ADVANTAGES AND SUITABILITY OF ACTIVITY-BASED COSTING: A STUDY FROM ENGINEERING INDUSTRY

Hudáková Stašová, L.

Lenka Hudáková Stašová / Technical University of Košice, Faculty of Economics, Department of Finance, Němcovej 32, 040 01 Košice, Slovakia. Email: lenka.hudakova.stasova@tuke.sk

Abstract

The objective of the paper is to assess the advantages and disadvantages of costing methods for companies in the engineering sector. We compare traditional costing methods (absorption costing and marginal costing) with the activity-based costing (ABC) method. The analysis is carried out in Slovakia and Czechia. We examine the reasons for the transition to the ABC method and also the reasons for continuing to use the traditional marginal costing method. For statistical analysis, we use the chi-squared test, the chi-squared data distribution test, the Wilcoxon paired test and the Mann-Whitney U-test for two independent selections. We use each of these tests for the individual hypotheses and research questions in accordance with the nature of the specific data appearing under the given hypothesis or research question. Slovak companies are statistically significantly more likely to perceive doubts about the suitability of the ABC method as its disadvantage compared to Czech ones. In the end, proposals for business practice are presented.

Implications for Central European audience: Managers of engineering companies are aware of the role and importance of costing, but they usually do not pay enough attention to the actual compilation and monitoring of costing. We analyse a selected sample of Slovak and Czech companies, but our conclusions and proposals can be generalized and applied in other Central European countries, which have similar political and economic environments, culture and history.

Keywords: traditional costing method; activity-based costing (ABC); mechanical engineering industry

JEL Classification: M21, M41

Introduction

Ever-increasing competition due to market globalization has forced industries to change their design and production strategies. It is therefore important to estimate and optimise costs at the earliest possible stage, as any subsequent changes will negatively affect efforts at reengineering and delivery times (Campi et al., 2021). In a globalised and highly competitive business environment, dynamic and accurate cost accounting information has become vital for promoting efficient planning and decision-making (Jassem, 2019). In response to

increasing technological changes due to the spread of globalization, there has been a number of innovations in management accounting (Yazdifar et al., 2019). The most intensively used strategic management accounting techniques are strategic planning and budgeting, customer accounting and target calculations (Petera & Šoljaková, 2020). Product and service costing is a process of great importance for businesses to develop their pricing policy but also to control the cost of their products or services. It is a reliable tool for evaluating the company's existing and future operational plans (Kartalis et al., 2019).
The paper focuses on an analysis of costing methods used by companies in the engineering sector. We compare the traditional costing method (marginal costing) with the activity-based costing method. The analysis is carried out in Slovakia and Czechia.
After the introduction, there is a literature review followed by a methodology explanation. The main part of the article is the section Results and Discussion, which contains research results from a survey of the costing methods used by companies in the engineering industry. The obtained data are analysed, and the established hypotheses are evaluated. In conclusion, the results are summarized, and proposals for business practice are presented.

1 Literature Review

The issue of costing in engineering companies is one of the key factors behind the intensive growth in conditions of uncertainty and the transition to innovative developments. Such changes require the structure and economic content of the costs of engineering products to be monitored in order to draw up proposals to reduce production costs. It is essential for management to detect the key cost elements causing increases in the production costs of engineering production. It is important to focus on identifying internal reserves to reduce production costs and create a further basis for stimulating the implementation of innovative projects in the development of engineering (Sunteev & Tikhonov, 2019).

Costs and determining them play a decisive role in all production companies. The traditional cost system has been criticised for the arbitrary allocation of indirect production costs (Vedernikova et al., 2020). Traditional accounting systems that provide variable and fixed cost information without an adequate overview of how resources are used do not provide sufficient information for decision-makers to enable them to streamline the organization's value chain. With the advent of relatively newer accounting systems, it is possible for managers to track resource cost flows with perfect accuracy (Jassem, 2019).

The aim of ABC implementation is to increase the accuracy of the costing and accounting of costs. These are the main characteristics of the ABC systems used by large companies (Kartalis et al., 2021).

ABC is an effective technique to improve the quality of services provided and the complexity of the processes of some companies. It is one of the costing approaches that eliminate the inaccuracies and shortcomings of the traditional costing system. Compared to other costing methods, there is a significant change, in particular, in how indirect cost units are assigned to activities based on actual causes and, consequently, the allocation of activities to the cost items themselves according to the intensity of their consumption. In addition, this approach enables decision-makers to identify a specific cost item in terms of determining how it can be managed (Stopka et al., 2021).

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Before a company's decision to implement an ABC system, it is important to examine the suitability of ABC to examine the impact and results of the adoption of ABC (Aljabr, 2021).

The acceptance and use of accounting information systems have been studied by many researchers in recent years. Research in this area focuses mainly on the suitability of adopting new methods, usefulness of systems, ease of use and many other factors that influence acceptance. The acceptance of an ABC information system in a company depends to a large extent on the amount of familiarization of users with the benefits brought by the system, not expected ones. Companies that set up a new accounting information system may encounter a degree of resistance. It is therefore necessary to raise the profile of the benefits of implementing the system for all departments in order for users to accept the system and maximise the benefits of its use (Al-Dhubaibi, 2021).

The implementation of ABC demonstrates a positive and important role in improving company performance. Promoting ABC implementation can help manufacturing companies develop steadily and sustainably and continuously improve their position and performance. It is recommended that business managers pay increased attention to the application of modern management methods, including ABC. In addition, business managers should pay close attention to environmental uncertainties caused by suppliers, competitors, customers and other factors. All these uncertainties affect the company performance through their impact on the implementation of ABC, which in turn has an impact on company performance (Pham et al., 2021).

The extensive use of ABC for cost analysis, cost strategy and cost assessment directly improves operating performance. It also indirectly improves financial performance. The results are similar for manufacturing and non-manufacturing companies and for large companies and small and medium-sized companies. For the use of ABC to be effective, managers must ensure cooperation of departments and staff involved in the design and implementation of ABC systems (Vetchagool et al., 2020).

Product diversity is considered a significant negative predictor of ABC adoption. Conversely, involvement of accountants and all other users in the design of product costing is a significantly positive factor in the successful implementation of ABC (Mazbayeva, 2022). According to Afonso and Paisana (2009), ABC cost calculation methodology is particularly appropriate to address the complexity and diversity of production. However, ABC systems are still considered a complex and relatively costly method for implementation.

The ABC system is a method of costing that can overcome limitations of traditional costing systems in view of economic and technological developments. In particular, it removes arbitrary and inaccurate allocation of indirect costs due to distortions in attribution of costs. The development of an adequate system of costs in organizations is extremely topical because companies feel the need to properly manage the resources at their disposal and control their costs in order to achieve efficient and economical management (Quesado & Silva, 2021). The ABC methodology is a tool capable of meeting the needs of management information (Makosky & Lopes, 2021), and can help solve problems such as assessing outsourcing options, increasing accountability and improving processes (Gosselin & Journeault, 2021).

Managers must make decisions only on the basis of knowledge of the full costs of the company's activities (Výstupová et al., 2020). Calculation of costs based on activities leads

to increased accuracy in decision making, but implementation costs may be high (Somapa et al., 2012).

Managers usually make rational decisions about the implementation of ABC. If the problems perceived during the implementation are relatively small, the company will adopt ABC. On the other hand, if the company perceives the implementation problems as quite serious, it will reject the implementation (Pietrzak et al., 2020). The application of the ABC system is suitable for determining actual costs and could result in more reasonable and competitive prices on the market. However, there is still resistance to its implementation due to human and technological ignorance (Escobar-Mamani et al., 2021).

Activity-based calculation is key to optimizing the cost structure of businesses (Grill-Kiefer et al., 2022). It is normally understood that many companies in the industry, especially in the SME sector, do their costing in the traditional way without much progress or knowledge of new ways of costing elsewhere. That is why studies focusing on the problems of implementing the ABC system in companies in the engineering industry are of great importance (Joseph et al., 2019).

