may not be more reliable and the whole cycle may be repeated again. Therefore, the method of selecting suppliers is rather important. Prahinski and Benton (2004) analyze how the suppliers perceive supplier evaluation communication with a producer and providing the feedback.

The difficulty of the feedback may vary by sector industry and enterprise size. So the following hypotheses are tested:

*H3a: The enterprises differ in providing feedback to the suppliers according to the sector.*

*H3b: The enterprises differ in providing feedback to the suppliers according to the size.*

### **2.4 Quality Control of Deliveries**

Quality control is an activity in manufacturing of goods or the provision of a service in the required and uniform acceptable quality that allows full customer

satisfaction. The main objective of quality control is to prevent production of defective items and scraps (Jain, 2001). Total Quality Management is “the process of designing and maintaining an environment conducive for performance for a group of people working together for attainment of the common objective in time” (Mukherjee, 2006, pp.17). The term “total” refers to the quality of the entire enterprise. Term “quality” include quality of product, services, processes, relationships and term “management” point out the managing and control processes to fulfil desired customer needs. Quality management use the statistical control techniques for detect deviations from quality standards. Mutual trust between the enterprises often leads to the fact that the customer does not check the quality of the supplies, possibly only at random, and relies on the supplier to always have done it. This also speeds up the manufacturing process. Regular suppliers have the certainty of selling their products for several years, however for such advantage they must strive to gradually reduce their prices.

In case of quality control, the authors tested the differences between industry and enterprises size. The working hypotheses are as follows:

*H4a: The enterprises differ in the way they realize quality control of their suppliers according to the sector.*

*H4b: The enterprises differ in the way they realize quality control of their suppliers according to the size.*

### 3 METHODOLOGY

The main aim of the paper is to analyze the differences in supplier performance management characteristics according to different enterprise size and sectors of industry. In 2016-2019, the authors carried out a questionnaire survey in 366 enterprises. The questionnaire focuses on five main groups of SPM characteristics: preferences for selecting suppliers, frequency of suppliers evaluation, providing feedback to the suppliers, and quality monitoring of deliveries. The research was processed according to two viewpoints:

- by sector (specialization) of the industry (classified by CZ-NACE) into: 1. Engineering and electro-technical production (CZ-NACE groups 24-30), 2. Production of products for domestic use (CZ-NACE Groups 13-16, 31-32; households supply), 3. Food production industry (CZ-NACE Groups 10-12), 4. Chemical, paper and non-metallic production (CZ-NACE groups 17-23), 5. Agriculture (CZ-NACE groups 01-03);
- by enterprise size (according to the number of employees) into: small enterprises (up to 49 employees), 2. Medium enterprises (50-249 employees) and 3. Large enterprises (over 250 employees).

More than half of the enterprises concerned mechanical engineering enterprises (51.1%), household goods made up 15.6% and food businesses 14.2%. The other two fields (Chemical, Agricultural) are represented only in some years (Table 1).

Table 1 – Research Sample Characteristics (2016-2019) (Source: Author’s Own Work)

Group	Category of enterprises	Number	Total
Sector	Engineering and electro-technical production	187	366
	Household supplies (next only household)	57	
	Food production industry	52	
	Chemical, paper and non-metallic production	49	
	Agriculture	21	
Size	Small (1-49 employees)	126	366
	Medium (50-249 employees)	128	
	Large (over 250 employees)	112	

The two-sided hypotheses were tested by the statistical analysis in software R based on the test of equal or given proportions (z-test) with the Yates continuity correction (Pearson’s chi-squared test statistic). The results are interpreted at alpha level 0.05. For reasons of clarity, only the significant results, including achieved level of significance (p-value), are given in the text.

$$z = \frac{p_A - p_B}{\sqrt{pq/n_A + pq/n_B}} \tag{1}$$

Where  $p_A$  is the proportion observed in group A with size  $n_A$ ,  $p_B$  is the proportion observed in group B with size  $n_B$   $p$  and  $q$  are the overall proportions.

## 4 RESULTS

The results of the analysis are summarised and divided into four parts according to the working hypotheses.

### 4.1 Preferences for Selecting Suppliers

The authors tested the factors playing the most decisive role in the process of selecting suppliers (quality, price, speed of deliveries etc.). It was possible to use three-point scoring (1 = low importance, 2 = middle, 3 = very important). For better overview, only the preferences scores are presented. As reported by Table 2, all the enterprises prefer reliability of the delivered items, followed by the quality. The price is scored as the third most important. Currently, less emphasize is surprisingly given to speed of delivery and services, in spite of, that both of these two factors offer a considerable advantage in competition.

