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THE USE OF LEAN METHODS IN CENTRAL EASTERN EUROPEAN COUNTRIES: THE CASE OF CZECH AND SLOVAK REPUBLIC

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ABSTRACT. Increasing competition, both at the global and local levels, shortening product life cycle, and strengthening customer's position are only some of the factors currently affecting the viability of businesses. To stay at a market, retain old and gain new customers businesses are constantly looking for new ways to improve. One of the possibilities to improve is the lean concept. This concept offers the ways to find the points with waste and eliminate them. The main objective of this research is to analyze the extent of lean methods' use in Central Eastern European countries – Czech and Slovak Republics. Two surveys were carried out independently of each other between 2013 and 2017. The purpose of the researchers was to determine the extent of the selected industrial engineering methods' use in both these countries through an online questionnaire survey. In general, the analyzed methods are more often implemented by businesses in Czech Republic, but the results also suggest that some of the analyzed methods are not implemented in these countries equally. E.g., Kaizen or 5S method are the methods more typical for the industrial companies in Czech Republic. On the other hand, for example, the Total Quality Management did not reveal statistically significant differences in the implementation by companies in Czech and Slovak Republics.

JEL Classification: L60, M20, O14

Keywords: Lean management; Operational performance; Business performance; Total Quality Management; Kaizen; Industrial companies; Total Productive Maintenance.

Introduction

For many companies, today's business environment is a challenge for survival. Keeping customers and meeting the needs of stakeholders at the same time is also the question of survival. Businesses face contradictory demands from customers (who require cheaper products and higher service quality at the same time along with additional product customization). On the other hand, owners and other stakeholders are constantly appealing to "be leaner" and cut costs. One of the ways to deal with these requirements is the lean concept. It focuses on finding and removing any kind of waste, either in production, or in other

business areas. Waste here is seen as unnecessary operations and cost-generating moves, which do not add value to end customers (due to waiting time, unnecessary movements, problems with supplies etc.). Therefore, these activities need to be eliminated (Antunes *et al.*, 2008; Bornia, 2002; Kwarteng *et al*., 2017).

Although literature deals with both implementation of some lean methods (Sun *et al*., 2003; Singh *et al*., 2013; Jaca *et al*., 2014; Karasu *et al*., 2014) and their impact on business processes and overall performance of companies (Zhu & Sarkis, 2004; Ward & Zhou, 2006; Losonci & Demeter, 2013; Yang *et al*., 2011), only a few of these studies deal with the comparison of differences in the extent of use of these different methods among countries (Czabke *et al*., 2008; Ahmad *et al.*, 2017). In addition, many recent studies realized in the V4 countries were focused on measuring the impact from management methods on overall economic performance (Gavurová *et al*., 2017; Afonina, 2015; Rajnoha & Lesníková, 2016; Wnuk-Pel, 2016; Tuček *et al*., 2013; Gavurová, 2011). Lean issues as applied to specific countries are covered in literature rather widely, however these studies focus primarily on Western countries, such as the USA, UK, Germany (Dobrin *et al*., 2015; Friel, 2005; Alsmadi *et al*., 2012; Sadreddini, 2012), or on rapidly developing countries such as China, India etc. (Bollbach, 2012; Panizzolo *et al*., 2012; Sharma *et al*., 2015). Significantly less scientific attention has been dedicated so far to lean methods' application in Central Eastern European countries.

This paper is focused on comparing the scope of lean concept (and industrial engineering) methods' use in two Central European countries – Czech Republic (CZE) and Slovak Republic (SVK). Some authors have already dealt with the use these methods in other European countries (Kumar & Antony, 2008; Antosz & Stadnicka, 2017; Salonitis & Tsinopoulos, 2016), however, mostly focusing on the selected sectors of the economy.

What is the scope of the selected methods' use in CZE and SVK? Are there differences between these two countries in terms of using the lean concept? If so, are these differences statistically significant? Moreover, in which country the analyzed methods are more widespread; is the introduction of some methods a more typical of a country? All of these questions are answered below in our research.