Research suggests that the current traditional approach disrupts the cost structure by choosing a uniform price. The ABC approach provides more accurate cost information to help set a competitive product pricing strategy, which is a major contribution to increasing a company's profitability and competitive strength (Lu et al., 2017).

Much research has been presented on the possibilities of use as well as application of activity-based costing (ABC) in various manufacturing industries and in the service industry. In the field of the engineering industry, there are few studies that examine the application and possibilities of using the ABC method. Therefore, we decided to focus our research in this direction to find out how companies using ABC perceive the benefits of the method in practice, why some companies do not want to implement ABC in practice, and to assess the suitability of the ABC method for engineering companies.

2 Research Methods

The objective of the paper is to assess the advantages and disadvantages of costing methods for companies in the engineering sector. We compare the traditional costing method (absorption or marginal costing) with the activity-based costing method. The analysis is carried out in Slovakia and Czechia. We examine the reasons for transition to the ABC method, but also the reasons for continuing to use the traditional marginal costing method. We find out how the problem of establishing an appropriate costing schedule for traditional methods is perceived. To achieve that goal, we set the following research questions (RQ) and hypotheses (H):

RQ1: Do companies see a static costing schedule as a problem in traditional costing?

RQ2: Do small and large companies use the ABC method in the same way?

RQ3: What benefits has the ABC method brought to companies that have decided to implement it and use it instead of the traditional costing method?

RQ4: Do managers of engineering firms doubt the suitability of the ABC method for their company?

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H1: We expect that there is no statistically significant difference by country in the perception of the problem of determining the appropriate cost allocation base as a disadvantage of traditional costing.

H2: We expect that the rate of use of the traditional method varies statistically significantly in relation to company size.

H3: We expect that statistically significantly, the biggest reason for using the ABC method is the identification of cost intensiveness of activities (in particular, the share of overheads).

H4: We expect that there is a statistically significant difference in the perception of how time demands are a disadvantage of the ABC method by country.

H5: We expect that the most common reason for not using the ABC method is doubts about the suitability of this method for engineering firms and that there is a statistically significant difference by country in the perception of doubts about the appropriateness of the ABC method as its disadvantage.

To collect data from various large engineering companies, we used a questionnaire survey accompanied by information from interviews and relevant published materials.

In the questionnaire, we asked about the types of costing methods that businesses use to calculate costs at present. In companies using the traditional marginal costing method, we examined whether, in practice, they had difficulties in establishing an appropriate cost allocation base or what other disadvantages they experienced in practice.

Where businesses are already using the ABC method in practice, we looked at the advantages it brings them compared to the traditional marginal costing method used previously: identification of cost intensiveness, in particular, the proportion of overheads; more efficient cost management (real valuation of activities and cost structures); a more logical, targeted division of overheads into activities (clarification of economic efficiency of processes); an indication of causes of costs incurred; process costing – better monthly product costing and evaluation of efficiency; increased attention to the management of ancillary and service processes and activities; elimination of activities that do not create value for the company; more precise price calculations; monthly evaluation of profit and economic added value by client and product.

In engineering companies that do not use the ABC method, we asked about the causes of non-use: lack of knowledge of the activity-based costing method; the need to reorganise the company before implementation; a presumption of the project implementation being highly time-consuming; expensive application of the method; lack of competent staff; managers' doubts about the value of the project to the company; the method being too complex/difficult to understand.

The questionnaire was sent to companies in the engineering industry with NACE codes C28, C29 and C30, as industrial production is classified under section C of SK NACE and CZ NACE. A total of 2054 companies were contacted by e-mail. We obtained data from 68 Slovak and 53 Czech companies. We ranked the companies into different sizes according to the number of employees (micro, small, medium-sized and large enterprises). Tables 1 and 2 show the distribution of enterprises by size and type. The representativeness of the sample is verified by the chi-square test, which included enterprises by type, separately for both

countries (Tables 3 - 6). The selected analysed sample is representative, it reflects the characteristics of the entire selected sector (statistical set, population), and all types of business companies are proportionally represented. The sample chosen in this way reflects the characteristics of the engineering industry.

Table 1 | Numbers of engineering enterprises by size

Enterprises	Population		Questionnaires sent		Sample	
	SK	CZ	SK	CZ	SK	CZ
Micro-enterprises (up to 10 employees)	723	2781	270	352	11	13
Small businesses (11 – 50 employees)	506	1910	250	384	24	19
Medium businesses (51 – 250 employees)	453	548	235	250	25	14
Large companies (over 250 employees)	223	620	95	218	8	7
Total	1905	5859	850	1204	68	53

Source: own elaboration based on data from FinStat (2022)

Table 2 | Numbers of engineering enterprises by type

Enterprises	Population		Questionnaires sent		Sample	
	SK	CZ	SK	CZ	SK	CZ
Joint stock company	176	518	57	251	6	5
Limited liability company	1647	5072	779	942	59	46
Cooperative	19	42	5	0	1	0
State enterprise	6	18	0	0	0	0
Limited partnership	8	0	0	0	0	0
Public trading company	3	68	0	5	0	1
Foreign company	45	0	9	0	2	0
Spin-off plant	0	139	0	6	0	1
Corporation	1	2	0	0	0	0
Total	1905	5859	850	1204	68	53

Source: own elaboration based on data from FinStat (2022)

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Table 3 | Cross tabulation of company * type (Slovakia)

Company * Type			Type		
			Population	Choice	Total
Company	1	Count	176	6	182
		Expected count	175.7	6.3	182.0
	2	Count	1647	59	1706
		Expected count	1647.2	58.8	1706.0
	3	Count	19	1	20
		Expected count	19.3	0.7	20.0
	4	Count	6	0	6
		Expected count	5.8	0.2	6.0
	5	Count	8	0	8
		Expected count	7.7	0.3	8.0
	6	Count	3	0	3
		Expected count	2.9	0.1	3.0
	7	Count	45	2.	47
		Expected count	45.4	1.6	47.0
	9	Count	1	0	1
		Expected count	1.0	0.0	1.0
Total		Count	1905	68	1973
		Expected count	1905.0	68.0	1973.0

Source: own elaboration

Table 4 | Cross tabulation of company * type (Czechia)

Company * Type			Type		
			Population	Choice	Total
Company	**1**	**Count**	518	5	523
		Expected count	518.3	4.7	523.0
	2	**Count**	5072	46	5118
		Expected count	5072.1	45.9	5118.0
	3	**Count**	42	0	42
		Expected count	41.6	0.4	42.0
	4	**Count**	18	0	18
		Expected count	17.8	0.2	18.0
	6	**Count**	68	1	69
		Expected count	68.4	0.6	69.0
	8	**Count**	139	1	140
		Expected count	138.7	1.3	140.0
	9	**Count**	2	0	2
		Expected count	2.0	0.0	2.0
Total		**Count**	5859	53	5912
		Expected count	5859.0	53.0	5912.0

Source: own elaboration

Table 5 | Chi-square tests (Slovakia)

Indicator	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)	Point probability
Pearson chi-square	0.893[a]	7	0.996	**1.000**		
Likelihood ratio	1.490	7	0.983	1.000		
Fisher-Freeman-Halton exact test	3.572			0.878		
Linear-by-linear association	0.007[b]	1	0.935	0.945	0.461	0.053
N of valid cases	1973.000					

a. 8 cells (50.0%) have an expected count lower than 5. The minimum expected count is 0.03.
b. The standardized statistic is 0.082.

Source: own elaboration

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Table 6 | Chi-square tests (Czechia)

Indicator	Value	df	Asymptotic significance (2-sided)	Exact sig. (2-sided)	Exact sig. (1-sided)	Point probability
Pearson chi-square	0.872[a]	6	0.990	**1.000**		
Likelihood ratio	1.394	6	0.966	0.995		
Fisher-Freeman-Halton exact test	3.403			0.857		
Linear-by-linear association	0.022[b]	1	0.883	0.902	0.507	0.049
N of valid cases	5912.000					

a. 7 cells (50.0%) have an expected count lower than 5. The minimum expected count is 0.02.
b. The standardized statistic is -0.147.