Table 2 – Preferences for Selecting Suppliers (%) (Source: Author's Own Work)

Category	Quality	Price	Speed	Reliability	Services*
Engineering and electro-technical production	28.2	15.8	15.3	30.7	10.0
Household supplies	30.6	16.5	12.4	30.6	9.9
Food production industry	28.9	18.4	16.7	27.2	8.8
Chemical, paper and non-metallic production	26.1	15.2	15.2	32.6	10.9
Agriculture	27.9	26.2	9.8	26.2	9.8
Small (1-49)	27.4	18.1	12.5	32.7	9.3
Medium (50-249)	28.7	17.5	15.7	28.3	9.8
Large (over 250)	29.4	15.2	16.0	29.0	10.4

Notes: \*Services include activities such as: timely provision of information, suitable before and after sales services, flexibility to customer wishes, past experience with suppliers, their proposals to any improvement in cooperation.

The same preferences are revealed as according to the industry sectors, as reported by the second part of Table 2, with the same factors grouped according to the enterprise size (number of employees). The results seem to be very similar as without the preference of the enterprise size.

*H1a: The differences between the sectors were statistically proved only for the price (p-value = 0.0030), in particular between agriculture and engineering (p-value = 0.0055) and agriculture and chemical production (p-value = 0.0055). This implies the importance of differences in the sectors by the price only.*

*H1b: No differences were found by the size of enterprises.*

## 4.2 Frequency of Evaluation of the Suppliers

Regular evaluation of the suppliers in the time interval of one year and less is the requirement for creating good partnership. Surprisingly, many enterprises do not perform any periodic evaluation, see Table 3.

*H2a: The differences between the sectors of industry were statistically proven for the annual and longer evaluation frequency (p-value = 0.0071) and for the evaluation without regular frequency (p-value = 0.0003). Through a deeper pairwise analysis, it was found that enterprises that do not regularly evaluate their suppliers are mostly agricultural. These differences are particularly significant when compared agriculture to food production (p-value = 0.0323), chemical production (p-value = 0.0323) and engineering and electro technical production (p-value = 0.0084).*

Table 3 – Frequency of Suppliers' Evaluation (%) (Source: Author's Own Work)

Category	1x per year and longer	Every 6 months	Quarterly	No regular evaluation
Engineering and electro-technical production	42.2	17.1	16.0	24.6
Household supplies	23.2	16.1	16.1	44.6
Food production industry	30.8	21.2	25.0	23.1
Chemical, paper and non-metallic production	42.9	22.4	12.2	22.4
Agriculture	14.3	9.5	14.3	61.9
Small (1-49)	27.8	15.1	16.7	40.5
Medium (50-249)	35.2	17.2	17.2	30.5
Large (over 250)	46.8	21.6	16.2	15.3

*H2b: The differences by the size of enterprises were found in annual and longer evaluation frequency (p-value = 0.0092) and in the case of enterprises not evaluating their suppliers (p-value = 0.0001). In the annual evaluation, this difference is apparent between the small and the large enterprises (p-value = 0.0110). It is clear that, in particular, the small enterprises do not carry out any regular evaluation.*

Overall, the sectors and the size of the enterprise are relevant for one-year and longer frequency of evaluation and for the evaluation without regular frequency.

### 4.3 Providing Feedback to the Suppliers

It is important to provide the suppliers the feedback so that they could react promptly. A discovered imperfection must be removed by means of mutual meetings, and inspections. It is not convenient to try replace the supplier quickly, when the producer is not satisfied. With a new one the situation might repeat. For this reason, it is necessary to “foster and educate” the suppliers, tell them the deficiency in their activities. There is always a possibility of improvement in this area, when only 10-20 % of suppliers are not familiarized with their results (Table 4). The best situation is in the Engineering and Electro-industry.

*H3a: The results show that the differences between enterprises operating in different sectors are important for providing feedback to the suppliers (p-value = 0.0164) and in case of their replacement (p-value = 0.0038). Replacement is the start of the process of selecting a new supplier. In this case, it the most important differences in pairwise comparison are found between the chemical industry and agriculture (p-value = 0.045). Overall, the impact of the industry is primarily on providing complete feedback to the suppliers and during their replacement.*



Table 4 – Providing Feedback to the Suppliers (%) (Source: Author's Own Work)

