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DETERMINATION OF EXPERT GROUP PREFERENCES IN THE MULTI-CRITERIA MODEL FOR THE ANALYSIS OF LOCAL ECONOMIC ENVIRONMENT

Jelena Stanković

University of Nis, Faculty of Economics, Republic of Serbia
✉ *jelena.stankovic@eknfak.ni.ac.rs*

Žarko Popović

University of Nis, Faculty of Economics, Republic of Serbia
✉ *zarko.popovic@eknfak.ni.ac.rs*

Sanja Kostevski

PhD student of Belgrade Banking Academy, Belgrade
✉ *sanjakostevski1986@yahoo.com*

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Abstract: Local economic environment is characterised by a range of economic, social, political and demographic parameters, based on which we can perform its analysis. Heterogeneity of relevant characteristics of the local economic environment imposes multiple criteria analysis as one of the suitable tools for the evaluation. Assessment of local economic environment often falls within the scope of group decision-making, as it is usually performed on the basis of an analysis of preferences of economic subjects or relevant experts on the issue of the economic environment at the local level. Regardless of whether it is based on economic subjects or expert group, in order to form a multi-criteria model, it is necessary to generate preferences of individuals into a single weight coefficient, which shows groups' preference on the importance of each criterion. The subject of this paper is determination of weight coefficients in the multi-criteria model for the analysis of local economic development based on the preferences from a group of experts, by applying adequate statistical tools, and then by ranking local governments according to the quality of business environment perceived by the expert group.In addition to descriptive statistics and testing the significance of differences, in the paper is applied multi-criteria method Simple Additive Weights - SAW.

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1. Introduction

The business environment in which economic activity takes place is an important factor in attracting investment and acceleration of economic activity, both at the state level and at the level of cities and municipalities.For this reason, the local governments, in this regard, are *competition* to each other, and each one of them is trying to emphasise its comparative advantages.

Uneven economic development isn't rare anywhere in the world, because, in practice, it is impossible to accomplish completely equal development of the municipalities, but it is important to constantly work on reducing the gap between developed and developing municipalities. One of the ways to do this is by starting the initiative to create a friendly business environment in municipalities. This can be achieved by identifying and presenting their comparative advantages.

Thanks to their specific characteristics in relation to others, with prior secured favourable business environment for the investors, local governments become more *friendly oriented to investments*. In order to receive this attribute, local governments must be familiar with the standards for the improvement of local economic development (Stanković et al., 2014, p. 106).

Certification of municipalities is a process of evaluation of the quality of services and information that they provide to investors and businesses. This process is aimed at improving the business environment in Serbia through institutional reforms with active participation and cooperation of businesses, municipalities and citizens. Certification of cities is based on certain criteria and represents a sort of recognition of the quality of municipalities' functioning in order to attract foreign investment. However, in order to meet the requirements for certification, local governments must view their municipality from the perspective of potential investors, in terms of information and conditions that they require. Certification of municipalities in Serbia has been actively implemented during the last five years, and every city or municipality involved in this process receives specific recommendations for improving the functioning and creating a favourable business environment that includes efficient administration, transparent local government, adequate infrastructure and partnership with the economy (Stanković et al., 2014, p. 106). Direct effects of the certification process are reflected in increased investment, and indirect effects are reflected in reduced unemployment and rising living standards. The holder of this process is the *National Alliance for Local Economic Development* - NALED, an independent association of businesses, local governments and non-governmental organizations working together to create a favourable business environment in Serbia. The certification process conducted by NALED takes place in several stages. The last phase is the visit of verification commission, which makes a final assessment on the award of the certificate. If

the Commission's assessment is positive and the certificate is awarded, the municipality is promoted as a municipality with friendly business environment. The duration of the certification process depends on the willingness of the municipality to take the necessary measures to fulfill the defined criteria.

As the assessment is done on the basis of twelve diverse criteria, so the multi-criteria analysis method is imposed as a method of choice for the analysis of the local economic environment. This paper applied *SAW - Simple Additive Weight* method, which will be used to rank local governments whose assessment of the business environment was given by a group of experts involved in the research. The problem is methodologically defined as a problem of group decision-making, which integrates the subjective preferences of the expert group members into a single preference, reflecting the collective preferences of the expert team. In accordance with the above problem description, the structure of the paper, in addition to the introductory part and the review of literature, includes parts which describe the research methodology and defining of hypotheses, presents the results of statistical analysis, but also presents the formation of multi-criteria model and methodologies for its solution.

2. Literature Review

Management of the local economic environment involves making a series of decisions by national and local authorities, regulating and improving the business environment in order to boost economic activity and attract a larger number of investment projects on the territory of the observed local government. This is a complex process that requires an analysis of the interests of different stakeholders and at the same time, involves making decisions under conditions of different criteria for its evaluation. Therefore, it is a problem of multi-criteria analysis in which the decision-maker is a group of people. One such complex decision-making process can be successfully managed by using modern approaches to decision-making - application of relevant mathematical models and advanced decision support systems.