Source: own elaboration

For the statistical analysis, given the established hypotheses and research questions and the nature of the data, we used the chi-squared test, the chi-squared data distribution test, the Wilcoxon paired test and the Mann-Whitney U-test for two independent selections. We used each of these tests for individual hypotheses and research questions in accordance with the nature of the specific data appearing in a given hypothesis or research question. We carried out the statistical analysis in the SPSS 22 programme.

3 Results and Discussion

The analysed sample consisted of 121 companies in the engineering sector (Table 7): 68 companies from Slovakia (56.2%) and 53 companies from Czechia (43.8% of the sample).

Table 7 | Distribution of analysed sample of enterprises by country

Country	Frequency	Percentage
Slovakia	68	56.2
Czechia	53	43.8
Total	121	100.0

Source: own elaboration

Table 8 | Distribution of analysed sample of enterprises by business size

Company size	Frequency	Percentage
Micro-enterprises	24	19.8
Small businesses	43	35.5
Medium businesses	39	32.2
Large companies	15	12.4
Total	121	100.0

Source: own elaboration

The largest group in the sample in terms of company size was small companies, which accounted for 35.5% of the sample. Conversely, the group with the fewest members was large companies, which made up only 12.4% of the sample (Table 8).

The analysis showed that up to 48% of engineering companies use the traditional marginal costing method in Slovakia. In Czechia, it is 30% of all the engineering companies.

The most serious problem with the traditional marginal method of compiling costing is finding a suitable cost allocation base. The cost allocation bases should be objective, easily detectable, controllable and comparable in terms of costing over each period in terms of scope and type. They should be large enough and be as close as possible to the indirect costs allocated in terms of the extent and changes in indirect costs so that a small error in the base does not cause major decision-making errors. We therefore looked at how engineering companies perceive problems in determining such a base.

H1 *We expect that, with regard to the country, there is no statistically significant difference in the perception of the problem of determining the appropriate cost allocation base as a disadvantage of the traditional method.*

Table 9 | Problem determining suitable schedule base as a disadvantage of traditional costing

Country	Answer	Frequency	Percentage	Country	Answer	Frequency	Percentage
Slovakia	Definitely not	15	31.3	**Czechia**	Rather not	9	29.0
	Rather not	8	16.7				
	Rather yes	10	20.8		Rather yes	10	32.3
	Certainly yes	15	31.3		Certainly yes	12	38.7
	Total	48	100.0		Total	31	100.0

Source: own elaboration

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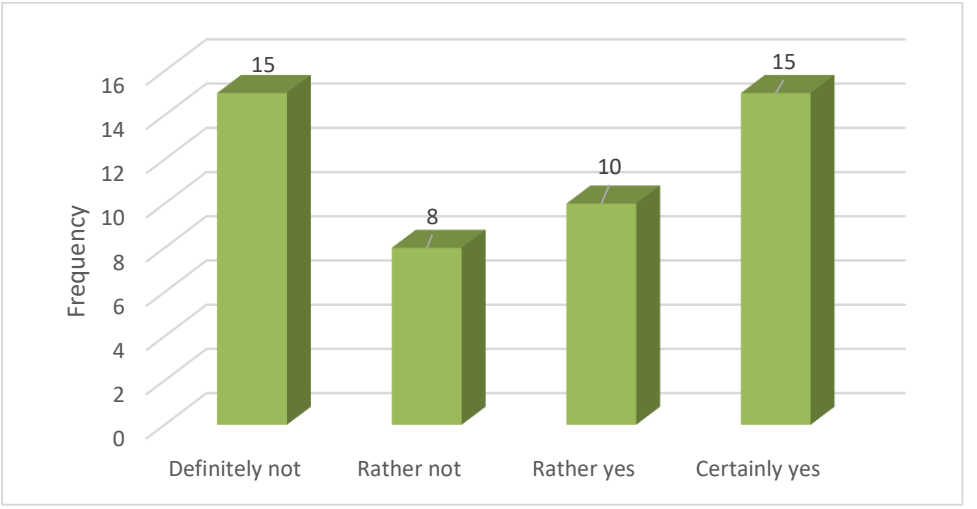
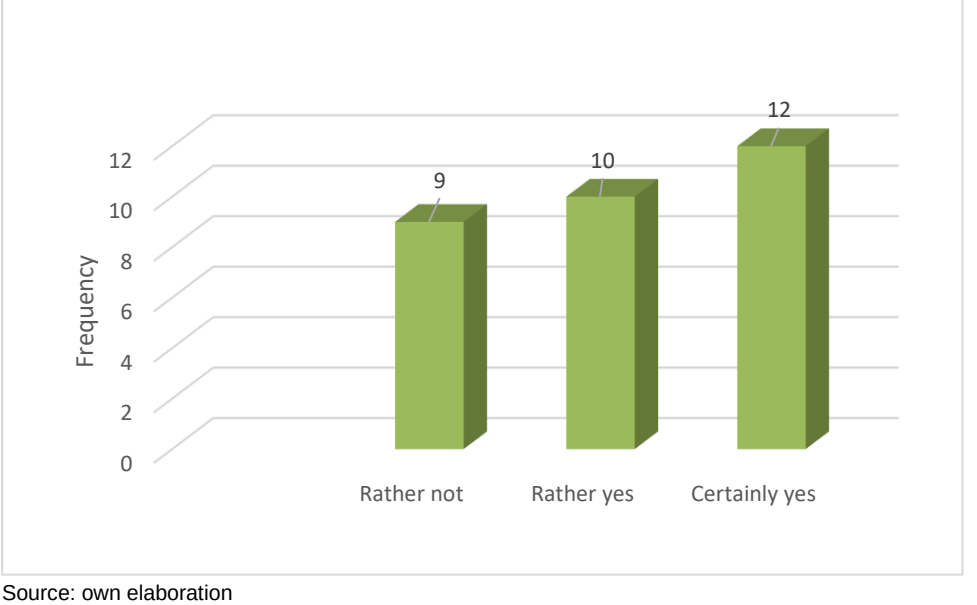
Figure 1 | Problem determining suitable schedule base as a disadvantage of traditional costing in Slovakia



Source: own elaboration

Figure 2 | Problem determining suitable schedule base as a disadvantage of traditional costing in Czechia



Source: own elaboration

Based on the results presented in Table 9 and Figures 1 and 2, it can be observed that in terms of perception of the problem of determining the appropriate cost allocation base as a disadvantage of the traditional method, most Slovak companies replied “Definitely not” or “Certainly yes”, making up 31.3% of their group. On the other hand, Czech companies most often replied “Certainly yes”, namely 38.7% of their group.

In order to correctly select the test for Hypothesis 1, it is necessary to test the normality of the distribution of the variables that will be represented in the sample, that is, whether the test data have a distribution following a Gaussian curve or not. However, in this case, the variable ”Problem determining appropriate cost allocation base as a disadvantage of traditional costing” does not correspond to a continuous variable, and therefore we will automatically use a non-parametric test.

For Hypothesis 1, we examined whether there was a statistically significant difference in the perception of the problem of determining the appropriate cost allocation base as a disadvantage of the traditional method in relation to the company's country of operation. To analyse the hypothesis, taking into account the nature of the variables, we used the non-parametric Mann-Whitney U-test for two independent selections.

Table 10 | Mann-Whitney U-test

Country mean rank	N	Mean rank	Mann-Whitney U-test	Problem determining suitable schedule base as a disadvantage of traditional costing
Slovakia	48	35.98	**Mann-Whitney U**	551.000
Czechia	31	46.23	**Wilcoxon W**	1727.000
Total	79		**Z**	-2.012
			Asymp. sig. (2-tailed)	0.044

Source: own elaboration

If in Table 10, the value in the row for Asymp. sig. (2-tailed) is less than 0.05, there is a statistically significant difference between the groups. In our case, the value is 0.044, so we know that there is a statistically significant difference between groups. Then we compare the mean rank values.

