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## BARRIERS THAT SMES IN THE WESTERN BALKANS ARE FACING IN ACCESSING THE SUPPLY CHAINS: A BINARY LOGISTIC REGRESSION APPROACH\*

Prepreke s kojima se mala i srednja preduzeća u regionu Zapadnog Balkana suočavaju u pristupanju lancima dobavljača – pristup zasnovan na binarnoj logističkoj regresiji

### Abstract

The inclusion of small and medium-sized enterprises (SMEs) in the supply chains is broadly used to leverage the internationalisation of operations of the companies. SMEs in the Western Balkans make up for a vast majority of the companies and tend to be better integrated into the EU and global market. The supply chains enable SMEs to raise their innovativeness and performance. However, large corporations also find mutual benefits in the integration of SMEs into their supply chains. Large supply chains have recently introduced a new approach towards the inclusion of SMEs as a part of their CSR and sustainability strategy. In this paper, we observe the state of play in accessing the supply chains in three non-EU Western Balkan countries, namely Serbia, Bosnia and Herzegovina and Montenegro, as well as in Croatia as the only EU member state from the observed region. It seems that, regardless of the current status of the EU accession process, the observed SMEs are facing the same challenges in accessing the supply chains. Therefore, our research has two goals: 1) to determine whether and in what way the perception of the importance of different barriers affects inclusion in the supply chains, and 2) to determine whether the different-sized companies perceive differently the importance of individual barriers to inclusion in the supply chains. The results have shown that there are no significant differences in the perception of the importance of barriers to inclusion in the supply chains between companies of different sizes. Also, the length of receivables collection period and inadequate and incomplete information on the requirements for participation negatively affect the inclusion of SMEs in the supply chains.

**Keywords:** *supply chain, barriers, Western Balkans, SMEs, logistic regression.*

### Sažetak

Uključivanje malih i srednjih preduzeća (MSP) u lance dobavljača široko se primenjuje kao instrument za što potpuniju internacionalizaciju poslovnih operacija. MSP u regionu Zapadnog Balkana predstavljaju većinu preduzeća koja teže da se što bolje integrišu u evropsko i globalno tržište. Uključivanje MSP u lanac dobavljača omogućava MSP da podignu inovativnost i da bolje posluju, dok velike kompanije takođe nalaze višestruke koristi u uključivanju MSP u svoje lance dobavljača. Odnedavno, veliki lanci dobavljača su uveli novi koncept integrisanja MSP u svoje sisteme, i to kao deo strategije svog društveno odgovornog poslovanja (DOP) i održivosti. U ovom radu posmatramo aktuelno stanje u pristupu lancima dobavljača od strane MSP u tri zemlje koje nisu članice EU, a to su Srbija, Bosna i Hercegovina i Crna Gora, kao i u Hrvatskoj, za sada jedinoj zemlji regiona koja je članica EU. Čini se da se, bez obzira na aktuelni status u pristupanju EU, MSP u sve četiri zemlje suočavaju sa istim barijerama pri uključivanju u lance dobavljača. Stoga, istraživanje ima dva cilja: 1) utvrditi da li i na koji način percepcija važnosti različitih barijera utiče na uključivanje u lance dobavljača, i 2) utvrditi da li kompanije različite veličine na različit način percipiraju važnost pojedinih barijera za uključivanje u lance dobavljača. Rezultati pokazuju da nema značajnih razlika u percepciji važnosti barijera za uključivanje u lance dobavljača između kompanija različite veličine. Takođe, pokazalo se da dužina u naplati potraživanja i neadekvatne i nepotpune informacije o uslovima učešća negativno utiču na uključivanje MSP u lance dobavljača.

**Ključne reči:** *lanac dobavljača, barijere, Zapadni Balkan, MSP, logistička regresija.*

\* The research presented in this paper was funded by the Ministry of Education, Science and Technological Development of Serbia.

## Introduction

SMEs are normally considered to be a booster of national economies, as they play an important role for economic growth and development of any country. SMEs are integral part of the innovation ecosystem which is facing different challenges. However, access to market and the financial aspect prevail. According to the literature, inclusion of SMEs in the global value chains (GVC) is defined as the sum of backward linkages (foreign inputs that are embodied in the exports of the country) and forward linkages (exports of intermediate goods of the country that are embodied in the exports of another country) [6].

Inclusion of SMEs in the supply chain is often considered as part of an innovation strategy, but also as one of the actions that are part of the CSR strategy of the company. Certain authors [2], [13], [25] emphasise in their studies that supply management has a significant role in the innovativeness of a company, and that suppliers greatly contribute in creating innovations. In the IMP<sup>3</sup>rove innovation assessment questionnaire, suppliers are also considered to be one of the sources in generating new ideas and improvements of the products/services. However, according to available research on this topic in the Serbian market [23], it seems that Serbian companies are not eager to use information gathered from suppliers to develop a new product and service concept. More often, companies cooperate with the suppliers in the early stages of innovation and product development. The ability of the suppliers to provide innovative and sustainable solutions and development of solutions integrated into the supply chains generates value both in terms of sustainability and business success [31]. Teece [27] stated that suppliers could be the drivers of innovations, therefore highlighting the need for feeling out the supply markets and detecting the suppliers' capabilities for innovation. Supplier orientation enables to feel out and seize the supply bases, because if the company has no strategic orientation towards its suppliers, feeling out the supply base and the supply market may not be that efficient, may not be strategically managed, or may not occur early enough. According to Pulles, Veldman and Schiele [24], professionalism, specialisation and collaborative attitude of the suppliers, together with

the characteristics of buyer–supplier relationships (e.g., supplier development programmes and statuses of the buyers as preferred customers), increase innovativeness in the supply base. Research has revealed examples of innovations achieved through collaboration and partnerships [5], as well as how intensive buyer–supplier collaboration promotes inter-firm learning and innovative ideas [25].

