

THE USE OF QUANTITATIVE METHODS IN BUSINESS PRACTICE: STUDY OF CZECH REPUBLIC

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ABSTRACT

The purpose of the study is to evaluate the use of quantitative methods in companies and determine the reasons for the non-use of quantitative methods. First, the context of dependence on individual characteristics of the company, such as size, amount of foreign share, and business sector, is analysed. Subsequently, the methods companies use, and those for which companies require scientific support and research are identified. The study is carried out in companies in the Czech Republic and is based on an electronic survey. Methods of statistical testing of dependencies are used for evaluation. The inputs showed that the size of the company is the most dependent on the use of quantitative methods in companies. From the results of the question on the reasons for not using quantitative methods in business practice, the most significant number of respondents answered that the methods are too academic and often their use in business practice is unrealistic due to their complexity. It is the trend of academic institutions and scientific societies to develop quantitative evaluation software with simple input and interpretation. They identified the forecasting of business variables as the method with the greatest scientific potential. The following are simulation methods and logistics management methods. The article may provide a central theme for future science and research development in business.

KEYWORDS: Quantitative methods, business research, potential of business research.

JEL CLASSIFICATION: M21, M10, C12.

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INTRODUCTION

Businesses have great innovation challenges. In these innovative challenges, the question of research into quantitative methods in business practice comes into discussion. This is concerning current research in this field. It is a big question whether research organizations with their outputs in quantitative business methods meet the requirements of innovated business practice. The question of what research

requirements companies have, given the innovative possibilities in the company, very often remains unanswered.

Moreover, there is a crucial reason for using quantitative methods in the future: the use of technologies that communicate with computer systems such as the Internet of Things (Ray, 2018; Pourghebleh & Navimipour, 2017) or technologies that create the core of ecosystems and services such as Cloud Computing (Hosseini-Far et al., 2017; Senyo et al, 2018) and so on. These will increase the production of data that will be in digital form. Ready for processing. These technologies will bring many changes to business management (Lee & Lee, 2015). Not only technological changes but also organizational changes in the approach to understanding information, etc.

The importance of using quantitative methods in business is already evidenced by research from the last century (Wisniewski, 1996). Even then, the share of companies using quantitative methods was 66%, and 24% of company managers said that the benefits of these methods are very high. Only 0.7% of respondents in this survey stated that there is no benefit. At the time, most business managers used quantitative methods for basic and descriptive statistics, cash flow discounting, quality and inventory management. About 67% of companies also used decision analysis or smoothing methods. More than 50% of the companies in this research used simulation or regression analyzes 25 years ago.

It can be assumed that in 25 years, the development of the use of quantitative methods has been based mainly on a more accurate and, above all, more achievable use of computer technology. Clearly, working with data is an important topic today. Certain assumptions are required to use data as a source of information for managing an organization. The primary is the knowledge of individual methods and their applications. The article deals with this topic. Other aspects may include, for example:

- Application of appropriate technology;
- Ability to obtain data;
- The ability to process and present data.

Brinch et al. (2021) identified 24 organizational capabilities that are needed to use big data. Therefore, the use of data cannot be reduced not only to the data itself but also to related aspects (organizational, procedural, human resources, etc.).

The question is whether the development of technologies and quantitative methods themselves has led to greater and better use of quantitative methods in business practice. He has already started a discussion on the usability versus the complexity of quantitative methods (Zellner et al., 2001). In this book, he says that even in accordance with the natural sciences in economic disciplines and in science in general, it is necessary to choose methods that are sophisticatedly simple. In this book, the authors also conducted a survey of Nobel Prize winners, and with a few exceptions, these scientists chose simplicity at the expense of more complex models.

In this study, we aim to map whether companies use quantitative methods in their decision-making, whether they always clearly understand the outputs and results, and what are the reasons for not using quantitative methods.

The aim of the study is to identify quantitative methods in which companies require more scientific development. The first research question is whether companies use quantitative methods and what methods. Also whether there is any relationship between the size of the company, the foreign share and difference of in the business sector and the use of quantitative methods.

The second research question is what are the reasons for not using quantitative methods in practice. Again in relation to the size of the company, foreign share and difference of the business sector. And finally question what is the understanding of these methods by entrepreneurs and managers.

The third and main research question is what methods companies require to submit to scientific research. That is, which methods according to practice have the greatest scientific potential and should be dealt with by research institutions.

The ability to process data and use their potential today depends to a large extent on the ability to apply adequate information technology. IT is at the beginning of the journey of working with data and can help at the end of this journey, to be a suitable interface for data presentation.

These issues will be examined in the context of dependencies on individual characteristics of the company, such as size, amount of foreign share and business sector. We also want to determine what specific methods of quantitative decision-making in practice are commonly used by companies. The focus of the study is to point out the areas of economic scientific research, where companies require scientific support and scientific research. The article can be input information on where economic research should be directed in the coming years and what its biggest weaknesses are.

The main benefit of the article is to help solve problems, especially with technological innovations of companies. By defining which quantitative methods companies need to research more scientifically, which quantitative methods have the greatest scientific potential. Of course, to help research organizations find out what areas of innovation companies expect in practice in quantitative methods. The study is carried out in companies in the Czech Republic and is based on an electronic survey.