1. Literature review

The lean concept can be an effective tool to enhance business competitiveness, improve a process or operational performance (Shah & Ward, 2003; Yang *et al*., 2011; Zhang & Niu, 2012; Yarasca & Soler, 2016). Lean can be described as an integrated socio-technical system that pursues one main goal of the eliminating waste by simultaneously reducing or minimizing supply, customer and internal variability (Shah & Ward, 2007). However, if the company wants to maximize the benefits of using lean, it is necessary to focus not only on techniques and tools but also on "soft techniques", thus the human side (Ahmad & Azuan, 2013). At the same time, the question is how can the implementation of the lean concept be considered successful? Scherrer-Rathje *et al.* (2009), consider lean to be successful if the company reaches key strategic parts of the lean concept, successfully implements and uses several lean concepts (such as JIT, Kaizen etc.) and at the same time achieves performance improvements that it can maintain.

The reasons for focusing on lean thinking are different. These may be, for example, various existential reasons – crises that threaten the very existence of an enterprise, such as the loss of a significant part of the market, or the resulting increased competition, the declining profitability of the business (Czabke *et al*., 2008). The intention to be more competitive is the second most common reason for implementing the lean concept identified by Antosz & Stadnicka (2017). These authors, however, stated in their research that the main

reason for implementing the lean concept (80% of respondents) was to increase company's operation (Antosz & Stadnicka, 2017).

The lean concept is used in all industries and is gradually expanding into non-production areas of the economy, e.g. healthcare or government (Radnor *et al*., 2012; Dickson *et al*., 2009; Habidin, 2017; Schonberger, 2018; Štefko *et al*., 2016; Zhu & Wang, 2014). It is also used in non-industrial manufacturing plants – e.g. in the food industry. For a comprehensive view of the current extent of the use of the lean concepts as a whole (or its individual methods), it is necessary to focus on studies from different areas – quality, process performance, economic performance, competitiveness, etc. (Rajnoha & Lorincová, 2015; Krause, 2017; Kozubíková *et al*., 2015; Ginevičius *et al*., 2015; Rajnoha & Lesníková, 2016; Monni *et al*., 2017; Muhammad *et al*., 2017).

The scope of the lean concept and selected methods (with emphasis on continuous improvement) is analyzed, for example, the 2008 study. The authors of this study focused on the use of the selected methods in the food industry in Canada. Their results indicate that companies that are constantly improving are less likely to return products from customers, for example, because of poor quality (Scott *et al*., 2008). The food industry is also concerned with a 2013 study focusing on the use of the lean concept in small and medium-sized enterprises in Belgium, Germany and Hungary. Based on the results of this study, the use of the lean concepts in this field is only in the beginnings, and businesses focus primarily on product quality rather than on process performance alone (Dora *et al*., 2013).

Although the lean concept is not one of the latest tools, studies carried out in different countries show that its introduction is not yet very widespread among businesses. E.g. according to a survey carried out in Poland in 2017, only 4% of the businesses involved in research have a functional lean system working for at least five years, with a total of 58% of respondents not using the system altogether (Antosz & Stadnicka, 2017). Another study examining the use of the lean concept and selected methods was conducted in the United Kingdom. This study was focusing on quality issues (with an emphasis on Six Sigma, TQM – Total Quality Management, Kaizen, BPR – Business Process Reengineering, TOC – Theory of Constraints, and ISO 9000). The following methods were identified as the most commonly used methods: ISO 9000 (introduced by 76.6% of respondents), Lean (introduced by 26.5% of respondents) or Six Sigma (introduced by 15.6% of respondents); on the other hand, TQM methods (introduced by 7.8% of respondents) or EFQM (none of the respondents involved) were the least used by this study (Kumar & Antony, 2008).