Considering the involvement of SMEs in the supply chain as a part of corporate social responsibility is actually a recent concept related to sustainable development and sustainable development goals. The rationale behind it is a better overall supply chain performance. There is not a unique definition of sustainable supply chain management (SSCM), but the one provided by Mentzer et al. [15] might be the best to illustrate the win-win approach. They define SSCM as “the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole”. A study performed by Gimenez, Sierra and Rodon [7] concluded that supply chain collaboration has a significant positive impact on economic, environmental and social performance of a company. For SMEs, potential benefits of their integration in the global supply chains include technology upgrades, improved technical and managerial skills, and an easier and more penetrating market access [11]. There are also benefits for the multinational companies, given that they could develop innovative concepts through SMEs. This way, a faster development of technologies and penetration into markets that are disruptive could be achieved [16]. Carter and Rogers [3] identified the following four factors as SSCM facilitators:

1. strategy – identifying individual SSCM initiatives that are in line with the company's overall sustainability strategy;
2. risk management, including contingency plans for activities within the supply chain;
3. organisational culture that is clearly defined and generally accepted and one that includes employees, as well as high ethical standards, along with concerns for society as a whole and the ecosystem;

4. transparency in terms of communication with key stakeholders and visibility of supply chain activities in both directions.

Serbian authors have also considered the benefits that SMEs gain through their involvement in the supply chains. Thus, integration in export-oriented value chains is considered to be a leverage to increase the competitiveness of the company that assumes its capability to reduce costs and achieve a higher level of specialisation [20]. According to the OECD [17], the participation of SMEs in GVCs brings them benefits. Some of the key benefits include the following: access to global markets at lower cost, which enables SMEs to expand their business and become sustainable in the long run, flexibility in becoming specialised in meeting the needs of large supply chains while ensuring a favourable position in the market, outsourcing as a common model of the engagement of SMEs by large companies, especially in the ICT sector, could strengthen the capacity of SMEs to be internationalised and, last but not least, involvement in the supply chains improves the efficiency and innovativeness of a small firm [19]. However, an UNCTAD study identifies that the greatest challenge for SMEs in accessing value chains through outsourcing is the globalisation process, which very often represents a threat for the SMEs' sustainability by causing dependence which can jeopardise their sustainability in the long run [28]. In addition to the traditional approach to the supply chains, the concept of a green supply chain has received increasing attention in the recent years. The concept of the green supply chain includes all the elements contained in the traditional supply chain, with the addition of some new elements such as the "two-side product movement from producer to customer thus forming the so-called "closed loop" which also includes some new activities such as green recycling and re-manufacturing, reverse logistics and waste management" [1]. It is believed that this concept brings more benefits to companies compared to a purely traditional approach to the supply chain and these benefits can be divided into three groups: material, non-material and emotional benefits (cited in [1]).

Although all of the abovementioned papers emphasise the mutual benefits for buyers and suppliers, there are still plenty of obstacles which SMEs are facing in accessing the

supply chains, which indicates that corporate sector is still searching for a well-balanced SMEs-friendly supplier policy and procurement. In this paper, we aim to explore the significance of the barriers that SMEs are facing when accessing the supply chains. Different literature elaborates on the barriers that SMEs are facing in accessing both public procurements and supply chains. Loader [10] mentions several barriers, including lack of awareness of procurement opportunities and difficulties in getting approved as a supplier. Peck and Cabras [21] identified bureaucracy and the time-consuming procurement process as key disadvantages in public procurements. Uyarra et al [29] highlighted a lack of feedback and communication, contract size, and the procurement process. Perry [22] singles out lack of knowledge/awareness, capacity issues, and complex procurement processes.

There are many similarities between barriers that SMEs are facing in accessing public procurements, as well as supply chains in the corporate sector. [30] elaborate on the challenges faced by SMEs in accessing the supply chains. The authors singled out five main challenges, namely:

1. lack of coordination & cooperation between parties. SMEs would not get in an unfavourable position if it had been aware of the buyers' needs and the demand that could exceed their capacity to deliver the potentially increased amount or quality;
2. potential risk negligence. Because of their size, SMEs can adopt flexible attitudes towards risks when compared to large organisations. This could force SMEs to face major challenges related to scalability and reaction to unstable demand;
3. limited accessible technology. SMEs have restricted access to innovation, which can prompt a misuse of assets, poor execution, and a value-based centre with poor administration. The majority of SMEs rely on manual work, which makes procedure slow and expensive, and this might influence their cash flow;
4. unrealistic approaches. It is not rare that SMEs adhere to unrealistic approaches and predict future sales by relying on the past sales data. Another impractical assumption abided by SMEs is that the supply chain will fix everything, which is not true;

5. locked working capital. Because of having less experience or poor track records, SMEs normally have weak negotiation power. They have to pay in advance or quickly after the shipment to their supplier, and at the same time their clients (normally large organisation) require 30 to 90 days payment terms. This results in locked working capital for SMEs for a long period.