Decision-making theory and decision-making analysis, as well as quantitative approaches and modeling of the decision-making process experienced its greatest expansion in the period between the 1960s and the 1980s of the last century (Simon, 1960; Delbecq, 1967; Mintzberg, 1973; Eden & Harris, 1975; Lee & Moore, 1975; Moody, 1983; Mescon et al. 1985; Harrison, 1987). Significant progress in the implementation of methods and models of the decision-making analysis and theory in economic practice and in real decision-making problems occurred in parallel with the development of decision support systems. The high degree of the ability to modify the basic models of decision making, with real economic problems, was enabled through

the application of software tools that simplify this process (Turban et al., 2005; Pinheiro-Böhl, 2007; Burnstein & Holsapple, 2008; Sauter, 2011).

New business trends that promote democratic organisational structures, global connectivity and advanced techniques and models of decision-making, increasingly suggest that strategic decisions are based on the process of collective decision-making, not on a decision maker's preferences. Organisations and economic system, in general, tend to increasingly use the potential power of collective decision-making, where it is assumed that the group of experts can bring a better or at least more objective decision or assessment, as opposed to the individual (Dias & Sarabando, 2012; Keeney, 2009).

In relation to individual decision-making, group decision-making gives the advantage to the integration of a larger number of information, more experience, but also a better diversification of cognitive limiting factors of the individuals, minor evaluation errors and higher level of solutions acceptability (Sims, 2002; Kreitner & Cassidy 2011). The participation of the group in the process of decision-making can lead to better use of different competences, as well as a higher level of integration of individual responsibilities in order to find the optimal solution for a given system (De Haas & Kleingeld 1999). However, at the same time, group decision-making incorporates some possible drawbacks such as the dominance of intrusive individuals within the group (Kreitner & Cassidy, 2011).

Based on these characteristics, it can be concluded that the group decision-making requires a more complex approach to modeling, but also the implementation of complex decision support systems. A special type of modeling is required in situations where decisions must be made on the basis of different and often conflicting criteria and when decisions are made by the group. Multi-criteria decision models, with the group as a decision-maker, are often used in management accounting and control, strategic decision-making at the enterprise level, as well as in strategic management at the macro level as well as in the modeling of social choice problems (Hülle et al., 2011, Huang, Liao & Lin, 2009; Van den Honert & Lootsma, 1996; Wallenius et al., 2008).

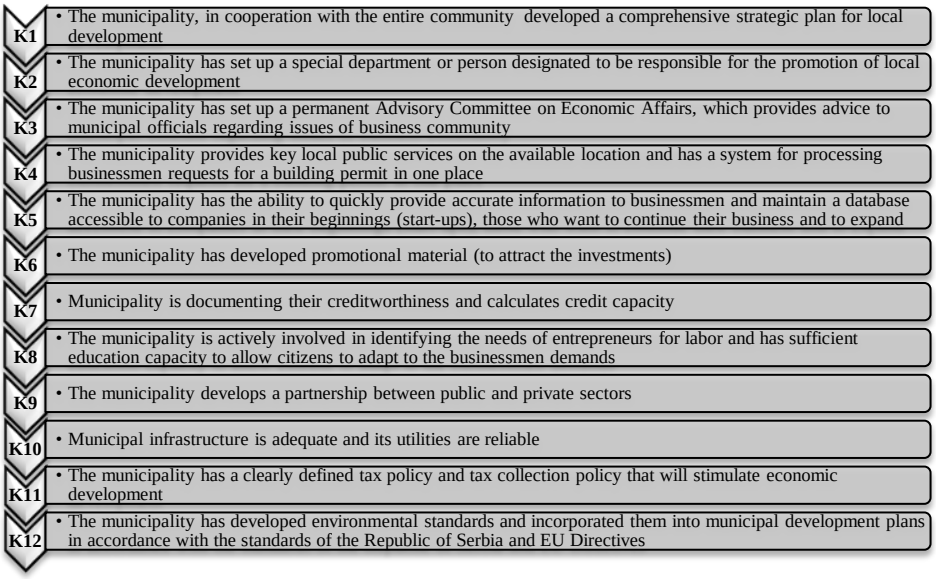
3. Methodology of Research, Data and Hypotheses

For the purpose of this research, we formed a sample of ten respondents made by ten experts from three cities in Serbia - Niš, Kragujevac and Belgrade. From a total of ten experts, five of them are from Niš, three are from Belgrade and two of them are from Kragujevac. These are mostly university employees, one of them is an employee in one of the ministries of the Republic of Serbia and one is employed in the local government of Niš. Nine of them have PhD title,

while one respondent has a master's degree. The survey was conducted through a questionnaire in December of 2014.