Very similar results can be seen in other countries, such as the UK or Australia. In a study focused on these two states, ISO's standards are the most frequently introduced, according to the authors, which are often the first step on the lean route, this concept being the second most often chosen (Kumar *et al*., 2014).

The successful implementation of the individual lean methods is closely related to their understanding. This relatively specific aspect was examined in Greece in the year 2016. The authors of this research presented a list of different methods to the respondents and asked whether the respondents were familiar with these methods or whether they thought they would be able to successfully implement these methods in their company (Salonitis & Tsinopoulos, 2016). The results of this study basically confirm the findings in previous research. Respondents reported SMED, 5S or Kaizen as the best applied methods (Salonitis & Tsinopoulos, 2016). The good knowledge appreciated by self-assessment is reflected, of course, in more frequent use of these methods. An interesting view of the issue also offers comparisons with less developed countries (outside Europe). E.g. authors Belhadi *et al*. (2017), address the level of knowledge of selected lean methods in manufacturing plants in North Africa. These authors found that the most well-known methods in this area include 5S,

PDCA, autonomous inspection, visual management or standardization. On the contrary, the least known methods are e.g. Six Sigma or Jidoka.

We can assume that in terms of CZE and SVK is the situation very similar. It can be assumed that even in these countries the limitations identified by Matt & Rauch (2013) in their research apply. They interviewed 10 small businesses and identified basic reasons for the low frequency of the lean implementation: inadequate knowledge of this concept, inability to establish closer cooperation with suppliers and purchasers, lack of theoretical managerial readiness, and the financial difficulty of hiring experts (Matt & Rauch, 2013). Other reasons may be lack of essential resources or resistance to change (AlManei *et al*., 2017; Kumar & Antony, 2008). Matt & Rauch (2013) also states that not all lean concepts are suitable for all businesses regardless of their size. In his study, it is appropriate to use simpler and less demanding methods such as 5S, Kaizen, visual management, benchmarking, TPM, milk-run, Six Sigma or TQM.

For our research, the TQM, TPM (Total Productive Maintenance), 5S, Kaizen, Six sigma methods that were part of the research are decisive. TPM is a tool that can help to develop hidden capacities and reduce production costs, while not creating the need for large capital investment (Muchiri & Pintelon, 2008). According to Gupta & Vardhan (2015), the TPM is a tool to minimize production losses and reduce production costs by up to 30%. Also 5S is a simple and inexpensive tool to achieve benefits by introducing lean, helping to reduce time for activities that do not add value, increase productivity, and contribute to quality improvement (Moriones *et al*., 2010; Omogbai & Salonitis, 2017).

2. Methodological approach

The main objective of this research is to compare the use of selected lean methods in manufacturing plants in the Czech and Slovak Republics and to say whether there are significant differences between the uses of selected methods in individual countries. To analyze the differences between the uses of lean methods in both countries, we defined the following research hypotheses:

- H1: We assume that the extent of the use of selected lean methods in the practice of manufacturing companies in the Czech Republic and the Slovak Republic is not equal in both countries.
- H2: We assume that the use of selected lean methods is dependent on country and stage of the economic development.

To fulfill the defined research goal, the required data was obtained at two levels. The first step was the realization of primary research between Czech and Slovak manufacturing companies. These two surveys were carried out independently of each other between 2013 and 2017. The purpose of these researchers was to determine the extent of use of selected industrial engineering methods in both countries through an online questionnaire survey.

Some results of this research in Slovak manufacturing companies have been elaborated and published in years 2015 and 2016 (Rajnoha *et al*., 2016; Rajnoha & Lorincová, 2015; Rajnoha & Lesníková, 2016). Selected production companies from all regions, different age, size and industrial focus were addressed. After two rounds of questionnaire distribution altogether, 164 companies (N = 164) were involved in the research, mainly from mechanical engineering, wood processing industry and automotive. A similar survey was carried out in 2017 in all regions of Czech Republic, involving a total of 235 manufacturing companies (N = 235) from different sectors of the economy, different sizes (in terms of a number of employees), different ages and different financing methods (domestic or foreign capital). The survey was driven by companies from mechanical engineering (22%), construction (16%), electrical engineering (12%), wood processing industry (9%), automotive (9%). We consider

the size of the research sample as being sufficiently representative, whereas it compares favourably with several other studies.