### **SMEs in the selected Western Balkan countries – Challenges faced in accessing the global value chains**

SMEs in the Western Balkans (WB) and Turkey make up for 99% of all firms, generating around 65% of the total business sector value added and accounting for 73% of the total business sector employment [19]. In the six countries of the WB, namely Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia, Albania, and Kosovo<sup>\*1</sup>, SMEs employ between 60% and 80% of the active population, which is on average higher than in the EU. Between 2013 and 2017, the WB and Turkey economies recorded a GDP growth of 3.1% per year on average. In relative terms, out of all the WB countries, Serbia had the largest number of SMEs per inhabitant in 2017, followed by Montenegro, North Macedonia, Kosovo\*, Albania, and Bosnia and Herzegovina. Recent studies have concluded that developing economies can achieve significant growth and productivity gains from engaging in GVC-related exports [4], [6]. Similarly, the experience from countries that joined the European Union in or after 2004 shows that participation in GVCs can help small economies accelerate export and income growth. WB countries are not well integrated into Europe's vibrant GVCs. Trade within the region is also limited – it tends to be bilateral and not cluster-like [6].

When measured as a share of GDP, WB countries are significantly less GVC-linked than the new member states (NMS-7), thus reflecting the limited role of exports in these economies. Among WB countries, Serbia, Montenegro,

and North Macedonia have experienced the largest increases in GVC links since 2000 [6]. The GVC links of WB countries are more concentrated in services and low value manufacturing products. These countries are mostly assembly centres in the GVCs in which they operate. However, in NMS 7, GVC links are mostly concentrated in high value manufacturing products. Compared to NMS-7, WB countries are less linked with Germany, which is the most important GVC hub in Europe. On the other hand, several WB countries have strong GVC links with Italy, which may explain the slow export growth in these countries. Two WB countries, Bosnia and Herzegovina and North Macedonia, also show strong links with NMS-7 countries, which is a possible indication of mature investors in NMS-7 outsourcing some of the low value activities. The potential of WB countries lies in their membership in the Central European Free Trade Agreement (CEFTA), whose members have zero tariff on trade. This advantage seems to be still underexploited by the European investors, able to bring capital and trade to the region [6].

In 2016, no economy in the WB countries had in place the tools to support SMEs involvement in GVC [18]. However, by 2019, all of them have introduced programmes to address this issue, whether by generating support for industrial clusters, industrial zones, and promoting business linkages, or supplier upgrading schemes. Bosnia and Herzegovina and Montenegro continue to implement cluster support programmes, while Kosovo\* has established one cluster in the metal industry and the renewable energy sector (KIMERK). Serbia has developed the most robust programmes to assist SMEs in upgrading their positioning in GVC by offering schemes for financial support to upgrade machinery [19].

Considering the broad areas that most economies in the region could develop, it is recommended to enhance integration of SMEs into the GVC by facilitating links between foreign direct investment and SMEs. Integration into the GVC is listed among the instruments which could leverage SMEs internationalisation in the region. However, economic diversification inside the economy remains low, and SMEs have limited links with GVC. The conclusion is that by increasing GVC links, WB countries could raise their GDP levels by 3-10 % [6].

<sup>1</sup> This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence.

In the recent years, digital entrepreneurship has been developing, representing the new emerging economic force in the regional economies and the SMEs sector. The entrepreneurs of the new “digital” generations often access GVC easier, which is an advantage for those SMEs operating in the ICT sector. There are interesting products, innovative technologies and promising teams led by founders with ambitious mind-sets. However, there are only few established intermediaries (investors, incubators, and accelerators) and other support systems, resulting in a limited scope of regional ecosystems. The WB region consequently features very few regional success stories of companies that have successfully grew and scaled up to offer their products to a wider base of consumers, clients, and beneficiaries.

Still, the majority of SMEs are facing the same barriers in accessing GVC, as identified in the literature reviewed in this paper.

## Methodology

### Sample and variables

Table 1 shows the key characteristics of the sample and the data related to the involvement of SMEs in the supply chains. The sample included in the research consists of 130 SMEs from the WB region. SMEs from Serbia, Bosnia and Herzegovina, Montenegro and Croatia were included in the analysis. The questionnaire was distributed to SMEs through the chambers of commerce in these four countries. The largest number of companies belong to the

category of micro-sized companies, while 14% of the total number are medium-sized companies. Male and female-owned companies are represented in a similar proportion in the sample. Most of the companies in the sample have been operating for 11 to 20 years or more than 20 years. Out of a total of 130 received questionnaires, 105 were fully usable, while 25 could not be used for the purposes of this research.