The questionnaire that was used for the purpose of this paper consists of 12 questions related to the criteria that NALED uses in the process of certification of cities and municipalities (Figure 1), questions were formulated in such a way that respondents expressed preferences on the basis of the so-called Likert scale. Likert scales are used for the operationalisation of a large number of variables, most commonly in social sciences, as well as in complex issues such as e.g.liberalism, conservatism, authoritarianism, religion, etc. Most often, it identifies several positions (preferably 4 or more) which can be considered an integral part of the concept that we seek to measure, and then the level of agreement measures that concept. Likert scale used in this work is the scale of five notches, where notch 1 indicates the lowest level of agreementof the decision-maker with the given statement, and notch 5, in contrast, represents the highest level of agreement.

Figure 1 Criteria for evaluation of the business environment of cities and municipalities in Serbia according to NALED



Source: Systematised by authors, according to NALED data (www.naled-serbia.org)

These criteria will be used for the investigation of the expert group positions on their importance for the creation of business environment at the local level, their fulfillment in the observed environment, and an analysis of the gap formed between the demands placed on the importance of certain criteria and their fulfillment.

The research will test the following hypotheses:

H_1: There is a statistically significant difference in the perception of experts regarding the achieved level of fulfillment of criteria in the respective local government, compared to the level of significance of that criteria for the creation of a favourable business environment;

H_2: Perception by expert group members varies depending on the place where they live and work, or the perception of the significance of criteria changes depending on the unit of local self-government that is observed.

4. Research Results

All research results presented in the paper can be systematised into two groups:

I. Statistical analysis of the results

II. The formation of multi-criteria model and ranking of local governments

4.1. Statistical Analysis of the Results

The first step of statistical processing of data collected is to analyse the frequency of individual scores occurrences - descriptive statistics. As the expert group gave a separate opinion on the significance, and separate opinion about the fulfillment of the criteria, these data will be especially examined through the analysis of the results. Table 1 gives the descriptive statistics of the expert group preferences on the significance of the listed criteria for the business environment at the local level, but also on their fulfillment in local governments where experts live and work.

Table 1 Descriptive statistics of *significance-fulfillment* score pairs

		Mean value	N	Std. deviation	Std. error
K1	Significance	3.70	10	1.160	0.367
	Fulfillment	2.30	10	0.675	0.213
K2	Significance	4.00	10	0.667	0.211
	Fulfillment	2.60	10	1.174	0.371
K3	Significance	3.70	10	0.823	0.260
	Fulfillment	2.00	10	1.054	0.333
K4	Significance	4.40	10	0.699	0.221
	Fulfillment	2.60	10	0.966	0.306

K5	Significance	4.10	10	0.738	0.233
	Fulfillment	2.50	10	1.080	0.342
K6	Significance	4.40	10	1.075	0.340
	Fulfillment	2.80	10	1.229	0.389
K7	Significance	3.50	10	0.850	0.269
	Fulfillment	2.00	10	0.667	0.211
K8	Significance	4.50	10	0.972	0.307
	Fulfillment	2.00	10	0.667	0.211
K9	Significance	3.80	10	1.476	0.467
	Fulfillment	2.10	10	0.876	0.277
K10	Significance	4.70	10	0.675	0.213
	Fulfillment	3.00	10	1.155	0.365
K11	Significance	4.00	10	1.155	0.365
	Fulfillment	3.20	10	1.549	0.490
K12	Significance	4.70	10	0.483	0.153
	Fulfillment	2.90	10	0.994	0.314

Source: Authors' calculations in SPSS

The most important criteria according to the experts, are the criteria K10 and K12 with an average significance score of 4.70. They are followed by K8 with an average score of 4.50 and K4 and K6 with a score of 4.40. The least important criteria for creation of a favourable business environment are the criteria K7 with an average score of 3.50 and criteria K1 with an average score of 3.70.

As far as the fulfillment of the criteria is concerned, the fulfillment of the criteria K11 has the best score, with an average score of 3.20, followed by K10 with an average score of 3.00. Afterwards, it is followed by K12 with a score of 2.90 and K6 with a score of 2.80. The least scores for the fulfillment of the criteria are given to K3, K7 and K8, who received an average score of 2. They are followed by a criterion K9 with an average score of 2.10 and K1 with a score of 2.30.

It can be concluded that there is an obvious difference between the perception of the importance of the criteria and the perception of its fulfillment.

This difference is largest in the criteria K8 and amounts to 2.5, and lowest with the criteria K11 and amounts to 0.8.

Since there is a difference in significance and fulfillment of the criteria observed, it is necessary to test the significance of this difference. The first segment of the analysis in this regard will be scores correlation between significance and fulfillment of the observed criteria, the results of which are presented in Table 2.