Category	Complex results	Negative results only	Only when replace	No feedback
Engineering and electro-technical production	43.5	29.3	16.8	10.3
Household supplies	25.5	32.7	30.9	10.9
Food production industry	21.6	37.3	23.5	17.6
Chemical, paper and non-metallic production	38.3	31.9	10.6	19.1
Agriculture	30.0	10.0	45.0	15.0
Small (1-49)	24.4	28.5	28.5	18.7
Medium (50-249)	35.5	28.2	21.8	14.5
Large (over 250)	50.0	34.5	10.9	4.5

*H3b*: When comparing the evaluation results according to the size of the enterprises, similar results were found, i.e. the differences are in providing complete feedback to the suppliers (p-value = 0.0003) and in case of their replacement (p-value = 0.0041). The significant difference was primary between the large and small sized enterprises. In addition, differences were also found if enterprises did not acquaint their suppliers with the evaluation results (p-value = 0.0045). This is particularly evident when comparing large and small enterprises (p-value = 0.0055) or medium-sized (p-value = 0.0389). Obviously, the large enterprises usually inform their suppliers about the results of the evaluation process. The results revealed that the size of an enterprise affects the way in which the enterprises provide the feedback to the suppliers.

#### 4.4 Quality Monitoring of Deliveries

The access to quality monitoring also worth mentioning: Electro-industry monitors the deliveries regularly, engineering randomly and food processing industry prefers trusting to its suppliers (Table 5). The statistical analysis failed to confirm any significant differences in quality monitoring, both in terms of different sectors of industry (*H4a*) and the size of the enterprise (*H4b*). In conclusion, the approach of the enterprises to quality monitoring is similar, regardless of their size or the industry in which they operate.

Table 5 – Quality Monitoring of Deliveries (%) (Source: Author's Own Work)

Category	Regularly	Randomly	Sometimes*	Other
Engineering and electro-technical production	70.0	20.9	6.4	2.7
Household supplies	73.0	21.6	5.4	0.0
Food production industry	77.4	16.1	6.5	0.0
Chemical, paper and non-metallic production	69.6	17.4	0.0	13.0
Agriculture	64.3	14.3	7.1	14.3
Small (1-49)	74.3	14.3	8.6	2.9
Medium (50-249)	72.4	21.1	5.3	1.3
Large (over 250)	66.7	23.2	2.9	7.2

Notes: \* "sometimes" means that enterprises trust their main suppliers and check several deliveries only.

## 5 DISCUSSION

This section outlines the results of the study. The key findings are discussed, and recommendations are provided for the future research. The results show that the reliability and quality are most important criteria in the selection of suppliers. Pernica (2004) states that logistics services include, in particular, reliability of delivery, completeness of supply, reasonable (short) delivery times, pre- and post-sale services provided, quality of distribution and provision of information. For production consumption, the weight of reliability is significantly higher. The importance of reliability is not so obviously discussed in foreign studies. It is the quality that is considered as the most important criterion. For example, Tan, Lyman and Wisner (2002) suggest quality, service level, on-time delivery, quick response and volume flexibility as the critical factors in evaluating supplier performance. Correct quantity and willingness to change products and price are also necessary. Ho, Xu and Dey (2010) gathered and analyzed the most popular evaluating criterion in literature from 2000 to 2008. About 87.18% of all the papers consider quality to be the most important criterion in selecting a supplier. This occurs more frequently as expected because enterprises want to satisfy the customer. According Abdolshah (2013) one of the most important criterion is quality which could integrate more factors to the evaluation. The meaning of the term "quality" may thus be broader and include reliability, which may not be perceived as a different criterion. Therefore, it would be appropriate for the authors to always specify and define the term "quality" in more details. This, in principle, can give rise to possibility of better comparison of studies.

## 5.1 Sector Industry

From a sectoral perspective, the research results indicate that the enterprises differ in the criteria for selecting their suppliers (*H1a*). The enterprises perceive the importance of prices differently, especially in agriculture. The ideal criteria of supplier selection in food processing industry are defined by Ramlan et al. (2016). They investigated that cost, quality, service and delivery are the most important criteria. The industry was also significant in comparing suppliers' evaluation frequency (*H2a*). It was found in particular, that the agricultural holdings do not carry out a regular evaluation. By Simpson et al. (2002), the frequency of the routine evaluation varied in most of the cases (59.5%). They concluded that the suppliers are usually evaluated after each shipment (2.3%), monthly (15.5%), quarterly (13.3%), semi-annually (6.7%) and annually (13.3%). Similarly, Watts and Hahn (1993) noticed that about 75.3% of the enterprises perform the evaluation of suppliers regularly, 6.9% after every order, 10.3% every three months, 8.6% every six months and 44.8% every twelve months, other 29.3%. These studies do not mention any differences by industry. Furthermore, in our research, the differences between the sectors are identified in providing feedback to the suppliers (*H3a*), particularly in replacing the suppliers, especially in agriculture. The sector of industry was also particularly important in the general results survey in the household and food production, where the suppliers are provided less feedback of the complete results. The enterprises approach to quality monitoring is similar regardless the industry (*H4a*).