Table 2 presents the variables used in the study. The dependent variable in the model indicates whether a company is included in a supply chain. Key independent variables in the research model are barriers to the inclusion of a company in the supply chains (the perceptions of the respondents). Respondents were asked to rate the importance of barriers on a scale of 1 to 5, with a score of 1 indicating a low level of importance and the score of 5 indicating a high level of importance of the barrier. To reduce the bias of the results or prevent the growth of

**Table 1: Characteristics of the sample**

Company size	Frequency (%)
1-9	65 (61.9)
10-49	25 (23.8)
50-249	15 (14.3)
Company age	Frequency (%)
<5	21 (20)
6-10	20 (19)
11-20	31 (29.5)
>20	33 (31.5)
Ownership > 50%	Frequency (%)
Male	55 (52.4)
Female	50 (47.6)
Usable questionnaires	Frequency (%)
Usable	105 (81.5)
Unusable	25 (18.5)

Source: Authors.

**Table 2: Variables description**

Dependent variable	Type/Measurement
Involvement of SMEs in the supply chain ( <i>Involvement</i> )	Dummy variable: 1 = Yes; 0 = No
Independent variables	Type/Measurement
Long period of collecting receivables from the customers ( <i>Receivables</i> )	Categorical 1-5: 1 – least important; 5 – most important
High costs of entering the supply chain ( <i>Costs</i> )	Categorical 1-5: 1 – least important; 5 – most important
High quality standards required from the suppliers ( <i>Quality</i> )	Categorical 1-5: 1 – least important; 5 – most important
Inadequate information on the conditions of participation ( <i>Information</i> )	Categorical 1-5: 1 – least important; 5 – most important
Control variables	Type/Measurement
Gender of the majority owner ( <i>Gender</i> )	Dummy: 1 = Female; 0 = Male
Number of employees ( <i>Size</i> )	Categorical: 0 = 1-9; 1 = 10-49; 2 = 50-249
Number of years the company has been in business ( <i>Age</i> )	Categorical: 0 = 1-5; 1 = 6-10; 2 = 11-20; 3 = >20

Note: Abbreviations in parentheses.

In case of the dependent and control variables, 0 denotes a reference category in the study.

a. In social sciences, the scale which is used for independent variables measurement can be also treated as continuous.

Source: Authors.

bias, three company-specific variables are included in the research model as control variables.

### Econometric methodology

#### Kruskal-Wallis test (one-way ANOVA on ranks)

The Kruskal-Wallis test is an extension of the Mann-Whitney test and allows for comparison of three or more groups with respect to the dependent variable. The Kruskal-Wallis test does not require that the assumption of normal data distribution be demonstrated, which is why this test belongs to the category of non-parametric tests and stands as a non-parametric alternative to the parametric one-way fixed effect ANOVA test. Since the normality tests (Appendix I) found that the variables used in this study did not reflect the normal distribution, it was decided to use the Kruskal-Wallis test to compare the differences in perceptions of the importance of barriers to inclusion in the supply chains between different-sized companies.

The Kruskal-Wallis statistics is calculated as follows:

$$KW = \frac{12}{N(N+1)} \sum \frac{R_i^2}{n_i} - 3(N+1)$$

where:  $N$  is a total number of observations;  $n$  is the number of observations per group -  $i^{th}$  group;  $R_i$  is the total sum of ranks in the  $i^{th}$  group.

#### Binary logistic regression

Binary logistic regression is used when the dependent variable is binary (two-category outcome), as in this case (1 = Yes; 0 = No), while independent variables can be mixed. This method applies a non-linear log transformation to the predicted odds ratio, so it can handle any type of relationship between the dependent and independent variables. Unlike the linear regression and general linear models that are based on OLS algorithms, binary logistic regression is robust to heteroscedasticity problems and non-normal data distribution, but an important assumption for obtaining unbiased results while using this method is the absence of the multicollinearity problem. In order to select values for the parameters of binary logistic regression, maximum likelihood estimation is used.

Binary logistic regression can be expressed as follows:

$$\begin{aligned} \text{Logit}(\text{Involvement}) &= \text{Ln} \frac{p(\text{Involvement} = 1)}{1 - p(\text{Involvement} = 0)} = \\ &= \beta_0 + \beta_1 (\text{Receivables}) + \beta_2 (\text{Costs}) + \\ &+ \beta_3 (\text{Quality}) + \beta_4 (\text{Information}) + \\ &+ \beta_5 (\text{Gender}) + \beta_6 (\text{Size}) + \beta_7 (\text{Age}) \end{aligned}$$

where:

$$p = \frac{e^{\beta_0 + \beta_1 (\text{Receivables}) + \beta_2 (\text{Costs}) + \beta_3 (\text{Quality}) + \beta_4 (\text{Information}) + \beta_5 (\text{Gender}) + \beta_6 (\text{Size}) + \beta_7 (\text{Age})}}{1 + e^{\beta_0 + \beta_1 (\text{Receivables}) + \beta_2 (\text{Costs}) + \beta_3 (\text{Quality}) + \beta_4 (\text{Information}) + \beta_5 (\text{Gender}) + \beta_6 (\text{Size}) + \beta_7 (\text{Age})}}$$

is the probability of involvement in the supply chain, which is also called Odds;  $\beta_0$  is constant;  $\beta_{1-7}$  are regression coefficients of the independent variables.