Table 2 The correlation between score pairs of significance and fulfillment of the criteria in the model

Criterion	N	The correlation coefficient	Significance
K1	10	0.412	0.237
K2	10	0.000	1.000
K3	10	0.128	0.724
K4	10	0.263	0.463
K5	**10**	**-0.488**	**0.153**
K6	10	0.404	0.247
K7	10	0.196	0.587
K8	10	0.514	0.128
K9	10	0.189	0.601
K10	**10**	**0.570**	**0.085**
K11	10	0.186	0.606
K12	10	0.393	0.261

Source: Authors' calculations in SPSS

In the criterion K10 there is the strongest agreement between significance and fulfillment, and the strongest disagreement (inverse correlation) is in K5. The correlation coefficient of the criteria K10 is 0.570, with the significance value of 0.085. Criterion K5 has a value of correlation coefficients -0.488 and a significance value of 0.153.

The second segment of the significance analysis for the differences between fulfillment and significance of all these criteria is the use of t-test to determine whether the established difference is statistically significant. T-test results are given in Table 3.

Only with the criterion K11 the difference between the significance and the fulfillment of the criterion is not statistically significant. Large differences

between fulfillment and significance scores of the criteria suggest that experts see in the local economic environment as insufficiently favourable, suggesting that it should be significantly improved in almost all segments tested. Through these tests, we proved the first hypothesis to test whether there is a statistically significant difference in the perception of experts regarding the achieved level of fulfillment of the criterion in the respective local government, compared to the level of significance of that criterion for the creation of a favourable business environment.

Table 3 The results of t-test and the significance of score differences for significance and fulfillment of the observed criteria

Criterion	Differences in score pairs					t	df	Significance
				95% Confidence interval of difference				
	Mean value	Std. deviation	Std. error	Lower	Higher			
K1	1.400	1.075	0.340	0.631	2.169	4.118	9	0.003
K2	1.400	1.350	0.427	0.434	2.366	3.280	9	0.010
K3	1.700	1.252	0.396	0.805	2.595	4.295	9	0.002
K4	1.800	1.033	0.327	1.061	2.539	5.511	9	0.000
K5	1.600	1.578	0.499	0.471	2.729	3.207	9	0.011
K6	1.600	1.265	0.400	0.695	2.505	4.000	9	0.003
K7	1.500	0.972	0.307	0.805	2.195	4.881	9	0.001
K8	2.500	0.850	0.269	1.892	3.108	9.303	9	0.000
K9	1.700	1.567	0.496	0.579	2.821	3.431	9	0.008
K10	1.700	0.949	0.300	1.021	2.379	5.667	9	0.000
K11	**0.800**	**1.751**	**0.554**	**-0.453**	**2.053**	**1.445**	**9**	**0.182**
K12	1.800	0.919	0.291	1.143	2.457	6.194	9	0.000

Source: Authors' calculations in SPSS

Further statistical analysis will be carried out to determine differences in the perception of experts about the significance and fulfillment of the criteria, depending on their place of work and residence. This will create a basis for comparison of the three local governments: Belgrade, Kragujevac and Niš. This comparison will be the starting point for the formation of multi-criteria model for ranking local governments according to the perceived economic environment.

Table 4 Descriptive statistics of the significance scores for the criteria according to the place of work and residence of experts

Local government		K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
Bgd	Significance	3.67	3.33	3.67	4.33	3.67	3.67	2.67	4.33	2.00	4.00	2.67	4.67
	N	3	3	3	3	3	3	3	3	3	3	3	3
	Std. deviation	0.577	0.577	0.577	0.577	0.577	1.528	0.577	0.577	1.000	1.000	0.577	0.577
Kg	Significance	5.00	4.50	4.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	5.00	5.00
	N	2	2	2	2	2	2	2	2	2	2	2	2
	Std. deviation	0.000	0.707	1.414	0.000	0.000	0.000	0.707	0.000	0.000	0.000	0.000	0.000
Niš	Significance	3.20	4.20	3.60	4.20	4.00	5.00	3.60	4.40	4.40	5.00	4.40	4.60
	N	5	5	5	5	5	5	5	5	5	5	5	5
	Std. deviation	1.304	0.447	0.894	0.837	0.707	0.707	0.548	1.342	0.894	0.000	0.894	0.548
In total	Significance	3.70	4.00	3.70	4.40	4.10	4.40	3.50	4.50	3.80	4.70	4.00	4.70
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Std. deviation	1.160	0.667	0.823	0.699	0.738	1.075	0.850	0.972	1.476	0.675	1.155	0.483

Source: Authors' calculations in SPSS

From the results of Table 4, we can conclude that experts from Belgrade, rated criterion K12 as the most important, with an average score of 4.67, followed by criteria K4 and K8 with an average score of 4.33. The least important evaluated criterion is K9 that got a very low average score - 2. In Kragujevac, the significance of a large number of criteria was given the score of 5, those criteria are: K1, K4, K5, K8, K9, K10, K11 and K12. The least important criteria assessed are K3 and K5, but they also have the high average score - 4. In Niš, only the significance of criteria K6 was scored with an average score of 5, following a criterion K12 with an average score of 4.60 and criteria K8, K9 and K11 that were scored with 4.40. The least important criterion was K1 with a score of 3.20.