The higher value is for companies from Czechia, so we can conclude that there is a statistically significant difference in the perception of the problem of determining the appropriate cost allocation base as a disadvantage of the traditional method, specifically that Czech companies perceive this disadvantage statistically significantly more than Slovak companies.

Hypothesis 1 is not confirmed because we hypothesised that there would be no difference.

H2 *We expect that the rate of use of the traditional method varies statistically significantly in relation to company size.*

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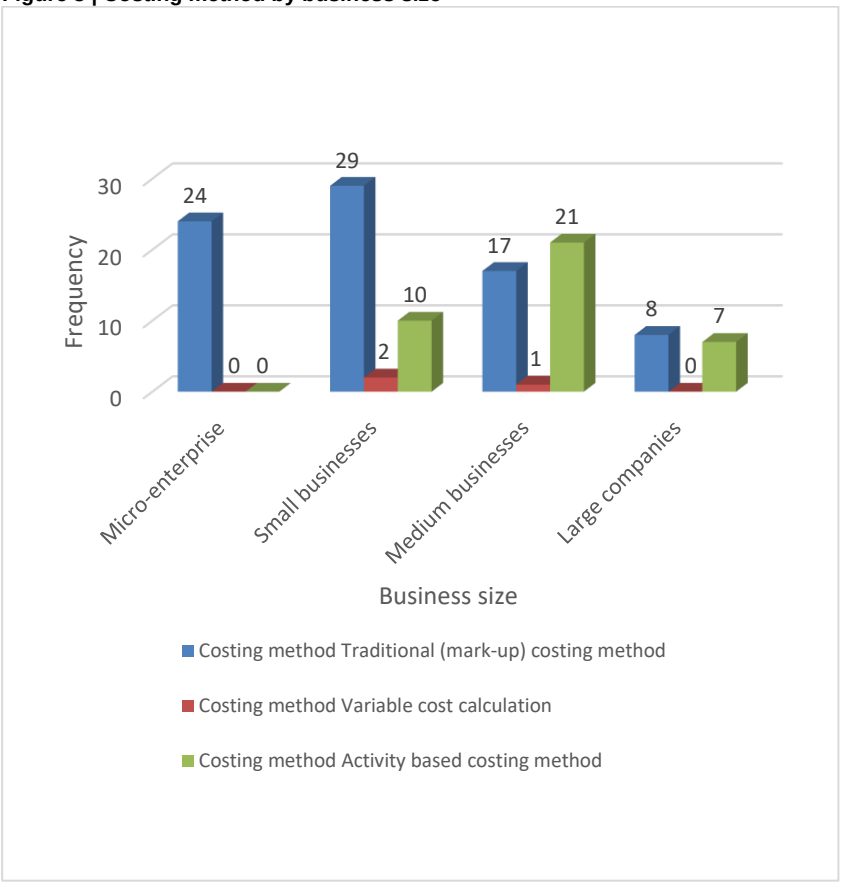
Table 11 | Costing method by business size

		Costing method			
		Traditional (mark-up) costing method	Variable cost calculation	Activity based costing method	Total
Business size	Micro-enterprises	24	0	0	24
	Small businesses	29	2	10	41
	Medium businesses	17	1	21	39
	Large companies	8	0	7	15
	Total	78	3	38	119

Source: own elaboration

Figure 3 | Costing method by business size



Source: own elaboration

According to the results presented in Table 11 and Figure 3, it can be observed that, in terms of using costing methods, medium-sized companies use the ABC method the most. Other companies use predominantly the traditional method. Micro-enterprises do not use any method other than marginal costing.

Based on the nature of the variables, we will use non-parametric tests to test Hypothesis 2.

For Hypothesis 2, we examined whether there was a statistically significant difference in the costing method used in relation to company size. To analyse the hypothesis, after taking into account the nature of the variables, we used the non-parametric chi-squared test.

Table 12 | Chi-square test – costing method

	Value	df	Asymp. sig. (2-sided)
Pearson Chi-square	24,890	6	0.000
Likelihood ratio	32,065	6	0.000
Linear-by-linear association	18,362	1	0.000
N of valid cases	119		

Source: own elaboration

In Table 12, in the row Pearson chi-squared, the value in the column Asymp. sig. (2-sided) is 0.000 (less than 0.05); therefore, we know that there is a statistically significant difference in the costing methods used based on company size. According to the data in Table 11 and Figure 3, we can see that while micro-enterprises do not use the ABC method, it is already being used in larger companies. This is precisely the statistically significant difference that we found.

On the basis of the results presented in Table 12, it can be concluded that the ABC method is used statistically significantly more in small, medium and large enterprises compared to micro-enterprises.

Hypothesis 2 is thus confirmed.

By analysis, we found that 18% of engineering companies in Slovakia use the ABC method. In Czechia, it is even 20%.

H3 *We expect that statistically significantly, the biggest reason for using the ABC method is the identification of cost intensiveness of activities (in particular, the share of overheads).*

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Table 13 | Reasons for not using ABC

Reason	Answer	Frequency	Percentage
Identification of cost intensity, in particular the proportion of overheads	Rather yes	13	34.2
	Certainly yes	25	65.8
	Total	38	100.0
More efficient cost management (real valuation of activities and cost structures)	Rather yes	10	26.3
	Certainly yes	28	73.7
	Total	38	100.0
More logical and targeted division of overheads into activities (clarifying economic efficiency of processes)	Rather yes	28	73.7
	Certainly yes	10	26.3
	Total	38	100.0
Indication of causes of costs	Rather yes	25	65.8
	Certainly yes	13	34.2
	Total	38	100.0
Process-based costing – better monthly final costing of products and evaluation of their effectiveness	Rather yes	16	42.1
	Certainly yes	22	57.9
	Total	38	100.0
Increased attention to management of auxiliary and servicing processes and activities	Rather not	2	5.3
	Rather yes	36	94.7
	Total	38	100.0
Enabling elimination of activities that do not create value for the business	Rather not	10	26.3
	Rather yes	28	73.7
	Total	38	100.0
More precise price calculations	Rather yes	20	52.6
	Certainly yes	18	47.4
	Total	38	100.0
Monthly evaluation of profit and economic value added by clients and products	Rather yes	31	81.6
	Certainly yes	7	18.4
	Total	38	100.0

Source: own elaboration

Based on the results presented in Table 13 and Figures 4 to 12 (in the Appendix), we can observe that most companies consider the reason for using ABC to be that the method enables more efficient cost management. This is how 73.7% of businesses responded.

Based on the nature of the variables, we will use non-parametric tests to test Hypothesis 3.

With Hypothesis 3, we need to discover whether there is a statistically significant difference in the degree of seriousness of the reasons for using the ABC method in companies. To analyse the hypothesis, taking into account the nature of the variables, we used a non-parametric Wilcoxon paired test.

We created 36 pairs using the Wilcoxon paired test (Table 14 in the Appendix). These represent a comparison between pairs. First, we looked at the table on the left and the row for Asymp. sig. (2-tailed). If there is a value lower than 0.05, then we know that there is a statistically significant difference between the reasons in that pair of tables. For example, for the pair "Process-based costing – Points to the cause of the cost incurred", the value is 0.003 and we therefore know that there is a statistically significant difference between the reason for "Process-based costing" and "Points to the cause of incurring costs". We now need to find out the direction. We evaluated the results of the comparisons of the individual variables for this pair. In the row Negative ranks, we find the number (N) of times the first variable (Process-based costing) is a lower value than the second variable (Indicates the cause of the cost). In the row Positive ranks, we find the number (N) of times the first variable (Process-based costing) is a higher value than the second variable (Indicates the cause of the cost). Finally, in the third line, Ties, we find the number of times these values matched. Process-based costing as a reason for using the ABC method were seen as a lesser reason in 0 cases, as a greater reason in 9 cases and in 29 cases equal to "Points to the cause of the costs". On this basis, we found that process-based costing were perceived statistically significantly as a greater reason for using the ABC method compared to "Points to the cause of the costs". We followed the same procedure for all other pairs.