For the purposes of the comparison were used the methods that are used locally only at specific locations in the company (e.g. 5S, although this method can be used globally in an enterprise, the activity of individual standards is limited to the workplace), as well as methods influencing enterprise as a whole (e.g. TQM). The basic criterion for the selection of methods was their use in both surveys. Finally, the following industrial engineering methods (and therefore lean management) were selected: TQM, TPM, 5S, Six Sigma, EFQM and ISO standards. ISO standards belonging rather to a quality management, but they also include a process area. Due to their widespread usage in the Czech and Slovak Republics, the ISO concept was included in this research.

For the basic evaluation of use of the selected methods in the first step only descriptive statistics were used – observed frequencies and percentage expression. To evaluate whether there are significant statistical differences in the use of selected methods between the Czech and Slovak Republics, the Pearson Chi-Square test of independence was used. This test is based on comparing the observed frequencies with the expected frequencies that would be compared in the case of the normal distribution. This test, therefore, tells whether the tested variables are dependent on each other or not. The zero hypothesis (H_0) assumes the independence of both variables, the alternative hypothesis (H_1) then assumes that the variables are dependent on each other. In the case of our research, the zero and alternative hypotheses can be defined as follows:

- H_0: There is no statistically significant correlation between tested methods and the country.
- H_1: There is a statistical significant correlation between tested methods and the country.

For the purposes of evaluating this test, the level of significance was sate as $\alpha = 0.05$.

Given that both questionnaires were created using Google forms, after the completion of the questionnaire collection, the answer database was automatically transferred to MS Excel workbook. In this application, basic descriptive statistics were performed, and pivot tables were processed. For further statistical analysis and Chi-Square test of independent processing, the database was copied into the programme Statistics.

3. Research results

3.1. The use of selected methods in Czech and Slovak Republic

The following table (*Table 1*) shows the frequency of the use of selected methods in manufacturing plants in Slovakia. The most used tool, in this case, are ISO standards, 48% of respondents use a different type of these standards. All other investigated methods are used considerably less in Slovakia. Only 16% of respondents use TQM, only 9% of respondents use Kaizen, 8% of respondents use 5S and TPM, 6% of respondents use the Six Sigma concept, and only 2% of respondents use EFQM.

Table 1. Selected methods – Frequency response in Slovak Republic

	Is used		Is not used	
	Frequency	Percentage	Frequency	Percentage
ISO	78	48%	86	52%
TQM	26	16%	138	84%
KAIZEN	14	9%	150	91%
5S	13	8%	151	92%
TPM	13	8%	151	92%

Six sigma	10	6%	154	94%
EFQM	3	2%	161	98%

Source: own.

Table 2 shows the use of the same methods in the Czech Republic. The highest frequency was again observed for ISO standards (64%). All analyzed methods in the Czech Republic had a percentage higher than 20% (Kaizen 33%, 5S 32%, TQM 24%, TPM 21%, Six sigma 20%). The EFQM model is not used by any of the surveyed respondents.

Table 2. Selected methods – Frequency response in Czech Republic

	Is used		Is not used	
	Frequency	Percentage	Frequency	Percentage
ISO	150	64%	85	36%
KAIZEN	78	33%	157	67%
5S	75	32%	160	68%
TQM	56	24%	179	76%
TPM	49	21%	186	79%
Six sigma	48	20%	187	80%
EFQM	0	0%	235	100%

Source: own.