### Research questions

The paper deals with barriers that SMEs in the WB region are facing in accessing the supply chains. There are two goals that are to be achieved by this research: to determine whether there are differences in the perception of the importance of barriers to inclusion in the supply chains between different-sized companies and to verify whether and how the perception of barriers to inclusion in the supply chains affects the probability of involvement in the supply chains.

According to the subject and goals of the research, this paper should provide answers to two questions:

RQ1: Do different-sized companies valorise the same barriers to involvement in the supply chains differently?

RQ2: Does the perception of barriers affect the likelihood of involvement of SMEs in the supply chains?

### Results

The results of verifying the significance of differences between different-sized companies in terms of barriers to inclusion in the supply chains are shown in Table 3. The Kruskal-Wallis test was used for this purpose. The results of the applied test show that there are no significant differences in the perception of the importance of barriers to inclusion in the supply chains between different-sized companies (asymptotic  $p > 0.05$ ). Regardless of their size, it seems that companies have a very similar perception of strength of these barriers to their inclusion in the supply chains.

In order to provide an answer to RQ2, the maximum likelihood estimation of the binary logistic regression was

**Table 3: Differences in the perception of barriers to involvement in the supply chains between different-sized companies**

Model	$\chi^2$	Asymptotic p-value
1	0.063	0.969
2	1.285	0.526
3	1.172	0.557
4	0.623	0.732

Note: Dependent variables in models 1, 2, 3, and 4 are receivables, costs, quality, and information, respectively. Multiple comparisons are not performed because the overall test does not show significant differences across samples. Source: Authors.

applied. Before creating the binary logistic regression model, the multicollinearity was verified by determining the degree of correlation between the independent variables (Appendix II). The correlation coefficients for the observed variables are below the lower threshold of 0.8, which means that the multicollinearity problem is not present in the model and that the binary logistic regression method can be applied. *Receivables* are found to be a significant, but also a negative predictor when it comes to predicting Involvement (OR=0.557; CI=0.347, 0.893). This is also the case when it comes to *Information* (OR=0.567; CI=0.337, 0.956). Roughly speaking, the odds of *Involvement* decreased by a factor of 0.56 when the score of *Receivables* increased by one unit. On the other hand, when the score of *Inadequate information on conditions* increased by one unit, the odds of *Involvement in the supply chains* decreased by a factor of 0.57. It is interesting that *Costs* (OR=0.833; CI=0.532,1.304)

**Table 4: Binary logistic regression – The maximum likelihood approach**

Variables	$\beta$	Wald	p-value	Odds ratio	Odds ratio – 95% CI	
					Lower	Upper
<i>Receivables</i>	-0.585	5.892	0.015	0.557	0.347	0.893
<i>Costs</i>	-0.183	0.640	0.424	0.833	0.532	1.304
<i>Quality</i>	0.081	0.124	0.724	1.084	0.693	1.697
<i>Information</i>	-0.567	4.541	0.033	0.567	0.337	0.956
<i>Age</i>		13.366	0.004			
<i>Age (6-10)</i>	0.442	0.276	0.600	1.556	0.299	8.110
<i>Age (11-20)</i>	2.728	10.073	0.002	15.300	2.839	82.468
<i>Age (&gt;20)</i>	1.606	5.243	0.022	4.985	1.260	19.720
<i>Gender (female)</i>	-0.371	0.391	0.532	0.690	0.216	2.208
<i>Size</i>		4.024	0.134			
<i>Size (10-49)</i>	-1.543	2.979	0.084	0.214	0.037	1.233
<i>Size (50-249)</i>	-0.342	0.150	0.698	0.710	0.126	4.007
Constant	5.031	10.339	0.001	153.012		

Source: Authors.

and *Quality* (OR=1.084; CI=0.693, 1.697) were not found to be significant predictors of *Involvement*. Size of the company is not a significant predictor of *Involvement* in the supply chain (Wald  $\chi^2=4.024$ ;  $p=0.134$ ). This also applies when it comes to the Gender of the majority owner of the company (OR=0.690; CI=0.216, 2.208). On the other hand, Age plays a significant role in a company’s *Involvement* in the supply chain (Wald  $\chi^2=13.366$ ;  $p<0.05$ ). Companies with longer business experience have greater odds of getting involved in the supply chains.

In Table 5, different indicators of goodness of the binary logistic model fit are presented.  $\chi^2$  from the omnibus test is statistically significant ( $p<0.05$ ), which indicates that somewhere in our model there is at least one explanatory variable that is statistically significant when it comes to predicting *Involvement*. The Hosmer-Lemeshow test indicates that the model is an adequate fit to the data ( $p=0.159$ ). Table 5 also presents the different types of Pseudo  $R^2$ . When it comes to logistic regression, McFaddens  $R^2$  and Nagelkerke  $R^2$  are most often reported in the papers. According to McFadden [14], values of 0.2 to 0.4 for  $R^2$  are an excellent fit. McFaddens  $R^2$  value for our model is 0.28, indicating an excellent fit of the binary logistic regression model. Nagelkerke  $R^2$  is 0.43, which also represents a relatively good model fit. It can be concluded that the model accounts for 43% variability of *Involvement* in the supply chain. Model is correctly classifying the outcome for 77.14% of the cases.