1 LITERATURE REVIEW

There are a number of quantitative methods in economic research. Quantity means frequency, quantity, size. Philosophically, is it anything we ask the question "how much"? It is therefore a property that can be measured and expressed by a number. From this point of view, quantitative methods can be qualified as a method of standardized scientific research, which describes the researched facts using variables that can be expressed by numbers. According to (Bell et al., 2018) "quantitative research can be characterized as exhibiting certain preoccupations, the most central of to are: measurement, causality, generalization and replication". The main characteristic of quantitative methods is measurability. Most quantitative methods are also quite afraid of a causal explanation. Quantitative methods do not answer the question of how things work but more often they focus on the question of why. Thus, in quantitative research, scientists often hope to generate generally the confines of the particular context (Bell et al., 2018). In the natural sciences, in quantitative research, there is often a requirement for replication (appropriate reproduction) of a given experiment (Chalmers, 2013). Quantitative methods find their application, especially in the natural sciences. However, even the humanities often use quantitative methods. For example, in sociological research, quantitative methods play an important role (Bhattacharjee, 2019).

The list of quantitative methods is very extensive. In addition, it is an obvious fact that ever new quantitative methods in economic research are emerging and will arise. Pioneering methods in economics, and business were introduced, for example (Alghalith, 2019), he also increased the interdisciplinary nature of economics. Economics cannot exist separately without information technologies (IT), marketing, management, statistics and mathematics. At other levels, new quantitative methods are being developed directly in companies, for example, new prognostic models are being created (Taylor & Letham, 2018). These methods can then be generalized to other economic entities (Navratil & Kolkova, 2019), or, for example, to different sectors of the economy (Kolkova, 2018; Kolkova, 2020).

Another direction of business research is the application of methods that were already known to managerial problems for which they have not yet been applied, for example (Kolkova, 2018). Other new quantitative methods are discussed, for example (Martin et al., 2021), (Ray et al., 2021) (Gopalswamy & Uzsoy, 2021) or (Guastaroba et al., 2021).

There is very little research about the use of quantitative methods in business practice. Testing and evaluation of quantitative knowledge have been addressed, for example (Martinik et al., 2016) or (Snee, 1993). As already mentioned below, the author deals with this issue (Wisniewski, 1996). At present, studies on this topic are infrequent and less published.

On the contrary, the use of a questionnaire survey is based on a number of different researches in various areas of economic research (Aquilante & Vendrell-Herrero, 2021), (Du et al., 2021) or (Casper Ferm & Thaichon, 2021).

In addition to the method itself, it is possible to discuss other factors related to the ability to obtain input data sources, process them, present and use them in the management of the organization. It is beyond the primary focus of the article and its scope to address these aspects in detail, however, it is appropriate to draw attention to them. It co-creates the overall ability to use the methods discussed and analyzed here. An example of context is the ability to understand results, i.e. the ability to present results. The simplicity of deploying methods can be related to the automation of their processing through appropriate IT.

Decision-making (as a part of management) and data (as a source of information) are areas that often determine the competitiveness of companies. IT is the connecting element, creating a digital infrastructure for digital data (ISACA, 2018) or like mentioned by AXELOS (2020) digital technology. Ghasemaghahi and Calic (2019) discuss data quality in the context of decision-making, AlSuwaidan (2020) mentions the importance of data management with respect to the development of other technologies (Internet and Internet of Things).

As Peterková and Franek (2018) state, many companies understand the necessity and importance of innovation for business but often do not know how to manage, implement and evaluate it. In particular, quantitative methods as a source of innovation are difficult for a company to grasp. These research requirements are also good to define and implement in scientific research.

2 DATA AND METHODOLOGY

The study was performed using the questionnaire method. The survey was carried out using a structured electronic questionnaire. The questionnaire contained 18 questions, of which 5 were identification questions and the others focused on the use of quantitative methods in companies. The survey was in the period from February to June 2021. A total of 3,150 companies were sent. The questionnaire was addressed to company owners or top management (44 percent of respondents were owners, 56 percent of respondents were people from top management). We addressed 3,150 companies from various areas of business. The return rate of the questionnaires was 7% (124 companies). The questions were designed on the use of quantitative methods.

The companies were divided according to size. The small enterprises involved in the questionnaire survey were 79(64%), medium-sized enterprises 33(27%) and big enterprises 12(9%). Furthermore, according to the foreign share. There were 99(80%) Czech companies, 20(16%) companies with foreign participation and 5(4%) completely foreign companies. According to the division of the business sector are enterprises in primary sector 9(7%), in secondary sector 29(23%), in tertiary sector 79(64%) and in quaternary sector 7(6%). According to this, we divide companies into the primary sector, which

represents the basic sourcing of raw materials, forestry, agriculture, mining industry, etc., and further into the secondary sector, we understand this as raw material processing. In this study, we identified services as the tertiary sector and the quaternary sector represents science, research and development.

The basic methodological element for analysing the survey results in this paper is cross-tabulation analysis. Furthermore, the calculation of frequency and rank statistics will be used. In cross-tabulation, the selected categorical character will always be considered as an independent variable. The dependent variable will then be the category of whether the company uses quantitative methods in corporate management, respectively whether the outputs were understood by the companies. Several measures of association and correlation are used in this paper to verify the independence on categorical variables. First is Pearson χ^2 . The null hypothesis assumes the independence on categorical variables. Test χ^2 is based on comparing the empirical frequencies of categorical variables with theoretical ones - that is, those that can be expected in the case of character independence (Pearson, 2009). χ^2 can be calculated by the relation,

$$\chi^2 = \sum_{j=1}^r \sum_{k=1}^s \frac{(n_{jk} - o_{jk})^2}{o_{jk}}, \quad (1)$$

where

n_{jk} - is the frequency of occurrence in j -row a k - column cross-tabulation,

o_{jk} - can be calculated by the relation $o_{jk} = \frac{n_j \cdot n_k}{n}$,

r - is the total number of rows,

s - is the total number of columns in the cross-tabulation.