For the analysis of the significance of differences in thethsignificance of the criteria depending on the experts' place of work and residence, a method of analysis of variance (ANOVA) was used. Variance analysis is an analytical model for testing the significance of differences and it is used when there are more than two groups of respondents. The advantage of this method is reflected in the fact that it takes into account all the variability, as well as their impact, which is impossible to evaluate otherwise. When choosing a model, one should

take into account the nature of the observed features, the observation units, as well as characteristics of the model, in order to best meet the set objectives and enable you to use the data collected to yield valid results. ANOVA test results are given in Table 5.

Table 5. Testing the importance of differences in the assessment of criteriasignificance depending on the place of work and residence of the experts

		Sum squares	df	The mean value of the square	F	Significance
K1	Among the (Combined) groups	4.633	2	2.317	2.172	0.185
	In the group	7.467	7	1.067		
	In total	12.100	9			
K2	Among the (Combined) groups	2.033	2	1.017	3.619	0.083
	In the group	1.967	7	0.281		
	In total	4.000	9			
K3	Among the (Combined) groups	0.233	2	0.117	0.139	0.872
	In the group	5.867	7	0.838		
	In total	6.100	9			
K4	Among the (Combined) groups	0.933	2	0.467	0.942	0.434
	In the group	3.467	7	0.495		
	In total	4.400	9			
K5	Among the (Combined) groups	2.233	2	1.117	2.931	0.119
	In the group	2.667	7	0.381		
	In total	4.900	9			
K6	Among the (Combined) groups	3.733	2	1.867	1.960	0.211
	In the group	6.667	7	0.952		
	In total	10.400	9			
K7	Among the (Combined) groups	**4.133**	**2**	**2.067**	**6.113**	**0.029**
	In the group	**2.367**	**7**	**0.338**		
	In total	**6.500**	**9**			
K8	Among the (Combined) groups	0.633	2	0.317	0.282	0.763
	In the group	7.867	7	1.124		
	In total	8.500	9			

K9	Among the (Combined) groups	**14.400**	**2**	**7.200**	**9.692**	**0.010**
	In the group	**5.200**	**7**	**0.743**		
	In total	**19.600**	**9**			
K10	Among the (Combined) groups	2.100	2	1.050	3.675	0.081
	In the group	2.000	7	0.286		
	In total	4.100	9			
K11	Among the (Combined) groups	**8.133**	**2**	**4.067**	**7.362**	**0.019**
	In the group	**3.867**	**7**	**0.552**		
	In total	**12.000**	**9**			
K12	Among the (Combined) groups	0.233	2	0.117	0.437	0.662
	In the group	1.867	7	0.267		
	In total	2.100	9			

Source: Authors' calculations in SPSS

When testing the difference in significance among the cities, it is significant for the criteria K7, K9 and K11. This result indicates that only in those three criteria there is a difference in perception of importance depending on the place where experts come from, Niš, Kragujevac or Belgrade. We also analyzed the fulfillment of criteria according to the place of work and residence of the experts, and the results of descriptive statistics are given in Table 6.

Table 6 Descriptive statistics on criteria fulfillment scores according to place of work and residence of the experts

Local government		K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
Bgd	Fulfillment	2.33	2.33	2.00	2.67	2.33	2.67	2.00	2.00	2.00	2.67	3.00	3.00
	N	3	3	3	3	3	3	3	3	3	3	3	3
	Std. deviation	1.155	1.155	1.000	1.528	1.155	1.528	1.000	1.000	1.000	1.528	1.732	1.000
Kg	Fulfillment	2.00	1.50	1.50	2.00	2.00	3.50	2.00	2.00	1.50	3.50	2.50	2.00
	N	2	2	2	2	2	2	2	2	2	2	2	2
	Std. deviation	0.000	0.707	0.707	0.000	0.000	2.121	0.000	0.000	0.707	0.707	2.121	1.414
Niš	Fulfillment	2.40	3.20	2.20	2.80	2.80	2.60	2.00	2.00	2.40	3.00	3.60	3.20
	N	5	5	5	5	5	5	5	5	5	5	5	5

	Std. deviation	0.548	1.095	1.304	0.837	1.304	0.894	0.707	0.707	0.894	1.225	1.517	0.837
In total	Fulfillment	2.30	2.60	2.00	2.60	2.50	2.80	2.00	2.00	2.10	3.00	3.20	2.90
	N	10	10	10	10	10	10	10	10	10	10	10	10
	Std. deviation	0.675	1.174	1.054	0.966	1.080	1.229	0.667	0.667	0.876	1.155	1.549	0.994

Source: Authors' calculations in SPSS

Experts from Belgrade gave the highest average score to the fulfillment of the criteria K11 and K12 (3.00), followed by the criteria K4 and K19 (2.67). The minimum fulfillment is, in their opinion, present in criteria K3, K7 and K9 that got an average score of 2. In Kragujevac, the best score for fulfillment was given to the following criteria: K6 and K10, and the smallest score are for the criteria K2, K3 and K9. In Niš, the highest average score of 3.60 was given to the fulfillment of the criteria K11, and worst-scored fulfillment of the criteria is in K7 and K8.