On the basis of the results given in Table 14, it can be concluded that there is no single leading significant reason for using the ABC method.

Hypothesis 3 is therefore not confirmed.

H4 *We expect that there is a statistically significant difference in the perception of time demands as a disadvantage of the ABC method by country.*

Table 15 | Perception of time demands as a disadvantage of ABC method

Country	Answer	Frequency	Percentage	Country	Answer	Frequency	Percentage
Slovakia	Rather yes	12	37.5	Czechia	Rather yes	17	89.5
	Certainly yes	20	62.5		Certainly yes	2	10.5
	Total	32	100.0		Total	19	100.0

Source: own elaboration

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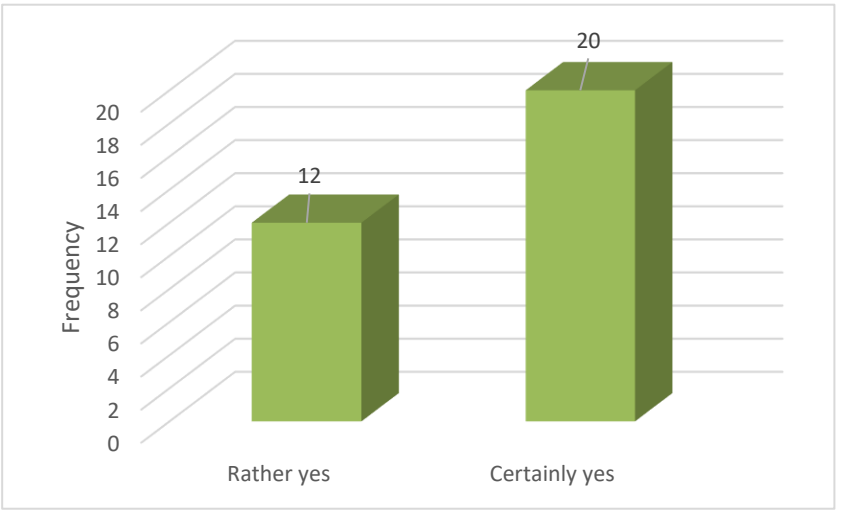
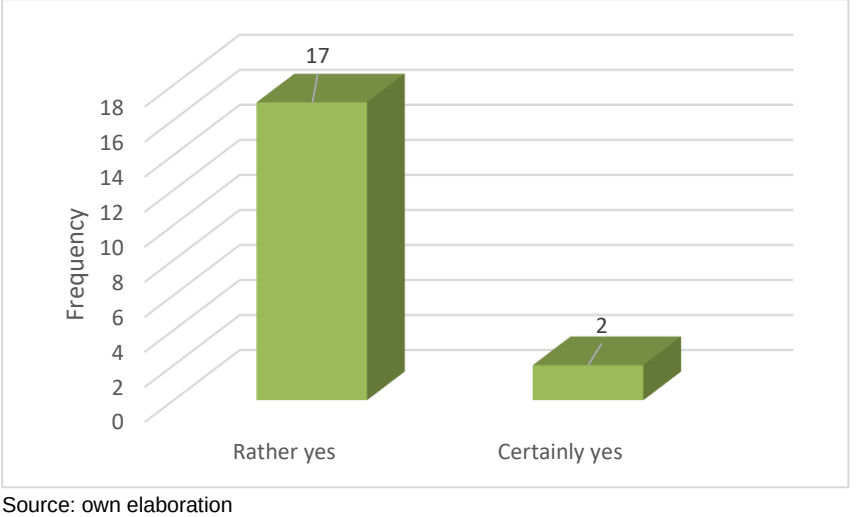
Figure 13 | Assumption of high-time complexity of project implementation as a disadvantage of ABC in Slovakia



Source: own elaboration

Figure 14 | Assumption of high-time complexity of project implementation as a disadvantage of ABC in Czechia



Source: own elaboration

Based on the results presented in Table 15 and Figures 13 and 14, it can be observed that in terms of perception of time demands as a disadvantage of the ABC method, most Slovak companies replied “certainly yes” making up 62.5% of their group. However, Czech companies most often replied “mostly yes” representing 89.5% of their group.

Based on the nature of the variables, we will use non-parametric tests to test Hypothesis 4.

For Hypothesis 4, we examined whether there was a statistically significant difference in the perception of time demands as a disadvantage of the ABC method relative to the country. To analyse the hypothesis, taking into account the nature of the variables, we used the non-parametric Mann-Whitney U-test for two independent selections.

Table 16 | Mann-Whitney U-test – Perception of time demands as a disadvantage of ABC method

Country	N	Mean rank	Mann-Whitney U-test	Perception of time demands as a disadvantage of ABC method
Slovakia	32	30.94	**Mann-Whitney U**	146.000
Czechia	19	17.68	**Wilcoxon W**	336.000
Total	51		**Z**	-3.588

Source: own elaboration

According to the results presented in Table 16, it can be concluded that there is a statistically significant difference in the perception of time demands as a disadvantage of the ABC method, namely that Slovak companies perceive time demands statistically significantly more as a disadvantage of the ABC method compared to Czech ones.

Hypothesis 4 is thus confirmed.

H5 *We expect that there is a statistically significant difference by country in the perception of doubts about the appropriateness of the ABC method as its disadvantage.*

Table 17 | Doubts about suitability of ABC calculation method as a disadvantage of ABC method

Country	Answer	Frequency	Percentage	Country	Answer	Frequency	Percentage
	Rather yes	17	53.1		Rather not	17	89.5
Slovakia	Certainly yes	15	46.9	**Czechia**	Rather yes	2	10.5
	Total	32	100.0		Total	19	100.0

Source: own elaboration

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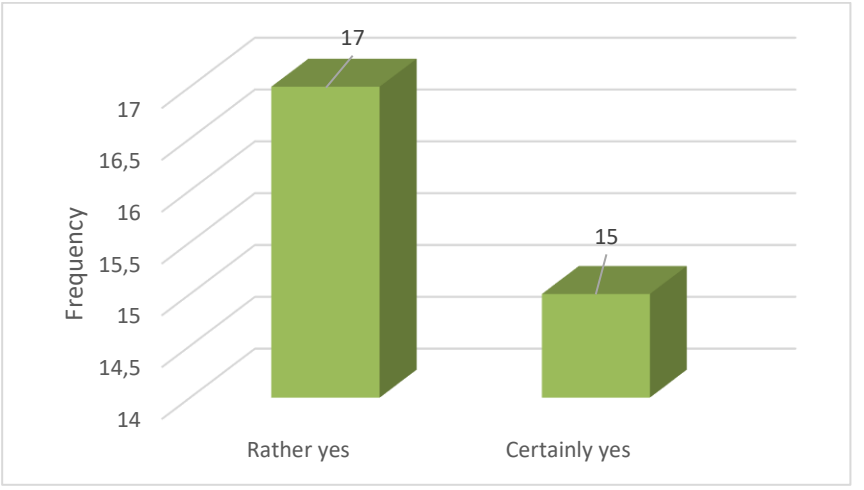
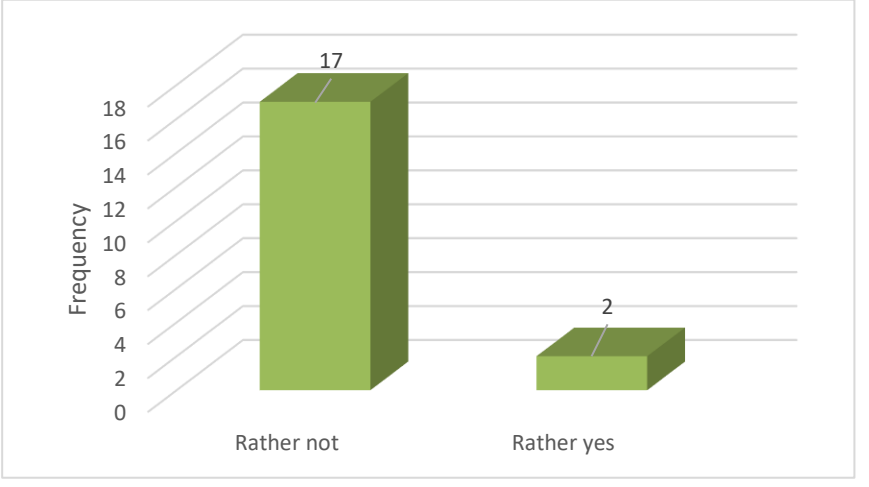
Figure 15 | Assumption of high time complexity of project implementation as a disadvantage of ABC method in Slovakia



Source: own elaboration

Figure 16 | Assumption of high time complexity of project implementation as a disadvantage of ABC method in Czechia



Source: own elaboration

Based on the results presented in Table 17 and Figures 15 and 16, it can be observed that in terms of doubting the appropriateness of the ABC method as its disadvantage, most Slovak companies chose the answer “Mostly yes” making up 53.1% of their group. Czech companies also responded most often with the answer “Mostly yes”, namely 89.5% of their group.