Results of χ^2 they are then compared with the test criterion (this is tested in this article at the level of significance of 95%) and if χ^2 does not exceed this value, the hypothesis of the independence on variables is confirmed.

χ^2 is a quantity that evaluates dependency or independence. However, it does not say anything about the degree of dependence and strength of the relationship that exists between categorical variables. To determine the degree of tightness and the direction of tightness, we use other coefficients of association or correlation. At the same time, it is necessary to distinguish whether it is an ordinal or a nominal categorical variable. For the ordinal variable in this study, a coefficient for directional measures Somers'D. This is enumerated according to (Somers, 1962), as

$$\text{Sommer's } D = \frac{N_C - N_D}{N_C + N_D + N_T}, \quad (2)$$

where

N_C - is the number of all concordances,

N_D - discordances,

N_T - is the number of neither concordant nor discordant pairs that are tied on variable X and not on variable Y.

For the nominal variable in the calculation directional measure is used Lambda, Goodman and Kruskal τ and uncertainty coefficient. Coefficient **Lambda**, is sometimes also referred to as Goodman-Kruskal lambda, for the authorship of two professors (Goodman & Kruskal, 1963), can be calculated by the relationship,

$$\lambda_{XY} = \frac{\sum_{j=1}^Y n_{jk} - n_{\min\{r,s\}}}{n - n_{\min\{r,s\}}} \quad (3)$$

Goodman and Kruskal τ is a coefficient that can be expressed by the relation,

$$\tau_{XY} = \frac{n \sum_{j=1}^r \sum_{k=1}^s \frac{(n_{jk} - m_{jk})^2}{n_{i+}}}{n^2 - \sum_{j=1}^r n_{+j}^2}, \quad (4)$$

where

m_{jk} - is the expected frequency in j rows and k columns.

Uncertainty coefficient can be calculated by the relationship,

$$U = \frac{H(X) + H(Y) + H(XY)}{H(Y)}, \quad (5)$$

where

$H(X)$ - we calculate as $H(X) = - \sum_{j=1}^r \left(\frac{n_{i+}}{n} \right) \ln \left(\frac{n_{i+}}{n} \right)$,

$H(Y)$ - can be calculated as $H(Y) = - \sum_{k=1}^s \left(\frac{n_{k+}}{n} \right) \ln \left(\frac{n_{k+}}{n} \right)$

$H(XY)$ - is then given by the relationship $H(XY) = - \sum_{j=1}^r \sum_{k=1}^s \left(\frac{n_{ik}}{n} \right) \ln \left(\frac{n_{ik}}{n} \right)$.

For symmetric measures and the ordinal categorical variable, it was chosen based on the order correlation Kendall's τ_b and τ_c and Gamma. Using Kendall's τ and Gamma, the dependence can be evaluated as completely identical if it reaches the value 1. If 0, then there is no degree of association between the variables. A value of -1 then indicates a negative dependence. Kendall's τ_b is suitable for use in square cross-tabulation, Kendall's τ_c in crosstabs of any size. The Gamma coefficient can also be used only in the case of a square table, as stated (Soukup & Rabušić, 2007). The use is more useful in this study **Kendal τ_c** (Kendall, 1970). It can be quantified according to the relationship,

$$\tau_c = \frac{N_C - N_D}{D}, \quad (6)$$

where

D - can be calculated as $D = \frac{n(n-1)}{2}$.

For symmetric measures and nominal categorical variable coefficients Phi, Cramer's V a contingency coefficient. **Cramer's V** can be calculated by the relationship,

$$V = \sqrt{\frac{\chi^2}{n \cdot \min(r-1, s-1)}}, \quad (7)$$

where

S - is the number of columns in the cross-tabulation,
 r - is the number of rows.

Coefficient contingency is then given by the equation,

$$CC = \sqrt{\frac{\chi^2}{\chi^2 + n}} \quad (8)$$

However, the quality of this coefficient is being discussed. As he points out, for example (Norusis, 1984) the coefficient does not take the value 1 even with a perfect dependence.

Based on these theoretical starting points, suitable coefficients are selected to evaluate the forces of association and correlation. First, we divide the quantities according to the type of variable and then choose a suitable coefficient. Table 1 shows the choice of coefficients.

Table 1 Choice of statistical characteristics in the evaluation of associations and correlations

	BUSINESS SIZE	SHARE OF FOREIGN CAPITAL	BUSINESS SECTOR
Using of quantitative methods	Ordinal/Nominal <i>Cramer's V, λ_{XY}</i>	Nominal/Ordinal <i>Kendal τ, Somer's D Gamma</i>	Nominal/Nominal <i>χ^2, Cramer's V, λ_{XY}</i>
Understanding quantitative methods	Ordinal/Ordinal <i>Kendal τ, Somer's D Gamma</i>	Ordinal/ Ordinal <i>Kendal τ, Somer's D Gamma</i>	Nominal/Ordinal <i>Cramer's V, λ_{XY}</i>

(Source: own calculation)

3 RESULTS

The first research question is whether companies use quantitative methods and what methods. Also whether there is any relationship between the size of the company, the foreign share and difference of the business sector and the use of quantitative methods.