One of the most effective and most often used measures of model quality is the receiver operating characteristic (ROC) curve (Figure 1). It is a visual measure, i.e., a plot of the sensitivity versus 1 – specificity of a diagnostic test.

**Table 5: Measure of the goodness of fit test**

Indicator	Value
-2log likelihood	101.782
McFadden’s $R^2$	0.28
Efron’s $R^2$	0.35
Nagelkerke $R^2$	0.43
McKelvey & Zavoina’s $R^2$	0.45
Hosmer-Lemeshow test $\chi^2(p)$	10.569(0.159)
Omnibus test $\chi^2(p)$	40.322(0.000)
Specificity	67.44%
Sensitivity	83.87%
Correctly classified	77.14%

Source: Authors.

Since it is a visual measure, the area under the ROC curve (AUROC) is used more often. The AUROC value ranges from 0 to 1, where the value of 0 indicates a perfectly inaccurate model and the value of 1 stands for a perfectly accurate model [12]. An AUROC of 0.5 suggests no discrimination, 0.7 to 0.8 is considered acceptable, 0.8 to 0.9 is considered excellent, and more than 0.9 is considered outstanding. In this case, ROC curve was determined based on 105 observations. The value of AUROC is 0.834 (CI=0.75404, 0.91401), indicating an excellent discriminating ability of the defined model.

## Conclusion

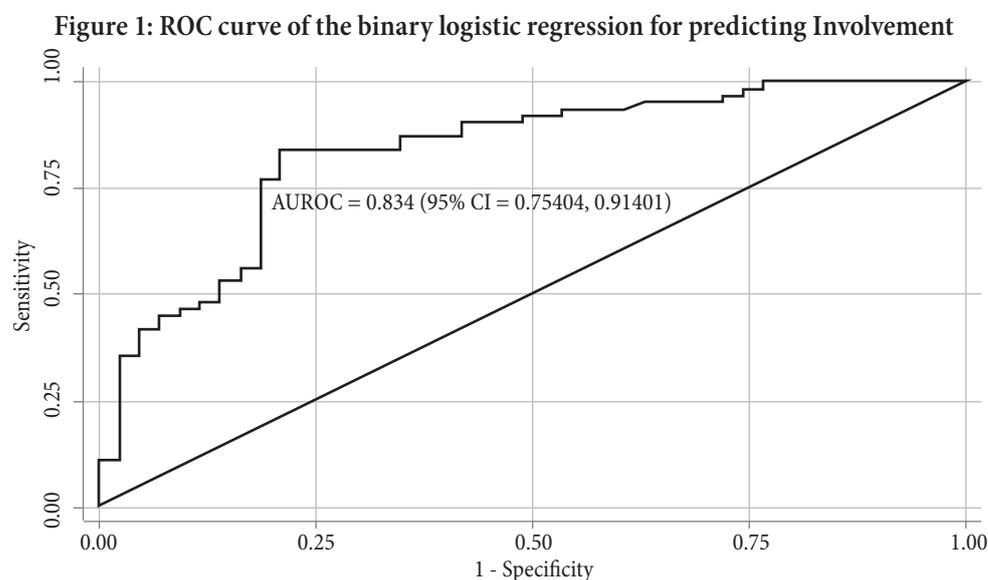
Although many authors in the literature explored and accepted the hypothesis that inclusion of SMEs in the supply chains contributes to the overall better performance of the company through enhanced innovativeness and competitiveness, many SMEs are still unable to enter the supply chains. For various reasons, they are facing difficulties in getting approved as suppliers. The most common barriers are: limited capacity to deliver the potentially increased amount or quality, challenges related to scalability and reaction to unstable demand, SMEs often having restricted access to innovation, which affects the quality of work and deliverables, late payments that cause the bankruptcy of thousands of SMEs each year across Europe. Many SMEs tend to be outsourced by large companies, and that way they ensure

their position in the global market. However, there are no guarantees that they could avoid the risks posed by involvement in the supply chains through other strategies of internationalisation.

SMEs in less developed regions such as the Western Balkans should be even more aware on the risks of involvement in the supply chains, as they are more vulnerable to market distortions. We have considered four common obstacles that SMEs in the WB region are facing, including long periods of collecting receivables from the customers, high costs of entering the supply chains, high quality standards required from the suppliers, and inadequate information on the conditions. Similar potential barriers for SMEs accessing either public procurements or supply chains have been cited in the literature.

Results show that there are no significant differences in the perception of barriers to inclusion in the supply chains between different-sized companies, which would be the answer to RQ1. Thus, companies, regardless of their size, have a similar way of perceiving the relative strength of barriers to inclusion in the supply chains.