Based on the nature of the variables, we use non-parametric tests to test Hypothesis 5.

For Hypothesis 5, we examined whether there was a statistically significant difference in the perception of doubts about the appropriateness of the ABC method as its disadvantage. To

analyse the hypothesis, taking into account the nature of the variables, we used the non-parametric Mann-Whitney U-test for two independent selections.

Table 18 | Mann-Whitney U-test – Doubts about suitability of ABC calculation method as a disadvantage of ABC method

Country	N	Mean rank	Mann-Whitney U-test	Doubts about suitability of ABC calculation method as a disadvantage of ABC method
Slovakia	32	29.45	**Mann-Whitney U**	193.500
Czechia	19	20.18	**Wilcoxon W**	383.500
Total	51		**Z**	-2.636
			Asymp. sig. (2-tailed)	0.008

Source: own elaboration

The value in the row for Asymp. sig. (2-tailed) in Table 18 is 0.008, which means that there is a statistically significant difference between the groups. The higher value of mean rank is for Slovak companies; they are statistically significantly more mindful of doubts about the suitability of the ABC method as its disadvantage compared to Czech ones.

Hypothesis 5 is hereby confirmed.

A study of the research literature on industrial calculation systems shows that similar studies in other countries also confirm the suitability of the ABC method for the practice of engineering companies (Joseph et al., 2019; Ding et al., 2022). Studies in other industry sectors also point to the benefits of implementing the ABC method in business practice – the automotive industry (Marjanovic et al., 2011), the iron and steel industry (Wu et al., 2014), the food industry (Mazbayeva et al., 2022; Kabinlapata & Sutthachai, 2017), the assembly industry (Vedrenikova et al., 2022), the bicycle parts industry (Lu et al., 2017) and waste management (Jiran et al., 2019).

Based on the studies, it is necessary to focus on benefits of implementing the ABC cost system in industrial enterprises, as well as on problems associated with it. The ABC method is suitable for its ability to calculate overhead costs and generate information that contributes to improving the overall production activity. Studies have shown that this method should not only be used as a way of allocating overheads, i.e., an accounting method, but also as a cost management tool. The basic goal of cost management is to reduce the company's costs and, at the same time, strengthen its strategic position. Cost management answers the question of how to reduce costs while improving the quality of products and services.

The analysis revealed that managers of engineering companies in Slovakia and Czechia have great doubts about the suitability of the ABC method for their companies. However, ABC allows company management to understand what causes costs and how they can be managed. Under this system, a company can gain insight into how effectively it converts its resources into values. ABC provides valuable information about operational processes, intermediate processes and activities, and helps promote competitive advantage. It is therefore a method well suited for the practice of engineering companies.

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On the other hand, it is necessary to draw attention to the time-consuming nature of the method. Engineering companies perceive its time-consuming nature as a significant disadvantage of ABC implementation, as identified by our analysis. This is one of the main disadvantages of the ABC method in general. The time-consuming nature of the method arises because there is no primary record of the necessary data. This fact may mean that the management focuses on obtaining the necessary data on the costs of individual activities rather than improving such activities. Obtaining information represents an additional cost for the organization. However, it is important to realize that ABC helps management understand which products consume the most resources, and therefore this method provides opportunities for informed product and cost decisions. ABC does not reduce production costs and does not reflect material or labour costs; it focuses only on corporate overheads, and the costs of capital are not taken into account.

However, studies have shown the success of this model around the world, and it is undeniable that if business owners and managers start implementing it in their businesses, they will eventually gain a significant competitive advantage over others. This situation will force other companies to take a similar step. Companies that are unwilling to adapt to change will be in financial trouble and will be forced to close down. It follows that the costs and time to implement process management in the company are worth the investment, and the sooner the process is implemented, the more companies will have an advantage over the competition.

Conclusion

Managers of engineering companies are aware of the role and importance of costing, but they usually do not pay enough attention to the actual compilation and monitoring of costing. They rely on the costing values provided by software, and they are not entirely clear about the calculation process. The values obtained are then corrected by empirical experience and anticipated needs. This procedure may result in several errors (assigning costs not related to a given performance, incorrectly selecting a cost allocation base and mechanical application of the same calculation procedures to all performances).

The problem in establishing an appropriate cost allocation base is perceived by Czech companies statistically significantly more than by Slovak ones. Up to 31.3% of companies do not see the problem of determining the appropriate cost allocation base as a disadvantage of the traditional method. However, the same percentage of Slovak companies understand this problem as significant (also 31.3%). On the other hand, 38.7% of Czech companies see determining a cost allocation base as a fundamental problem.

Small and medium-sized companies, in particular, are under increasing pressure to survive in a highly competitive environment. It is these companies that are mostly unable to adopt newer management accounting practices and adapt to changing business scenarios. Our analysis confirmed that there is a stronger interest in using the ABC method in larger businesses.

The reasons why the management of an engineering company decides to implement the ABC system are various. This was confirmed by our analysis. There is no single major reason for using the ABC method. For some businesses, the process-based costing that the ABC method can provide is important. On the other hand, another group of companies prefers

using the ABC method, as it can reveal the exact cause of the costs. Companies also consider the identification of cost intensiveness, in particular the proportion of overheads, to be important. Most companies identified more efficient cost management (real valuation of activities and cost structures) and more accurate price costing as the advantage of the ABC.

A significant drawback of the ABC method is its time demands. This was confirmed in our analysis, and engineering companies see this as a disadvantage. There is a statistically significant difference by country, namely that Slovak companies perceive time demands statistically significantly more as a disadvantage of the ABC method compared to Czech ones. Up to 62.5% of Slovak companies surveyed identified the time demands as a disadvantage.

Using inappropriate costing methods, managers do not have information for flexible pricing decision making because it is not possible to determine from the distorted information which costs will affect the decision. If the manager uses distorted information for decision making about their product range, then the decision will be affected by a number of irrelevant costs.

However, we find that there are great doubts among business managers in the engineering sector about the suitability of the ABC method for their company. Of the Slovak companies surveyed, 53.1% doubt the suitability (answer “mostly yes”), and so do 89.5% of the Czech ones. Slovak companies are statistically significantly more likely to perceive doubts about the suitability of the ABC method as its disadvantage compared to Czech ones.

The conventional costing formula of the traditional marginal method really meets the needs of the valuation of own production and, in accounting, also as a basis for establishing the sales price in the bidding procedure with the customer. However, it is not suitable for other management decisions, particularly when deciding on price policy on the market or on changes to the range of products offered. Non-traditional costing methods are suitable for this purpose, but they are currently underutilised in practice.

As part of the innovation of managerial accounting, one way of putting new methods into practice is to build corresponding information flows in the company.

In order to design and improve information flows for the purposes of costing, it is necessary to improve the software used for cost calculations. Such software should ensure the allocation of the total direct and indirect costs. Indirect costs are to be allocated to each type of overhead, making it possible to allocate overheads according to several cost allocation bases, enabling individual costs to be divided between the several performances to which they relate. In order for costs to be broken down in this way in the costing software, it is necessary to specify the accounting records for the initial documents of direct and overhead costs of performance. To this end, the engineering company should develop a detailed internal directive on the costing procedure, specifying which costs are direct costs and which fall within indirect costs (production, administrative, sales, supply overheads).