The survey examined the use of quantitative methods and the understanding of quantitative methods in business economics. The results show, that 70% of companies use quantitative methods. According to the results of this empirical study, 70(56%) companies use one of the quantitative methods. 54(34%) companies, on the other hand, stated that they do not use any of the quantitative methods in their business.

3.1 The relationship between the size of the company and the use of quantitative methods in managerial decision-making

Table 2 Cross-tabulation between the use of methods and the size of the company

		YES, I OR OTHER EMPLOYEES OF THE COMPANY USE ONE OR MORE OF THE METHODS	NO, I DO NOT USE ANY METHOD, NOR DO I KNOW THAT HE USES ANYTHING IN THE COMPANY	TOTAL
size	Small business	25	54	79
	Medium business	20	13	33
	Large enterprise	9	3	12
Total		54	70	124

(Source: own calculation)

In evaluating the relationship between the use of quantitative analysis methods and size, we used the collected data. Table 2 shows the frequencies of the individual responses to the survey.

According to the previous consideration, the size of the company can be considered an ordinal variable and the use of methods as nominal. Therefore, for symmetric measures, we used Cramer's V, see Table 3. The results of this coefficient show the fact that the degree of tightness is equal to 0.327. This, according to (De Vaus, 2013), we can evaluate it as a medium to substantial dependence. It can therefore be said that the dependence on the size of the company on the use of quantitative methods has been confirmed.

Table 3 The degree of dependence between the size of the company and the use of quantitative methods - calculation of symmetric measures

	VALUE	APPROXIMATE SIGNIFICANCE
Cramer's V	0.327	0.001
N of Valid Cases	124	

(Source: own calculation)

The Lambda coefficient is more suitable for use in determining directional measures. If we verify the hypothesis that the use of methods depends on business size, we can assume that the use of methods is a dependent variable and the business size is an independent variable. Therefore, the size of the correlation of these two quantities is 0.241, which would indicate a low to medium dependence. The result is shown in Table 4.

Table 4 The degree of dependence between business size and the use of quantitative methods - calculation of directional measures

		VALUE	ASYMPTOTIC STANDARD ERROR ^A	APPROXIMATE T ^B	APPROXIMATE SIGNIFICANCE
λ_{XY}	Symmetric	0.131	0.061	1.968	0.049
	Size - Dependent	0.000	0.000	. ^c	. ^c
	Using - Dependent	0.241	0.108	1.968	0.049
A. Not assuming the null hypothesis. B. Using the asymptotic standard error assuming the null hypothesis. C. Cannot be computed because the asymptotic standard error equals zero. D. Based on chi-square approximation					

(Source: own calculation)

The comprehensibility of these methods was also researched. The results of cross-tabulation are shown in Table 5. Within this table, the answers were evaluated, which were marked 1. Yes, I always fully understood the results. 2. The results were often incomprehensible to me and I had to spend quite a lot of time studying them using other sources (manual, literature, internet, addressed. 3. I got a basic idea of the results, however, I interpreted most of the results using manual, literature, internet, or I asked. 4. I always understood the basic outputs, some I easily understood using manual or literature or the internet. 5. I did not understand any results, I left the interpretations and their explanation to experts.

Only companies that use one of the quantitative methods were subjected to this analysis.

Table 5 Cross-tabs business size and understanding of quantitative methods

		1	2	3	4	5	
Size	Small business	8	1	6	10	0	79
	Middle business	11	1	2	6	0	33
	Large enterprise	1	1	2	4	1	12
Total		20	3	10	20	1	124

(Source: own calculation)

In this case, we consider the quantities to be ordinal and therefore Somer's D was used for directional measures. If we could not distinguish between the dependent and independent variables, the degree of tightness of the dependencies would be 0.043. However, in this case, we can verify the hypothesis whether the comprehensibility of the methods depends on the business size. Thus, it can be assumed that the intelligibility of the methods will be a dependent variable and the business size will be an independent variable. To analyze the relationship, we must take a correlation value of 0.045. This indicates a positive relationship but with trivial to no dependencies. The results are shown in Table 6.

Table 6 Relationship between business size and understanding of quantitative methods

		VALUE	ASYMPTOTIC STANDARD ERROR ^A	APPROXIMATE T ^B	APPROXIMATE SIGNIFICANCE
Somer's D	Symmetric	0.043	0.123	0.347	0.729
	Size Dependent	0.041	0.118	0.347	0.729
	Understanding Dependent	0.045	0.130	0.347	0.729
Kendall's τ_c		0.042	0.122	0.347	0.729
Gamma		0.064	0.182	0.347	0.729
N of Valid Cases		54			
A. Not assuming the null hypothesis.					
B. Using the asymptotic standard error assuming the null hypothesis.					

(Source: own calculation)

Of course, symmetric measures were also evaluated. This is an ordinal variable therefore, the Kendall τ and gamma coefficients were used. Kendall's τ_b is only used for squared cross-tabulation. We do not have this in this study, so we will only use the Kendall's τ_c . The results are shown in Table 6. The results show the fact that the dependence is really trivial to none. Thus, the hypothesis that the understanding of quantitative decision-making methods depends on business size cannot be unequivocally confirmed.