Table 7 Testing the significance of differences in the assessment of fulfillment of the criteria depending on the place of work and residence of the experts

			The sum of squares	Df	The mean value of the square	F	Significance
K1	Among the groups	(Combined)	0.233	2	0.117	0.211	0.815
	In the group		3.867	7	0.552		
	In total		4.100	9			
K2	Among the groups	(Combined)	4.433	2	2.217	1.948	0.213
	In the group		7.967	7	1.138		
	In total		12.400	9			
K3	Among the groups	(Combined)	0.700	2	0.350	0.263	0.776
	In the group		9.300	7	1.329		
	In total		10.000	9			
K4	Among the groups	(Combined)	0.933	2	0.467	0.438	0.662
	In the group		7.467	7	1.067		
	In total		8.400	9			
K5	Among the groups	(Combined)	1.033	2	0.517	0.382	0.696
	In the group		9.467	7	1.352		

	In total	10.500	9			
K6	Among the (Combined) groups	1.233	2	0.617	0.349	0.717
	In the group	12.367	7	1.767		
	In total	13.600	9			
K7	Among the (Combined) groups	0.000	2	0.000	0.000	1.000
	In the group	4.000	7	0.571		
	In total	4.000	9			
K8	Among the (Combined) groups	0.000	2	0.000	0.000	1.000
	In the group	4.000	7	0.571		
	In total	4.000	9			
K9	Among the (Combined) groups	1.200	2	0.600	0.737	0.512
	In the group	5.700	7	0.814		
	In total	6.900	9			
K10	Among the (Combined) groups	0.833	2	0.417	0.261	0.777
	In the group	11.167	7	1.595		
	In total	12.000	9			
K11	Among the (Combined) groups	1.900	2	0.950	0.338	0.725
	In the group	19.700	7	2.814		
	In total	21.600	9			
K12	Among the (Combined) groups	2.100	2	1.050	1.081	0.390
	In the group	6.800	7	0.971		
	In total	8.900	9			

Source: Authors' calculations in SPSS

Based on the results shown in Table 7, when we view the fulfillment of the criteria, there are no statistically significant differences between the cities in any of the criteria.

As for testing the hypothesis H_2, we can conclude that it is not refuted, but that it cannot be accepted as proved, because there are differences in significance with the three criteria K7, K9 and K11 (Table 5), while there are no statistically significant differences in fulfillment (Table 7).

4.2. The Formation of Multi-Criteria Model and Ranking of Local Governments

Multi-criteria model is formed as weight coefficients were determined by additive normalisation of the average criterion significance results (Table 4), according to the preferences of all experts, regardless of their place of work and residence. The data from Table 6 form decision-making matrix, with presented average experts' scores on the perception of fulfillment of the criteria in local governments where they live and work.

Determined values of weight coefficients are presented in Table 8.

Table 8 Determining the weight coefficients

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
Sign.	3.7	4.00	3.70	4.40	4.10	4.40	3.50	4.50	3.80	4.70	4.00	4.70
Wj	0.075	0.081	0.075	0.089	0.083	0.089	0.071	0.091	0.077	0.095	0.081	0.095

*Source:*Authors' calculations

Method of *SAW - Simple Additive Weight* and its application in solving the problem involves linearised matrix of decision-making. The value of each alternative is calculated by multiplying its linearised parameters for each of the attributes with corresponding weight coefficient and then summing up the obtained products.

Let it be a problem where we have *m* alternatives A_i (i=1,2,...,m) and n criteria K_j (j=1, 2,..., n) and let the vector W be the vector of weights w_j (j=1, 2,..., n) whose values are normalized ($\sum_{j=1}^{n} w_j = 1$). Then, according to Hwang and Yoon (1981), the value of i-th alternative $V(A_i)$ is calculated as

$$V(A_i) = \sum_{j=1}^{n} r_{ij} w_j, \quad i = 1, 2, ..., m \tag{1}$$

where r_{ij} are coefficients of the linearised decision matrix. Linearisation, otherwise called simple, or linear normalisation, is the simplest form of standardization of decision matrix coefficients. Coefficients of decision matrix x_{ij}, reported with different measuring units are transformed into comparable linearised coefficients r_{ij} in the following way:

$$r_{ij}^{+} = \frac{x_{ij}}{x_j^*} \qquad r_{ij}^{-} = \frac{x_j^-}{x_{ij}} \tag{2}$$

where linearised values of revenue attributes are marked with r_{ij}^{+} , and linearised values of the expenditure attributes are r_{ij}^{-} . Values x_j* and x_j^{-} are calculated as

$$x_j^* = \max_i x_{ij} \tag{3}$$

$$x_j^{-} = \min_i x_{ij}. \tag{4}$$

Optimal alternative A^* is defined as:

$$A^* = \max_i \sum_{j=1}^{n} r_{ij} w_j, \quad i = 1, 2, ..., m \tag{5}$$

Obtained values $V(A_i)$ of all alternatives form the so-called vector of priorities, on the basis of which it is possible not only to determine the optimal alternative, but also to perform the complete ranking of alternatives.

Based on the SAW method algorithm, the linearised matrix of decision-making is determined, as well as preferential linearised matrix for the described decision-making problem in ranking of local governments according to the perceived local economic environment by a group of experts. The results are presented in Table 9 and Table 10.

Table 9 Linearised matrix of decision-making

LS	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
BG	0.971	0.728	0.909	0.954	0.832	0.763	1.000	1.000	0.833	0.763	0.833	0.938
KG	0.833	0.469	0.682	0.714	0.714	1.000	1.000	1.000	0.625	1.000	0.694	0.625
Niš	1.000	1.000	1.000	1.000	1.000	0.743	1.000	1.000	1.000	0.857	1.000	1.000

*Source:*Authors' calculations

Table 10 Preferential linearised matrix of decision-making

LS	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
BG	0.073	0.059	0.068	0.085	0.069	0.068	0.071	0.091	0.064	0.072	0.067	0.089
KG	0.062	0.038	0.051	0.063	0.059	0.089	0.071	0.091	0.048	0.095	0.056	0.059
Niš	0.075	0.081	0.075	0.089	0.083	0.066	0.071	0.091	0.077	0.081	0.081	0.095

*Source:*Authors' calculation

The final ranking of the observed local governments that was determined based on the relation (5) is given in Table 11.

Table 11. Priorities' vector and ranking of local governments

Local government	V (Ai)	Rank
Belgrade	0.875232	2
Kragujevac	0.782682	3
Niš	0.963579	1

*Source:*Authors' calculation

Ranking of local governments involved in the study shows that the city ofNiš has the best rank, followed by Belgrade and then at the end with Kragujevac. The established rank demonstrates subjective preferences of the expert group and does not comply with certain realistic indicators of economic activity in those cities. Although Belgrade is undoubtedly the city with the highest economic activity, average salary and employment rate, it is not the highest ranked city according to the given model. This phenomenon is due to higher expectations of experts in municipalities where business activities are more intensive and where the objective indicators of economic activities are also better. On the other hand, the expectations of experts in underdeveloped local governments were modest, and this has led to inversions in rankings in relation to the objective information about the business environment in the observed local governments.

5. Conclusion

The local economic environment is determined by different economic, social, technical and technological factors, which, because of their heterogeneity impose the need for applying the method of multi-criteria analysis, as a relevant approach in assessing the local economic environment. One of the key elements in the formation of the multi-criteria model is the determination of weight coefficients. This task becomes especially complicated in cases where decision-makers are groups of experts rather than the individuals. There is a need for integration of individual preferences into one that would express the collective opinion, that is, group preference.

A multi-criteria model was developed based on the criteria for assessing the local economic environment used by the National Alliance for Local Economic Development (NALED) in the process for certification of cities with favourable business environment. With the analysis of individual preferences by a group of experts in the field of local economic development in three local governments in Serbia (Belgrade, Kragujevac and Niš), it was concluded that there is a statistically significant difference in the perception of significance and perception of fulfillment in almost all the criteria which are included in the model. When place of work and residence of the expert group members is taken as a basis for comparison, it can be concluded that only three criteria show a statistical difference in the perception of criteria significance. On the other hand, when it comes to meeting (fulfilling) the criteria, there were no statistically significant differences.

The paper is based on empirical results and proves that there is a statistically significant difference in the perception of experts regarding the achieved level of fulfillment of criteria in the respective local government, compared to the level of significance of the same criteria for the creation of a favourable business environment. On the other hand, the hypothesis of the existence of

differences in the significance and fulfillment of the criteria on the basis of perception of expert group members who live and work in different places does not confirm but it also does not prove that the residence of an expert group member is the factor that makes the difference. Namely, only in three criteria, we observed have a statistically significant difference in the perception of the significance of those criteria for the improvement of local economic environment depending on the place of work and residence of expert group members, while the fulfillment of the criteria show no such difference.