In both countries, the ISO concept was the most commonly used. This concept is one of the world's most widespread quality management concepts. ISO standards should be an instrument of systematic and transparent management of the organization aimed at meeting the needs of all stakeholders and continually improving corporate performance. The second most commonly used method in Slovakia is TQM. TQM is related to the concept of ISO standards, but in the Czech Republic, it is up to the fourth most used in terms of the order of selected methods. In both countries, TPM, Six Sigma, and EFQM methods are used least. Overall, it can be concluded (*Table 3*) that in the Czech Republic, the use of the surveyed methods is more frequent in percentage than in the Slovak Republic.

Table 3. Comparison of frequency – Slovak and Czech Republic

	SK		CZ	
	Frequency	Percentage	Frequency	Percentage
ISO	78	48%	150	64%
TQM	26	16%	56	24%
KAIZEN	14	9%	78	33%
5S	13	8%	75	32%
TPM	13	8%	49	21%
Six sigma	10	6%	48	20%
EFQM	3	2%	0	0%

Source: own.

3.2. Statistical relations between the use of selected methods and the country

Descriptive statistics were further supplemented by a statistical analysis of the relationship between the use of selected methods and the countries in which they are introduced. The aim of this part of the research was to find out whether there are statistically significant differences between the implementation of certain methods between the Czech and Slovak Republics. For all selected methods, the p-value (rounded to some very low values to 9 decimal places), expected values and residues (the difference between observed and expected values) was calculated.

The following table (*Table 4*) shows observed and expected values and calculated residual values for ISO standards. The P-value, in this case, is 0.001233718. At the level of significance $\alpha = 0.05$, it can be stated that the zero hypothesis of independence was rejected. The relationship between ISO standards and the country is strong statistically significant. Residue levels showed that the ISO standards are typically used in the Czech Republic.

Table 4. The use of ISO x Country - Statistics

ISO p-value = 0.001233718	SVK	CZE	Row total
The observed frequency			
is used	78	150	228
is not used	86	85	171
total	164	235	399
Expected frequency			
is used	93.7143	134.2857	228.0000
is not used	70.2857	100.7143	171.0000
total	164.0000	235.0000	399.0000
Observed minus the expected frequencies (residue)			
is used	-15.7143	15.7143	
is not used	15.7143	-15.7143	

Source: own.

P-value for TQM (*Table 5*) is 0.052381770. Although the threshold value of 0.05 is exceeded by only a few tenths, it must be stated that at the level of significance $\alpha = 0.05$ we accept the zero hypothesis of independence. TQM is independent of the country in which businesses operate. The use of this method is typical in both countries – there are no statistical differences between them. As can be seen from the residual values, the use of this method would be typical again in the Czech Republic. However, due to the size of the p-value, these differences are not statistically significant.

Table 5. The use of TQM x Country – Statistics

TQM p-value = 0.052381770	SVK	CZE	Row total
The observed frequency			
is used	26	56	82
is not used	138	179	317
total	164	235	399
Expected frequency			

is used	33.7043	48.2957	82.0000
is not used	130.2957	186.7043	317.0000
total	164.0000	235.0000	399.0000
Observed minus the expected frequencies (residue)			
is used	-7.7043	7.7043	
is not used	7.7043	-7.7043	

Source: own.

The opposite situation occurs for the Kaizen method (*Table 6*). The P-value (0.000000009) in this case indicates a very strong dependence between the method and the country. It can be stated that at the level of significant $\alpha = 0.05$ we reject the zero hypothesis of independence. As can be seen in *Table* 6 the residue levels indicate, that Kaizen is also typically used in the Czech Republic.

Table 6. The use of Kaizen x Country – Statistics

Kaizen p-value = 0.000000009	SVK	CZE	Row total
The observed frequency			
is used	14	78	92
is not used	150	157	307
total	164	235	399
Expected frequency			
is used	37.8145	54.1855	82.0000
is not used	126.1855	180.8145	317.0000
total	164.0000	235.0000	399.0000
Observed minus the expected frequencies (residue)			
is used	-23.8145	23.8145	
is not used	23.8145	-23.8145	

Source: own.