3.2 The relationship between the share of foreign capital of the company and the use of quantitative methods in managerial decision-making

In the following section, we analysed the relationship between the use of quantitative decision-making methods and the share of foreign capital. The foreign share can be described as an ordinal variable, use as a nominal one. Therefore, we will use Somer's D and Kendall's τ_c and gamma for symmetric measures for evaluation.

Table 7 The relationship between the share of foreign capital in the company and the use of quantitative methods

		VALUE	ASYMPTOTIC STANDARD ERROR ^A	APPROXIMATE T ^B	APPROXIMATE SIGNIFICANCE
Somers' D	Symmetric	0.092	0.087	1.041	0.298
	Foreign share - Dependent	0.077	0.074	1.041	0.298
	Using- Dependent	0.113	0.107	1.041	0.298
Kendall's τ_c		0.076	0.073	1.041	0.298
Gamma		0.224	0.209	1.041	0.298
A. Not assuming the null hypothesis.					
B. Using the asymptotic standard error assuming the null hypothesis.					

(Source: own calculation)

As we can see from Table 7, the degree of dependence on the use of methods on the foreign share is 0.113, this can be described as low to medium dependence. The same interpretation is obtained using the gamma coefficient of symmetric measures. However, Kendall's τ_c speaks only of trivial addiction.

When measuring the strength of the correlation of the share of foreign capital and understanding the quantitative methods, we arrived at a value of -0.025 when evaluating the directional measures. This speaks to the trivial to reapply the connection of these two quantities. When evaluating symmetric measures, we arrive at the same results using a Kendall τ_c value of -0.014 and a Gamma of -0.036. Again, this is trivial with no addiction. The results are shown in Table 8.

Table 8 The relationship between the share of foreign capital in the company and the understanding of quantitative methods

		VALUE	ASYMPTOTIC STANDARD ERROR ^A	APPROXIMATE T ^B	APPROXIMATE SIGNIFICANCE
Somers' D	Symmetric	-0.018	0.123	-0.147	0.883
	Foreign share - Dependent	-0.014	0.095	-0.147	0.883
	Understanding - Dependent	-0.025	0.172	-0.147	0.883
Kendall's τ_c		-0.014	0.098	-0.147	0.883
Gamma		-0.036	0.249	-0.147	0.883
N of Valid Cases		54			

- A. Not assuming the null hypothesis.
- B. Using the asymptotic standard error assuming the null hypothesis.

(Source: own calculation)

3.3 The relationship between the company's sector of activity and the use of quantitative methods in managerial decision-making

The relationship between the company's sector of activity and the use of quantitative methods has not been confirmed. There is no dependency here. We have now measured this dependence using χ^2 , as this is a comparison of two nominal variables and the coefficient is suitable. The results are shown in Table 9.

Table 9 The relationship between the business sector and the use of quantitative methods

	VALUE	df	ASYMPTOTIC SIGNIFICANCE (2-SIDED)
Pearson χ^2	5,188 ^A	3	0,159
Likelihood Ratio	5,203	3	0,158
N of Valid Cases	124		
A. 3 cells (37,5%) have an expected count less than 5. The minimum expected count is 3,05.			

(Source: own calculation)

However, to evaluate the strength of the association, it is necessary to express other coefficients. Therefore, Lambda coefficients were calculated as directional measures and Cramer's V as symmetric measures. The results are in Table 10. If we talk about the use of methods as a dependent variable, then we achieve a low to medium degree of association, this is also confirmed by Cramer's V.

Table 10 The relationship between the business sector and the use of quantitative methods

		VALUE	ASYMPTOTIC STANDARD ERROR	APPROXIMATE T	APPROXIMATE SIGNIFICANCE
λ_{XY}	Symmetric	0.061	0.060	0.977	0.329
	Sector - Dependent	0.000	0.000	-	-
	Using - Dependent	0.111	0.108	0.977	0.329
Cramer's V		0.205			0.159
N of Valid Cases		124			

(Source: own calculation)

Similarly, when evaluating the dependence on understanding the methods of quantitative decision-making and the sector of activity, we find very little dependence. According to the directional measures of Lambda, the dependence on the limit of low to medium dependence and trivial to none. However, Cramer's V evaluates the dependence as low to medium. Therefore, little dependence on the business sector can be expected to exist. However, because it is a nominal variable, its direction cannot be determined. The results are shown in Table 11.

Table 11 The relationship between the business sector and an understanding of quantitative methods

		VALUE	ASYMPTOTIC STANDARD ERROR ^A	APPROXIMATE T ^B	APPROXIMATE SIGNIFICANCE
λ_{XY}	Symmetric	0.086	0.079	1.053	0.292
	sector - Dependent	0.042	0.041	1.009	0.313
	Understanding - Dependent	0.118	0.130	0.859	0.391
Cramer's V		0.297			0.285
	N of Valid Cases	54			
A. Not assuming the null hypothesis. B. Using the asymptotic standard error assuming the null hypothesis. C. Based on chi-square approximation					

(Source: own calculation)

The reasons for not using quantitative methods were further analysed. The results are shown in Table 12.