There are few studies on this topic in the field of engineering industry. Therefore, we performed an analysis on a selected sample of 121 Slovak and Czech engineering companies, but the conclusions and proposals can be generalized and applied in other developed and developing countries. In the future, similar research can be extended to other countries or to other research questions and hypotheses in the field of practical use of the ABC method.

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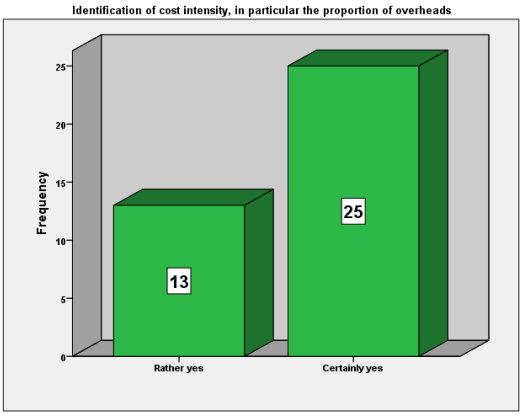
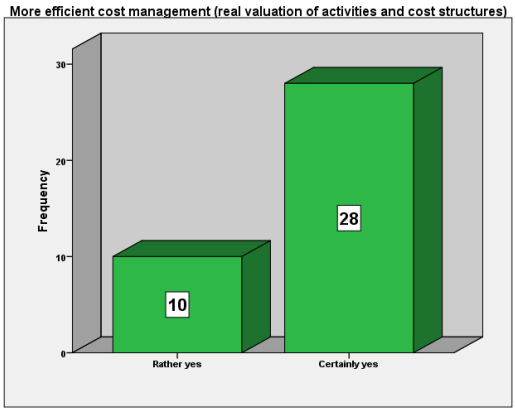
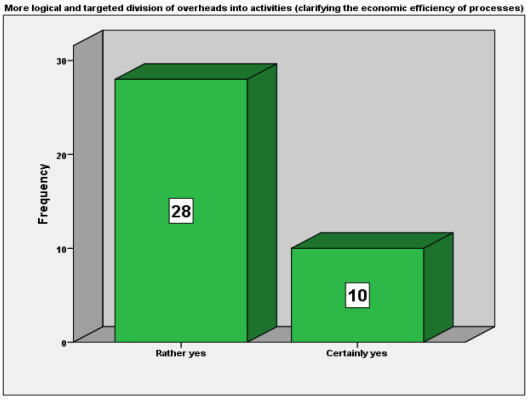
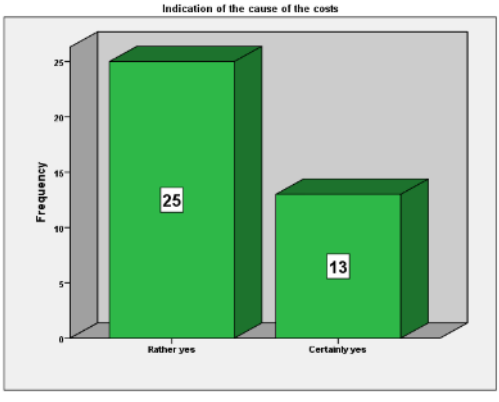
Appendix

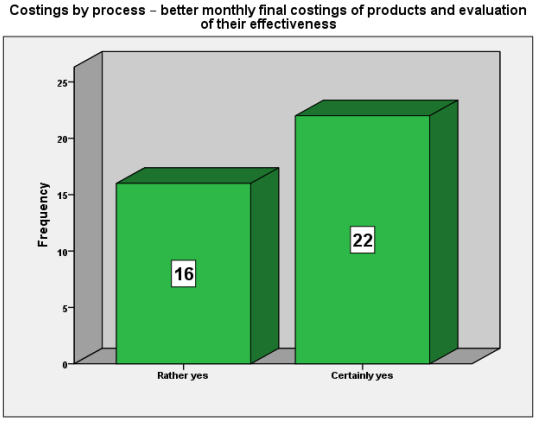
Figures 4-12 | Reasons for not using ABC method

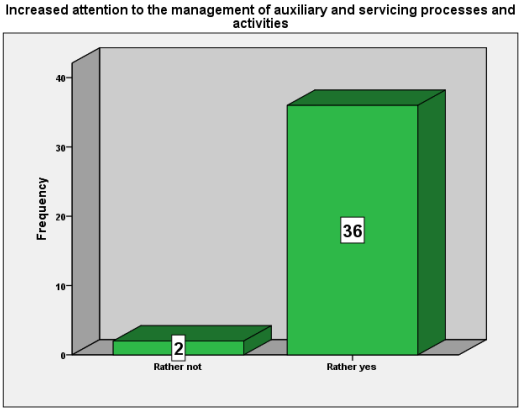












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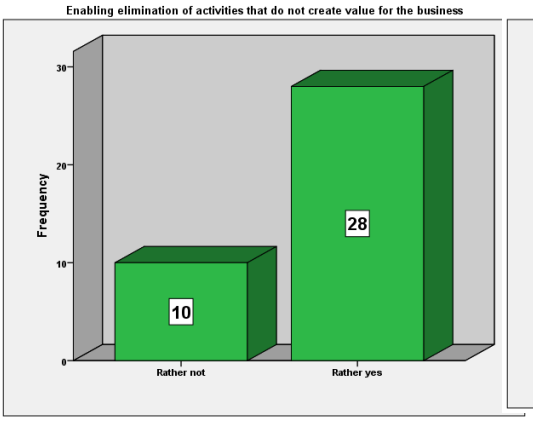