By applying binary logistic regression, it was concluded that out of the considered barriers, only the length of receivables collection period and the inadequacy and incompleteness of information on conditions significantly and negatively affect inclusion in the supply chains. The remaining barriers are not essential determinants of the decision to join the supply chain. The above is the answer to RQ2.



Source: Authors.

Such results are somewhat expected, because every company needs to have insight into all the information that is relevant for participating in the supply chain in order to be aware of all the advantages and disadvantages. Also, the length of receivables collection period affects the company's liquidity, which can create certain financial problems. This problem has been noticed even in the practices of companies operating in the European Union, which is why the European Union has adopted a Directive for Late Payment, which regulates the receivables collection period in order to support the sustainability of SMEs. Interestingly, Costs do not affect the inclusion in the supply chains, which can be explained by the fact that either the costs were not perceived as high or that the companies that applied for involvement in the supply chains thought that the initial costs would be significantly lower than the expected benefits. However, it is not clear why Quality is not recognised as significant, since it is crucial to enter the supply chains, especially when it comes to food products. Therefore, this particular barrier should be explored in greater detail in further research.

A company's age has a significant impact on access to the supply chains. It means that companies with longer business experience have greater odds of becoming parts of the supply chains. Company size is not a relevant factor, which is also the case when considering the gender of the majority owner. Different-sized companies, as well as companies with different genders of the majority owner, have similar odds of getting involved in the supply chains.

The biggest limitation of this research relates to the sample size. Taking into account that the analysis included SMEs from four countries, the sample size of 105 observation units seems to be rather small, which is, generally, the greatest challenge for any research based on primary data covering multiple countries. However, since all of the four countries share the same economic and social background of being part of the same country in the recent past, they are still facing similar challenges, especially the three non-EU states. Therefore, this sample of 105 companies could provide at least an indicative insight into the barriers and their impact on SMEs in accessing the supply chains in the WB region.

## References

1. Aćimović, S., & Mijušković, V. (2014). Managing the green supply chain – Concept importance and Indian IT sector case study. *Ekonomika preduzeća*, 65(5-6), 251-263.
2. Azadegan, A., & Dooley, K. (2010). Supplier innovativeness, organizational learning styles and manufacturer performance: An empirical assessment. *Journal of Operations Management*, 28(6), 488-505.
3. Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution and Logistics Management*, 38(5), 360-387.
4. Constantinescu, C., Mattoo, A., & Ruta, M. (2017). *Does vertical specialization increase productivity?*. Policy Research Working Paper 7978. World Bank, Washington, DC.
5. Darnall, N., Jolley, G. J., & Handfield, R. (2008). Environmental management systems and green supply chain management: Complements for sustainability? *Business Strategy and Environment*, 17(1), 30-45.
6. Faezeh, R., Ignatenko, A., & Mircheva, B. (2019). *Global value chains: What are the benefits and why do countries participate?*. IMF Working Paper 19/18. Washington, DC: International Monetary Fund.
7. Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, 140, 149-159.
8. Ilahi, N., Khachatryan, A., Lindquist, W., Nguyen, N., Raei, F., & Rahman, J. (2019). Lifting growth in the Western Balkans: The role of global value chains and services exports. Retrieved from <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2019/11/11/Lifting-Growth-in-the-Western-Balkans-The-Role-of-Global-Value-Chains-and-Services-Exports-46860>.
9. Lintukangas, K., Kähkönen, A., & Hallikas, J. (2019). The role of supply management innovativeness and supplier orientation in firms' sustainability performance. *Journal of Purchasing and Supply Management*, 25(4), 1-10.
10. Loader, K. (2005). Supporting SMEs through government purchasing activity. *International Journal of Entrepreneurship and Innovation*, 6(1), 17-26.
11. Luetkenhorst, W. (2004). Corporate social responsibility and the development agenda: The case for actively involving small and medium enterprises. *Intereconomics*, 39, 157-166.
12. Mandrekar, J. N. (2013). Receiver operating characteristic curve in diagnostic test assessment. *Caspian Journal of Internal Medicine*, 4(2), 627-635.
13. Mazzola, E., Bruccoleri, M., & Perrone, G. (2015). Supply chain of innovation and new product development. *Journal Purchasing and Supply Management*, 21(4), 273-284.
14. McFadden, D. (1977). Quantitative methods for analyzing travel behaviour of individuals: Some recent developments. Retrieved from <http://cowles.yale.edu/sites/default/files/files/pub/d04/d0474.pdf>.
15. Mentzer, J., DeWitt, W., Keebler, J., Min, S., Nix, N., Smith, C., & Zacharia, Z. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1-25.