Table 12 Reasons for not using quantitative methods in business practice

The methods are too academic and often their use in business practice is unrealistic due to their complexity.	27
We do not have a worker who would apply the methods in practice. I do not consider outsourcing within these methods due to the high price of these services.	22
I don't have time to quantitatively evaluate my data.	18
We do not have a worker who would apply the methods in practice. I do not consider outsourcing within these methods due to my reluctance to provide data to strangers.	12
These methods seem unnecessary and useless to business.	8
I am not interested in learning to interpret new methods and procedures.	5
The results of the methods are incomprehensible and complex.	3

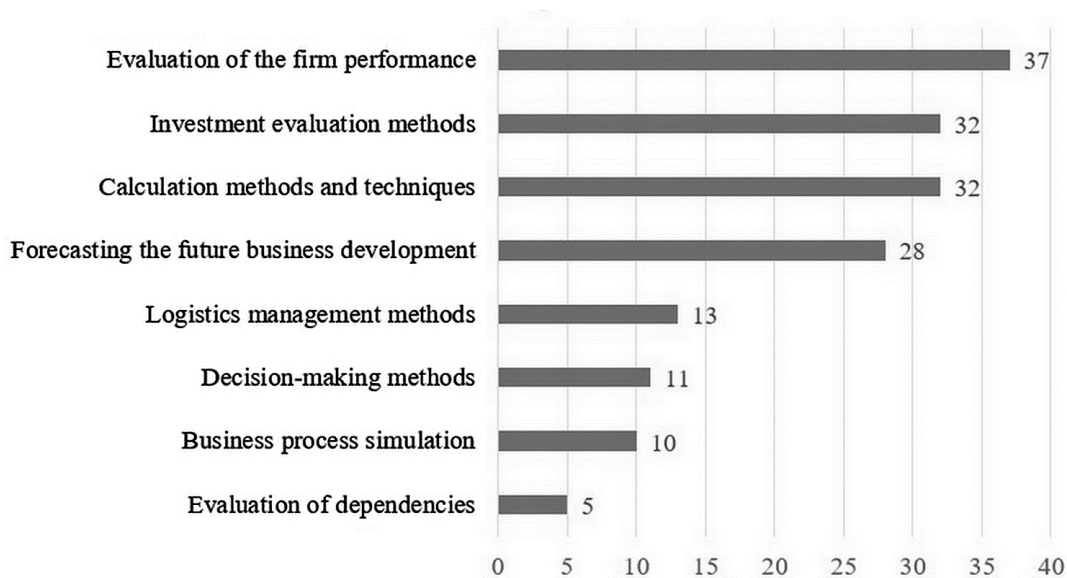
(Source: own calculation)

From the result of the question on the reasons for not using quantitative methods in business practice, the largest number of respondents answered that the methods are too academic and often their use in business practice is unrealistic due to their complexity. This finding is consistent with Zellner's (2001) requirement to keep it simply sophisticated. And in line with the efforts of the companies themselves to develop quantitative evaluation software with simple input and interpretation (Taylor & Letham, 2018). However, only a minimal number of respondents are not willing to learn to interpret new methods and procedures. It is therefore clear that respondents are willing to learn new procedures and methods. However, current methods of quantitative research in academia seem unrealistic to them due to their complexity in business practice.

3.4 Quantitative methods used in business practice

Respondents were asked which of the quantitative methods they used. That is the exact question: Which of these more complex methods would you be able to imagine the use in business practice, or do you already use them. The results of the survey are shown in Figure 1.

Figure 1 Quantitative methods used in business practice

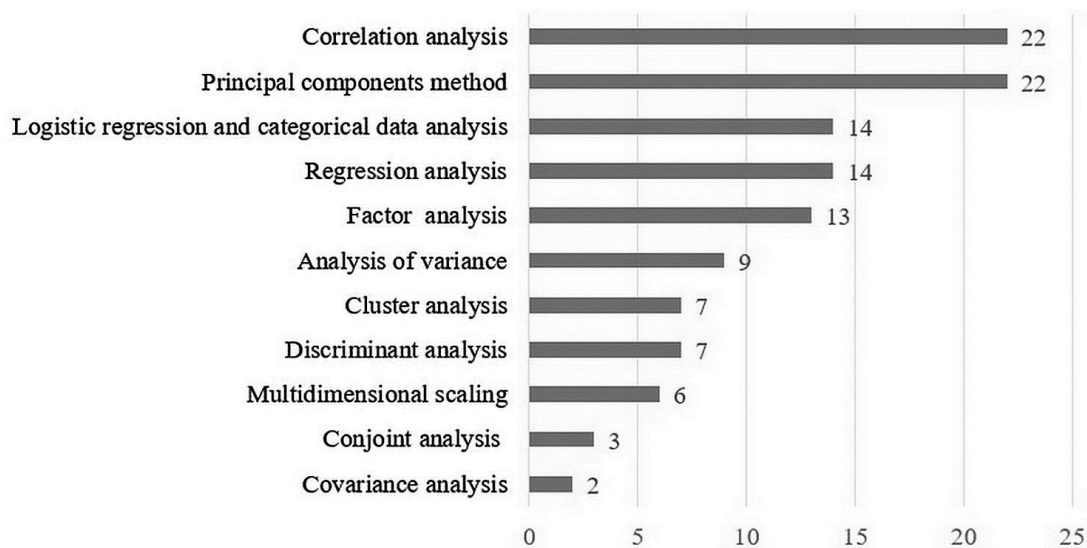


(Source: own calculation)

The results of this survey revealed the fact that the most used methods of evaluation of firm performance. The same number of respondents (32) identified investment evaluation methods and calculation methods and techniques as the second most used method in the company. 28 respondents identified forecasting future business development as another of the methods used. Other quantitative methods, namely decision support for managers (multicriteria decision-making methods, DEA, etc.), business process simulation, logistics management methods, and evaluation of dependencies (regression modelling, correlation coefficients, etc.) are only marginal.