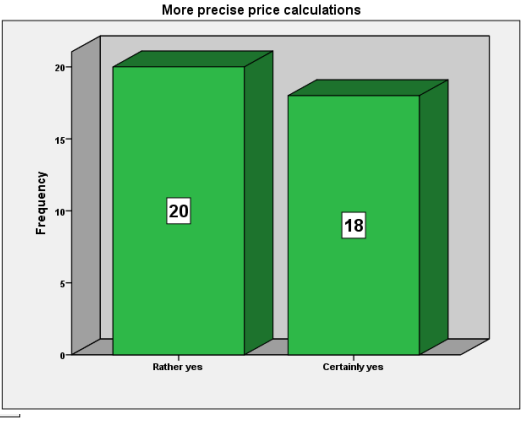

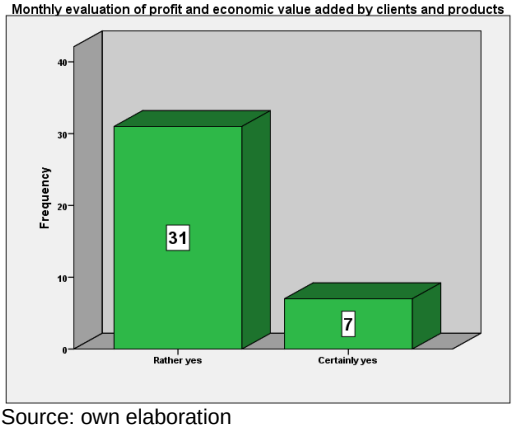

Source: own elaboration

Table 14 | Wilcoxon paired test – Reasons for not using ABC method

Wilcoxon paired test	Reasons for not using ABC method	Pairs	Ranks	N	Mean rank	Sum of ranks
Z	-0.728	More efficient cost management (real valuation of activities and cost structures) – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	7	9.00	63.00
			Positive ranks	10	9.00	90.00
Asymp. sig. (2-tailed)	0.467		Ties	21		
			Total	38		
Z	-3.873	More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes) – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	15	8.00	120.00
			Positive ranks	0	0.00	0.00
Asymp. sig. (2-tailed)	0.000		Ties	23		
			Total	38		
Z	-3.000	Indication of the cause of the costs – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	14	8.50	119.00
			Positive ranks	2	8.50	17.00
Asymp. sig. (2-tailed)	0.003		Ties	22		
			Total	38		
Z	-0.905	Process-based costing –- Identification of cost intensity, in particular the proportion of overheads	Negative ranks	7	6.00	42.00
			Positive ranks	4	6.00	24.00
Asymp. sig. (2-tailed)	0.366		Ties	27		
			Total	38		
Z	-4.838	Increased attention to management of auxiliary and servicing processes and activities – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	25	13.00	325.00
			Positive ranks	0	0.00	0.00
Asymp. sig. (2-tailed)	0.000		Ties	13		
			Total	38		
Z	-4.756	Enabling elimination of activities that do not create value for the business – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	27	14.00	378.00
			Positive ranks	0	0.00	0.00
Asymp. sig. (2-tailed)	0.000		Ties	11		
			Total	38		
Z	-1.460	More precise price calculations – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	15	12.00	180.00
			Positive ranks	8	12.00	96.00
Asymp. sig. (2-tailed)	0.144		Ties	15		
			Total	38		
Z	-4.025	Monthly evaluation of profit and economic value added by clients and products – Identification of cost intensity, in particular the proportion of overheads	Negative ranks	19	10.50	199.50
			Positive ranks	1	10.50	10.50
Asymp. sig. (2-tailed)	0.000		Ties	18		
			Total	38		
Z	-40.243	More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes) – More efficient cost management (real valuation of activities and cost structures)	Negative ranks	18	9.50	171.00
			Positive ranks	0	0.00	0.00
Asymp. sig. (2-tailed)	0.000		Ties	20		
			Total	38		
Z	-3.873	Indication of the cause of the costs – More efficient	Negative ranks	15	8.00	120.00

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Asymp. sig. (2-tailed)	0.000	cost management (real valuation of activities and cost structures)	Positive ranks Ties Total	0 23 38	0.00	0.00
Z	-2.121	Process-based costing – More efficient cost management (real valuation of activities and cost structures)	Negative ranks Positive ranks Ties Total	7 1 30 38	4.50 4.50	31.50 4.50
Asymp. sig. (2-tailed)	0.034					
Z	-5.303	Increased attention to management of auxiliary and servicing processes and activities – More efficient cost management (real valuation of activities and cost structures)	Negative ranks Positive ranks Ties Total	29 0 9 38	15.00 0.00	435.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-5.291	Enabling elimination of activities that do not create value for the business – More efficient cost management (real valuation of activities and cost structures)	Negative ranks Positive ranks Ties Total	32 0 6 38	16.50 0.00	528.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-3.162	More precise price calculations – More efficient cost management (real valuation of activities and cost structures)	Negative ranks Positive ranks Ties Total	10 0 28 38	5.50 0.00	55.00 0.00
Asymp. sig. (2-tailed)	0.002					
Z	-4.379	Monthly evaluation of profit and economic value added by clients and products – More efficient cost management (real valuation of activities and cost structures)	Negative ranks Positive ranks Ties Total	22 1 15 38	12.00 12.00	264.00 12.00
Asymp. sig. (2-tailed)	0.000					
Z	-1.134	Indication of the cause of the costs – More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes)	Negative ranks Positive ranks Ties Total	2 5 31 38	4.00 4.00	8.00 20.00
Asymp. sig. (2-tailed)	0.257					
Z	-3.464	Process-based costing – More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes)	Negative ranks Positive ranks Ties Total	0 12 26 38	0.00 6.50	0.00 78.00
Asymp. sig. (2-tailed)	0.001					
Z	-3.464	Increased attention to management of auxiliary and servicing processes and activities – More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes)	Negative ranks Positive ranks Ties Total	12 0 26 38	6.50 0.00	78.00 0.00
Asymp. sig. (2-tailed)	0.001					
Z	-4.066	Enabling elimination of activities that do not create value for the business – More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes)	Negative ranks Positive ranks Ties Total	18 0 20 38	9.50 0.00	171.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-2.828	More precise price calculations –	Negative ranks	0	0.00	0.00

Asymp. sig. (2-tailed)	0.005	More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes)	Positive ranks Ties Total	8 30 38	4.50	36.00
Z	-0.775	Monthly evaluation of profit and economic value added by clients and products – More logical and targeted division of overheads into activities (clarifying the economic efficiency of processes)	Negative ranks Positive ranks Ties Total	9 6 23 38	8.00 8.00	72.00 48.00
Asymp. sig. (2-tailed)	0.439					
Z	-3.000	Process-based costing – Indication of the cause of the costs	Negative ranks Positive ranks Ties Total	0 9 29 38	0.00 5.00	0.00 45.00
Asymp. sig. (2-tailed)	0.003					
Z	-3.873	Increased attention to management of auxiliary and servicing processes and activities – Indication of the cause of the costs	Negative ranks Positive ranks Ties Total	15 0 23 38	8.00 0.00	120.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-4.413	Enabling elimination of activities that do not create value for the business – Indication of the cause of the costs	Negative ranks Positive ranks Ties Total	21 0 17 38	11.00 0.00	231.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-1.291	More precise price calculations – Indication of the cause of the costs	Negative ranks Positive ranks Ties Total	5 10 23 38	8.00 8.00	40.00 80.00
Asymp. sig. (2-tailed)	0.197					
Z	-1.500	Monthly evaluation of profit and economic value added by clients and products – Indication of the cause of the costs	Negative ranks Positive ranks Ties Total	11 5 22 38	8.50 8.50	93.50 42.50
Asymp. sig. (2-tailed)	0.134					
Z	-4.707	Increased attention to management of auxiliary and servicing processes and activities – Process-based costing	Negative ranks Positive ranks Ties Total	23 0 15 38	12.00 0.00	276.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-4.590	Enabling elimination of activities that do not create value for the business – Process-based costing	Negative ranks Positive ranks Ties Total	25 0 13 38	13.00 0.00	325.00 0.00
Asymp. sig. (2-tailed)	0.000					
Z	-0.943	More precise price calculations – Process-based costing	Negative ranks Positive ranks Ties Total	11 7 20 38	9.50 9.50	104.50 66.50
Asymp. sig. (2-tailed)	0.346					
Z	-3.638	Monthly evaluation of profit and economic value added by clients and products – Process-based costing	Negative ranks Positive ranks Ties Total	16 1 21 38	9.00 9.00	144.00 9.00
Asymp. sig. (2-tailed)	0.000					
Z	-2.530		Negative ranks	9	5.50	49.50

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Asymp. sig. (2-tailed)	0.011	Enabling elimination of activities that do not create value for the business – Increased attention to the management of auxiliary and servicing processes and activities	Positive ranks Ties Total	1 28 38	5.50	5.50
Z	-4.472	More precise price calculations – Increased attention to the management of auxiliary and servicing processes and activities	Negative ranks Positive ranks Ties Total	0 20 18 38	0.00 10.50	0.00 210.00
Asymp. sig. (2-tailed)	0.000					
Z	-3.000	Monthly evaluation of profit and economic value added by clients and products – Increased attention to the management of auxiliary and servicing processes and activities	Negative ranks Positive ranks Ties Total	0 9 29 38	0.00 5.00	0.00 45.00
Asymp. sig. (2-tailed)	0.003					
Z	-4.939	More precise price calculations – Enabling elimination of activities that do not create value for the business	Negative ranks Positive ranks Ties Total	0 26 12 38	0.00 13.50	0.00 3510.00
Asymp. sig. (2-tailed)	0.000					
Z	-3.900	Monthly evaluation of profit and economic value added by clients and products – Enabling elimination of activities that do not create value for the business	Negative ranks Positive ranks Ties Total	0 16 22 38	0.00 8.50	0.00 136.00
Asymp. sig. (2-tailed)	0.000					
Z	-2.400	Monthly evaluation of profit and economic value added by clients and products – More precise price calculations	Negative ranks Positive ranks Ties Total	16 5 17 38	11.00 11.00	176.00 55.00
Asymp. sig. (2-tailed)	0.016					

Source: own elaboration