16. Moore, S., & Manring, S. (2009). Strategy development in small and medium sized enterprises for sustainability and increased value creation. *Journal of Cleaner Production*, 17, 276–282.
17. OECD. (2008). *Enhancing the role of SMEs in global value chains*. Retrieved from [https://www.ecb.europa.eu/home/pdf/research/compnet/Enhancing\\_the\\_role\\_of\\_SMEs.pdf?9235c9ba9b76a6a403bc10723d6dd11e](https://www.ecb.europa.eu/home/pdf/research/compnet/Enhancing_the_role_of_SMEs.pdf?9235c9ba9b76a6a403bc10723d6dd11e).
18. OECD. (2016). *SME policy index Western Balkans and Turkey. Assessing the implementation of the Small Business Act for Europe*. Retrieved from <https://europa.ba/wp-content/uploads/2016/06/SME-Policy-Index-Western-Balkans-and-Turkey-2016.pdf>.
19. OECD. (2019). *Assessing the implementation of the Small Business Act for Europe*. Retrieved from <https://www.oecd-ilibrary.org/docserver/g2g9fa9aen.pdf?expires=1591011240&id=id&accname=guest&checksum=09C8A6EDDA54FC3D97BDEE1F1C11C654>.
20. Paunović, B., & Ivanić, V. (2018). Value chain upgrading in transition economies. *Ekonomika Preduzeća*, 65(7-8), 386–399.
21. Peck, F., & Cabras, I. (2011). The impact of local authority procurement on local economies: The case of Cumbria, North West England. *Public Policy and Administration*, 26(3), 307–311.
22. Perry, C. (2011). *Supporting SME access to public procurement opportunities*. Research and Information Service research paper. Northern Ireland Assembly. Retrieved from <http://www.niassembly.gov.uk/globalassets/documents/raise/publications/2012/education/1212.pdf>.
23. Popović-Pantić, S. (2014). An analysis of female entrepreneurship and innovation in Serbia in the context of EU competitiveness. *Economic Annals*, 59(200), 61–90.
24. Pulles, N. J., Veldman, J., & Schiele, H. (2014). Identifying innovative suppliers in business. *Industrial Marketing Management*, 43(3), 409–418.
25. Schiele, H. (2006). How to distinguish innovative suppliers? Identifying innovative suppliers as new task for purchasing. *Industrial Marketing Management*, 35(8), 925–935.
26. Sofka, W., & Grimpe, C. (2010). Specialized search and innovation performance – Evidence across Europe. *R&D Management*, 40(3), 310–323.
27. Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic management journal*, 28(13), 1319–1350.
28. UNCTAD. (2010). *Integrating developing countries' SMEs into global value chains*. Retrieved from [https://unctad.org/en/Docs/diaeed20095\\_en.pdf](https://unctad.org/en/Docs/diaeed20095_en.pdf).
29. Uyarra, E., Edler, J., Garcia-Estevéz, J., Georghiou, L., & Yeow, J. (2014). Barriers to innovation through public procurement: A supplier perspective. *Technovation*, 34(10), 631–645.
30. Waseem, A. A., Zongrun, W., & Asaad, A. (2018). Overcoming SMEs financing and supply chain obstacles by introducing supply chain finance. *Holistica*, 9(1), 7–22.
31. Western Balkan Enterprise Development and Innovation Facility. *Building the future of SMEs in the Western Balkans*. Retrieved from <https://wbif.eu/10-years-success-stories/success-stories/building-future-smes-western-balkans>.
32. Windahl, C., & Lakemond, N. (2006). Developing integrated solutions: The importance of relationships within the network. *Industrial Marketing Management*, 25(7), 806–818.

## APPENDIX I

### Normality test

Parameters	Kolmogorov-Smirnov		Shapiro-Wilk	
	Statistic	Sig	Statistic	Sig
Receivables	0.242	0.000	0.839	0.000
Costs	0.196	0.000	0.847	0.000
Quality	0.170	0.000	0.895	0.000
Information	0.187	0.000	0.899	0.000

Source: Authors.

## APPENDIX II

### Correlation matrix

	Receivables	Costs	Quality	Information	Age (6-10)	Age (11-20)	Age (>20)	Gender (female)	Size (10-49)	Size (50-249)
<i>Receivables</i>	1.000	-0.387	0.182	-0.008	-0.065	-0.194	-0.044	0.058	0.137	-0.005
<i>Costs</i>	-0.387	1.000	-0.037	-0.199	0.113	-0.001	-0.010	-0.134	-0.221	-0.100
<i>Quality</i>	0.182	-0.037	1.000	-0.473	0.115	0.151	0.099	0.112	-0.028	-0.007
<i>Information</i>	-0.008	-0.199	-0.473	1.000	-0.170	-0.288	-0.113	0.248	0.274	0.202
<i>Age (6-10)</i>	-0.065	0.113	0.115	-0.170	1.000	0.457	0.553	0.173	-0.395	-0.079
<i>Age (11-20)</i>	-0.194	-0.001	0.151	-0.288	0.457	1.000	0.473	0.071	-0.326	-0.167
<i>Age (&gt;20)</i>	-0.044	-0.010	0.099	-0.113	0.553	0.473	1.000	0.131	-0.338	-0.072
<i>Gender (female)</i>	0.058	-0.134	0.112	0.248	0.173	0.071	0.131	1.000	0.295	0.139
<i>Size (10-49)</i>	0.137	-0.221	-0.028	0.274	-0.395	-0.326	-0.338	0.295	1.000	0.666
<i>Size (50-249)</i>	-0.005	-0.100	-0.007	0.202	-0.079	-0.167	-0.072	0.139	0.666	1.000

Source: Authors.



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### **Dušica Semenčenko**

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