After the question of which of the methods you use, the question was asked: Which of these more complex quantitative methods would you be able to imagine the use in business practice, or do you already use them? In this question, relatively complex methods were deliberately inserted as answers, often used only in scientific studies and texts, see Figure 2.

Figure 2 More complex quantitative methods that companies could use in practice.



(Source: own calculation)

These methods were intentionally relatively complex nevertheless, as the methods that companies can imagine that the use was the most often chosen method, principal components method and correlation analysis. Furthermore, respondents consider using regression analysis, logistic regression and categorical data analysis, factor analysis. Quantitative methods that did not identify even 10 respondents included analysis of variance, discriminant analysis, cluster analysis, multidimensional scaling, conjoint analysis and covariance analysis.

3.5 Scientific potential of quantitative methods

The second research question is what are the reasons for not using quantitative methods in practice. Again in relation to the size of the company, foreign share and difference of the business sector. And what is the understanding of these methods by entrepreneurs and managers.

Regarding the understanding of the results, 20(37%) of respondents always understood the results. In addition, 20(37%) stated that the basic outputs were small, some easily understood from the accompanying materials. On the contrary, only 1(2%) did not understand any results and left the interpretation to experts. 3(6%) respondents said, that the results were often incomprehensible. 10(19%) said, that always understood the basic outputs, some I understood using other materials.

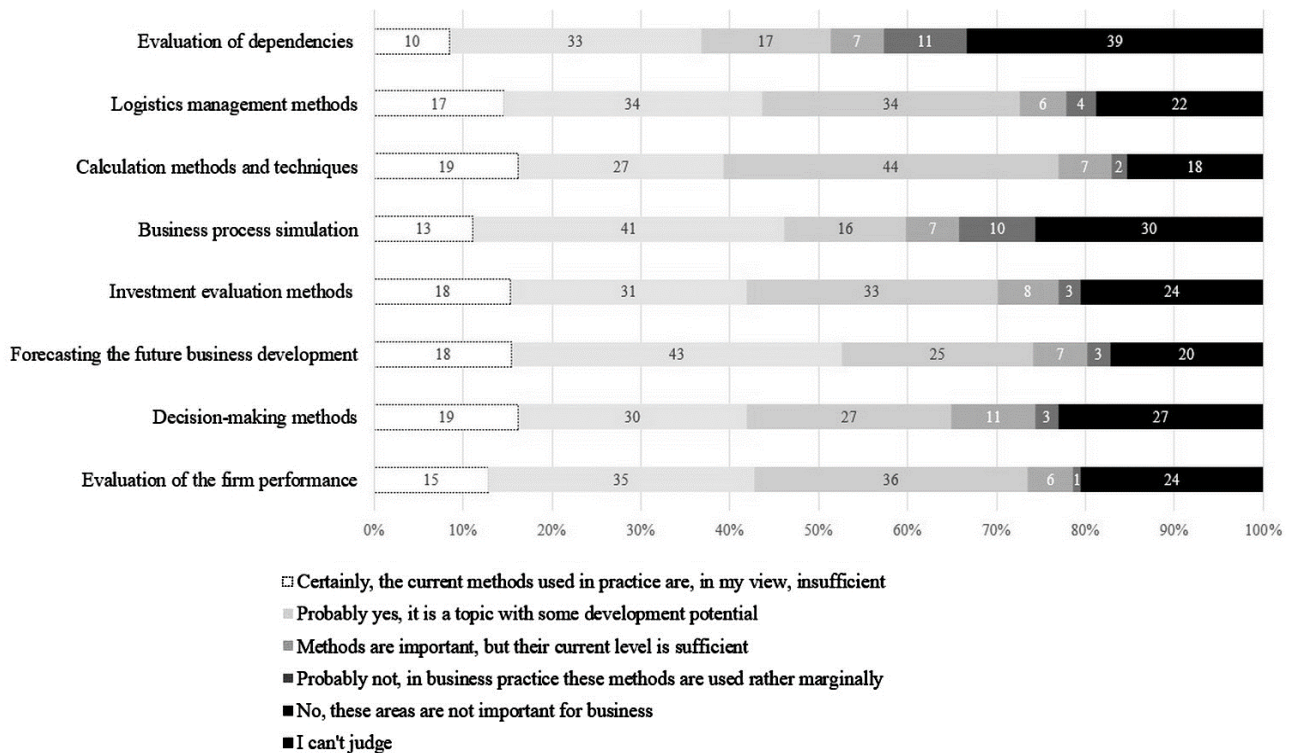
The third and main research question is what methods companies require to submit to scientific research. That is, which methods according to practice have the greatest scientific potential and should be dealt with by research institutions.

In the study, the respondents were also asked the question: Which areas of the business should be subject to clarification and deeper scientific interpretation. The greatest scientific potential can be seen in these methods, see Figure 3.