## 5.2 Enterprise Size

The results show, that no differences between the enterprises of different size were found in the criteria for selecting suppliers (*H1b*) and in the quality monitoring method (*H4b*). The size of the enterprise was significant in the evaluation of suppliers (*H2b*) in the case of annual and longer frequency evaluations, and also for the evaluation of the suppliers without a regular frequency. While the large enterprises prefer a one-year or longer evaluation period, the small enterprises do not carry out any evaluation. By Vanecek (2013), the selection process is important only for 36.8% of the small and medium sized enterprises and evaluation process for 25.4% of them. In the study of Su and Gargeya (2016), the small and medium-sized enterprises carry out supplier selection mostly related to the product quality, strategic factors and supplier responsiveness. Pearson and Ellram (1995) compared the frequency of evaluation of the suppliers between the small and the large enterprises. The results show that ad hoc evaluation at buyers' discretion is 35.6% in the small enterprises, and 17.9% in the large enterprises. Review of performance every year and more frequent 33.3% in the small enterprises and 57.7% in the large enterprises. The results of the overall evaluation are then more frequently (*H3b*) communicated to their suppliers by the large enterprises, when the suppliers are replaced. The difference in evaluation frequency can be attributed to a number of factors. Firstly, there is a lack of workers and absence of a quality department in small

enterprises. Another problem may be implementation of strategy (if any) or efficiency of the management system. It is difficult to say if these are the underlying factors of overall performance. Ghadimi et al. (2016) believe that the small manufacturing enterprises try to improve their competitive advantage by increasing their commitment in being environmentally and socially responsible, increasing their chance to be selected as a supply partner for a large manufacturing organisation. The competitive advantages of small enterprises are different from those of large enterprises.

## 6 CONCLUSION

Quality approach to supplier performance management has increased in importance during the last decades. Many enterprises have a supplier quality management function with performance management processes. The paper deals with the evaluation of supplier performance management s on the basis of two criteria: sector industry and enterprise size.

The results show that enterprises differ in terms of sector industry in particular in the criteria of supplier selection, frequency of supplier evaluation and providing feedback to the suppliers. When comparing supplier performance management, the enterprises differ only in frequency of supplier evaluation and use of suppliers evaluation feedback. On the other hand, it is not shown that the enterprises differ in the way of quality monitoring as regards the size of the enterprise and the sector in which they operate.

First, the authors recommend using top rated selection criteria such as quality (including reliability) and new environmental and technological criteria in the supplier selection process too. Preferences of selecting criteria may change over time, especially in fourth era of the industrial revolution, which is characterized by Industry 4.0, globalization, digitalization and information technology, robotics, the global supply chains and new environmental requirements.

Second, the authors suggest that supplier evaluation and reviews with feedback are combined. The objective for evaluating the suppliers is to improve their performance. Training, consulting and assistance are the most important challenges of supplier sustainable continuous-development. Implementation of sustainable changes and development projects brings long-term benefits, higher quality and comprehensive performance improvement.

The contribution of the research in the paper is mainly related to confirming the increasing importance of human factor in production. Reliability, consisting primarily of adherence to agreed contracts, is assessed by the enterprises as important as quality, which is viewed more technical. The human factor then influences the regularity of suppliers' evaluation, and the lack of familiarization with the overall evaluation, especially in the small and medium-sized enterprises.

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## ABOUT AUTHORS

**Martin Pech** – (M.P.) University of South Bohemia in Ceske Budejovice, Czech Republic, Faculty of Economics, Department of Management, Asst. Prof., e-mail: mpechac@ef.jcu.cz, Author's ORCID: 0000-0002-0807-3613.

**Drahoš Vaněček** – (D.V.) University of South Bohemia in Ceske Budejovice, Czech Republic, Faculty of Economics, Department of Management, Prof., e-mail: dvanecek@ef.jcu.cz, Author's ORCID: /0000-0003-2767-2686.

## AUTHOR CONTRIBUTIONS

M.P. and D.V. – conceptualization, investigation, resources, writing original draft preparation, writing review and editing; M.P. – methodology, software, formal analysis, data curation, visualization, project administration, funding acquisition; D.V. – validation, supervision.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.



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