Clear dependence can be also seen in the case of 5S method (*Table 7*). At the level of significance $\alpha = 0.05$, considering the residual values can be stated that this method is also typically used in the Czech Republic. Even with this method, we can observe a very strong relationship – the p-value, in this case, was only 0.000000013. The method 5S is one of the basic tools of industrial engineering. Its introduction often precedes the attempt to introduce more complex methods of industrial engineering.

Table 7. The use of 5S x Country – Statistics

5S p-value = 0.000000013	SVK	CZE	Row total
The observed frequency			
is used	13	75	88
is not used	151	160	311
total	164	235	399
Expected frequency			
is used	36.1704	51.8296	82.0000

is not used	127.8296	183.1704	317.0000
total	164.0000	235.0000	399.0000
Observed minus the expected frequencies (residue)			
is used	-23.1704	23.1704	
is not used	23.1704	-23.1704	

Source: own.

A very similar situation (in terms of p-value size) also occurred with the TPM (*Table 8*). In addition, the analysis results for TPM revealed very strong statistically significant dependence. As in the previous case, according to residue levels is the use of this method typical in the terms of Czech Republic. TPM is an example of the more complex lean method, and its use is closely related to the previous 5S. The TPM method cannot be successfully implemented in a workplace where workplace standardization does not work.

Table 8. The use of TPM x Country – Statistics

TPM p-value = 0.000454558	SVK	CZE	Row total
The observed frequency			
is used	13	49	62
is not used	151	186	337
total	164	235	399
Expected frequency			
is used	25.4837	36.5163	82.0000
is not used	138.5163	198.4837	317.0000
total	164.0000	235.0000	399.0000
Observed minus the expected frequencies (residue)			
is used	-12.4837	12.4837	
is not used	12.4837	-12.4837	

Source: *own.*

The latest Six Sigma (*Table 9*) method does not differ from previous methods. At the level of significance $\alpha = 0.05$ can be stated that the relationship between this method and the country in which the enterprise operates is statistically significant. In addition, in this case, a very low p-value (0.000064646) indicates a very strong statistical dependence. Based on the residual value, it can be stated that this method (as well as others) is typically used in the companies in the Czech Republic.

Table 9. The use of Six Sigma x Country – Statistics

Six sigma p-value = 0.000064646	SVK	CZE	Row total
The observed frequency			
is used	10	48	58
is not used	154	187	341
total	164	235	399
Expected frequency			
is used	23.8396	34.1604	82.0000

is not used	140.1604	200.8396	317.0000
total	164.0000	235.0000	399.0000
Observed minus the expected frequencies (residue)			
is used	-13.8396	13.8396	
is not used	13.8396	-13.8396	

Source: own.

Given that only pivot tables of 2x2 size were used in the statistical evaluation of the relationship between selected lean methods and the country in which the enterprise operates, the Fisher's exact test was also processed with the Chi-square Independence Test. However, the P-value calculated based on this test corresponded in all cases to the value calculated using the Chi-square test (there was no conflict between these two p-values due to the rejection or zero hypothesis assumption). That is why we finally decided not to re-value this value because in most cases the differences would be displayed around the eighth or ninth decimal number.

An exception here is the last selected lean method EFQM. For this method, basic Chi-square test conditions were not met – more than 20% of the expected values were less than 5 (or four-pane tables, 100% of the expected frequencies must be greater than 5 which was also not met) while some of the expected values were 0. For this reason, the statistical evaluation was based on Fisher's exact test. Therefore, the p-value in the following *Table 10* was calculated using this test.

Table 10. The use of EFQM x Country – Statistics

EFQM p-value = 0.069	SVK	CZE	Row total
The observed frequency			
is used	3	0	3
is not used	161	235	396
total	164	235	399
Expected frequency			
is used	1.2	1.8	3.0
is not used	162.8	233.2	396.0
total	164.0	235.0	399.0
Observed minus the expected frequencies (residue)			
is used	1.8	-1.8	
is not used	-1.8	1.8	

Source: own.