It is clear from the graphical expression that in assessing the importance and defining positive answers (certainly yes, and probably yes), the area of forecasting business variables has the greatest potential. The following are simulation methods and logistics management methods. On the contrary, the respondent evaluates the methods and techniques of calculation and evaluation of the financial health of the company as sophisticated but their current level is sufficient. In the case of quantitative methods for assessing

additions, respondents from companies were most often identified as methods that they cannot infer and at the same time as methods that are the least important for business.

Figure 3 Scientific potential of quantitative methods - methods that according to business managers should be subjected to a deeper scientific interpretation.



(Source: own calculation)

If we evaluate from the other side of the spectrum of scientific potential, the least necessary methods, according to the respondents, are the evaluation of dependencies, then simulation. Other methods are similar in terms of negative need assessment.

4 DISCUSSION

The paper evaluated the use of quantitative methods in companies as an innovation potential. These were divided according to size, region of activity, share of foreign capital, and business sector. Based on data collected in the first quarter of 2021, the measures of dependence on individual quantities were evaluated. From the results described in the previous chapters, the dependencies listed in Table 13 were found.

It is clear that the use of quantitative methods depends on business size. At the same time, larger enterprises use quantitative methods more than small enterprises.

Furthermore, they examined the detailing of the methods used by companies, which, according to respondents from among entrepreneurs or members of management, should be subjected to clarification and deeper interpretation. This is hardly the result of a study, and research in business economics should focus more on these methods. In their practice, companies use the evaluation of the firm's performance and investment evaluation methods, and calculation methods and techniques the most. However, according to the respondents, these methods are not among those that should be subjected to deeper

scientific research, and developed in academia. Respondents usually use these methods but consider their level of scientific knowledge to be sufficient. According to companies, these methods are sufficient and their scientific deepening would not lead to the support of innovation in companies.

Table 13 Relationship between business parameters and the use and understanding of quantitative methods.

	BUSINESS SIZE	SHARE OF FOREIGN CAPITAL	BUSINESS SECTOR
Use of quantitative methods	Dependence medium	Dependence low	Dependence low to medium
Understanding quantitative methods	Dependence trivial to none	Dependence trivial to none	Dependence low to medium

(Source: own calculation)

On the contrary, methods for forecasting business variables were identified as methods that would be appropriate to develop. The following are simulation methods, and logistics management methods. For such focused methods, an increasingly strong use can be expected in the future, as there will be enough input data from computers systems to specify future developments. Principal components method and correlation analysis were identified as methods that companies could imagine using. The further scientific development of these methods may directly depend on innovation in enterprises and on the ability of enterprises to manage their innovation potential.

The development of all methods with great scientific potential for companies is based on more significant development of computer technology. It is obvious that future developments in quantitative methods and innovation in business practice will have to be more strongly associated with building data governance within the entire organization. Wider application of information technologies, reengineering of processes, provision of suitable organizational structures, and overall IT / business alignment can be a way to ensure a qualitatively higher level of innovation also in the context of the use of quantitative methods in the management of the organization.

On the other hand, as the most common reason for not using quantitative methods, respondents answered: "Methods are too academic, and often their use in business practice is unrealistic due to their complexity." This testifies to the fact that the development of computer technology and software products to support managerial decision-making must go the way of simplicity of output and ease of interpretation. These findings are consistent with the already existing concept of KISS (Zellner et al., 2001). It also supports certain efforts to eliminate quantitative methods in business practice according to researchers such as Ludwig von Mises, Rothbard Murray or Tomáš Sedláček (2017).

It turns out that on the one hand there is a rapid development of technologies that produce more and more data, on the other hand, the ability to adapt to emerging systems, and the ability to make sufficient use of data for the development of innovation opportunities in companies.

It is now up to the scientific community not to push quantitative methods into the background but to provide businesses with models, methods, and software tools so user-friendly that they provide relevant information for innovation in businesses, without extreme demand on the knowledge and statistical knowledge of managers, and entrepreneurs.

CONCLUSION

The study was based on a questionnaire survey, which was conducted in the period February - to June 2021. The survey was conducted using a structured electronic questionnaire. A total of 3150 companies were sent. One hundred twenty-four companies responded to the questionnaire.

The study aimed to identify quantitative methods in which companies require more scientific development, especially to support the innovation potential in companies.

The first research question is whether companies use quantitative methods and what methods. Also, whether there is any relationship between the size of the company, the foreign share, the difference in the business sector, and the use of quantitative methods.

The second research question is what are the reasons for not using quantitative methods in practice. Again concerning the company's size, foreign share, and business sector differences. Moreover, what is the understanding of these methods by entrepreneurs and managers?

The third and main research question is what methods companies require to submit to scientific research. That is, which methods, according to practice, have the most incredible scientific potential and should be dealt with by research institutions.

The questions were analysed based on dependencies. It was found that the use of quantitative methods is most dependent on the size of the company and the sector in which it operates. On the contrary, no dependence was found between the understanding of quantitative methods, the company's size, and the foreign share. The use of quantitative methods and the share of foreign capital contains a low dependency.

The study's main goal was to find areas of economic scientific research where companies require more scientific support and research. Among the methods for which companies require more profound scientific research were, in particular, the forecasting of company variables. The following are simulation methods and logistics management methods.

Scientific research in business economics has a large potential with the development of computer technology. Quantitative methods can be significant support in the managerial discussion. Research on quantitative methods for innovation in business practice is a huge challenge for economic research institutions.

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