The P-value calculated according to Fisher's exact test is 0.069 (*Table 10*). Thus, we can conclude that at the level of significance $\alpha = 0.05$ we accept a zero hypothesis of independence. The differences between countries in the implementation of this method are not statistically significant.

Discussion and Conclusion

The main objective of this research was to compare the use of selected methods of lean concept in the Czech and Slovak Republics. Based on the facts described in the previous chapter, we can conclude that:

Research hypothesis H1 was accepted. Although the extent of the use of selected methods has already been the subject of more studies (Kumar & Antony, 2008; Salonitis & Tsinopoulos, 2016; Kumar *et al*., 2014; Czabke *et al*., 2008; Ahmad *et al*., 2017), the focus on Central Eastern European countries (with emphasis on the Czech Republic and Slovakia) was inadequate. Yet, based on a literature search, we assume that the scope of individual concepts will vary from country to country. Through analyzes of the results of the surveys conducted in the both countries, it was found that the extent of use of selected lean methods by firms in individual countries is different. Generally, based on a percentage comparison of the results, the implementation of selected lean methods is more common in the Czech Republic than in the Slovak Republic. Except for the EFQM – according to our research this method was not used in any interviewed Czech company. Unlike Slovakia, where this method was used.

In order to reject or accept the H2 hypothesis, it is necessary to analyze each selected method of the lean concept separately. Based on the statistical evaluation using the Chi-square Independence Test and the Fisher Exact Test, it was found that are statistically significant differences in the implementation of the lean concept. A summary of the research results and the basic outputs of these analyzes is given in the following figure (*Figure 1*).

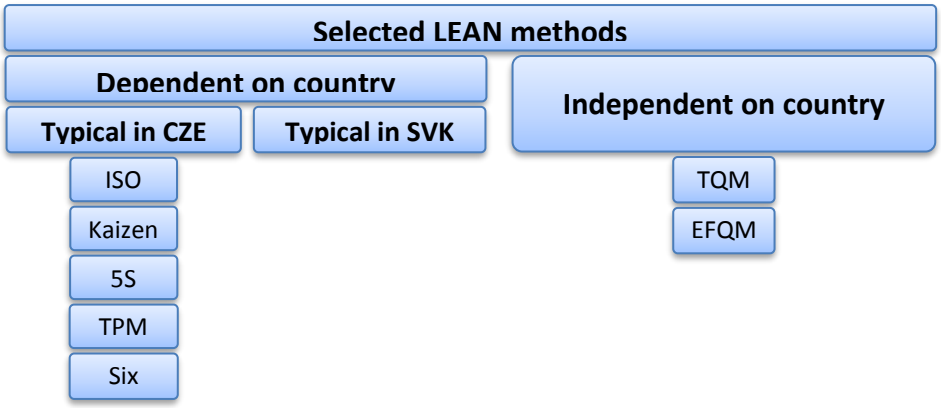

Figure 1. Summary of research results – Lean methods comparison by countries
Source: own data and elaboration.

Both countries have their own economy and its decisive strategy focused on selected industry and industry itself, which are the highest share of overall GDP in comparison with other EU countries.

Although the level of overall macroeconomic parameters and data (e.g. GDP per capita) in the Czech Republic is higher – in recent years SVK has slowly reached the level of CZE. However, our research results may in the future indicate that this economic development of the SVK was large of an extensive character.

In terms of intense development (for example, the implementation of the lean concept in the management of industrial enterprises), it seems to us that CZE may gain a competitive advantage over the SVK in the future in terms of higher efficiency and productivity of industrial plants. We will continue to observe this phenomenon empirically. However, due to our recent findings, we can recommend to Slovak companies to bring more efforts to implement selected lean management concepts into their business practice.

Described significant difference in the use of the lean concept in both countries can also be caused by the time difference in the realization of a questionnaire surveys.

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