The described model is limited in terms of taking more of the given criteria for evaluating local economic environment defined by NALED. One of the research development directions will primarily focus on identifying the criteria for assessing the local economic environment where business community is the decision-maker, and identifying the criteria that are relevant to the assessment of the business climate at the local level in terms of economic agents who do business there. Also, further research will be focused on the application of other methods of multi-criteria analysis for scoring group preferences, namely, the analytic hierarchy process method.

References

Burnstein, F. & Holsapple, C. W. (2008). *Handbook on Decision Support Systems 1: Basic Themes*. Berlin Heidelberg: Springer-Verlag.

De Haas M. & Kleingeld A. (1999) Multilevel design of performance measurement systems: enhancing strategic dialogue throughout the organization. *Manag Acc Res* 10: 233–261

Delbecq, A.L. (1967). The Management of Decision-Making within the Firm – Three Types of Decision-Making. *Academy Management Journal*, 322-339.

Dias L.C. & Sarabando P. (2012) A note on a group preference axiomatization with cardinal utility. *Decions Analysis* 9: 231–237

Eden, C. & Harris, J. (1975). *Management Decision and Decision Analysis*. London: The Macmillian Press LTD.

Harisson, E. F. (1987). *The Managerial Decision-Making Process* (3rd Edition). Boston: Houghton Mifflin Company.

Huang Y.S., Liao J.T. & Lin Z.L. (2009) A study on aggregation of group decisions. *Syst Res Behav Sci* 26: 445– 454

Hülle J., Kaspar R. & Möller K. (2011) Multiple criteria decision-making in management accounting and control—state of the art and research perspectives based on a bibliometric study. *Journal of Multi Criteria Decision Analysis* 18:253–265

Hwang, C. L. & Yoon, K. (1981). *Multiple Attribute Decision Making, Methods and Applications*. A State-of-the-Art Survey, Lecture Notes in Economics and Mathematical Systems, Berlin: Springer-Verlag.

Keeney R.L. (2009) The foundations of collaborative group decisions. *Int J Collab Eng*. 9:231–237

Kreitner R. & Cassidy C.M. (2011) *Management* (12th Edition). Mason: Cengage Learning.

Lee, S. M. & Moore, L. J. (1975). *Introduction to Decision Science*. New York: Petrucelli.

Mescon, M., Alberi, M. & Khedouri, F. (1985). *Management*. New York: Harper and Row.

Mintzberg, H. (1973). *The Natur of Managerial Work*. New York: Harper and Row.

Moody, P. E. (1983). *Decision Making-Proven Methods for Better Decisions*. New York, McGraw - Hill book Company.

Pinheiro-Böhl, C. (2007). *Development of Knowledge Based Decision Support System for Private Sector Participation in Water and Sanitation Utilities*. http://elib.uni-stuttgart.de/opus/volltexte/2008/3391/pdf/Diss_Carla_Boehl_2007_08_24_FEI_final.pdf , Accessed December 15, 2015.

Sauter, V. L. (2011). *Decision Support Systems for Business Intelligence*. John Wiley & Sons.

Simon, H. A. (1960). *The New Science of Management Decision*. New York: Harper & Row.

Sims R.R. (2002*) Managing organizational behavior*. Westport: Greenwood Publishing Group.

Turban, E., Aronson, J. E. & Liang, T.P. (2005). *Decision support systems and intelligent systems*. Upper Saddle River, NJ: Pearson.

Van den Honert, R.C. & Lootsma, F.A. (1996) Group preference aggregation in the multiplicative AHP—the model of the group decision process and Pareto optimality. *European Journal of Operations Research* 96: 363–370.

Wallenius J., Dyer J.S., Fishburn P.C., Steuer R.E., Zionts S. & Deb K. (2008) Multiple criteria decision making, multiattribute utility theory: recent accomplishments. *Management Science* 54:1336–1349

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UTVRĐIVANJE PREFERENCIJA EKSPERTSKE GRUPE U VIŠEKRITERIJUMSKOM MODELU ZA ANALIZU LOKALNOG EKONOMSKOG OKRUŽENJA

Apstrakt: Lokalno ekonomsko okruženja karakteriše niz ekonomskih, sociooloških, političkih i demografskih parametara, na osnovu kojih se može izvršiti njegova analiza. Raznorodnost relevantnih karakteristika lokalnog ekonomskog okruženja nameće višekriterijumsku analizu kao jedan od pogodnih alata za njegovu evaluaciju. Ocena lokalnog ekonomskog okruženja vrlo često spada u domen grupnog odlučivanja, jer se uobičajeno vrši na bazi analize mišljenja privrednih subjekata ili relevantnih eksperata o stanju ekonomskog okruženja na lokalu. Bez obzira da li je reč o privrednim subjektima ili ekspertskoj grupi, u cilju formiranja višekriterijumskog modela neophodno je izvršiti generisanje preferencija pojedinaca u jedinstveni težinski koeficijent kojim se iskazuje preferencija grupe o značaju svakog od kriterijuma. Predmet rada je utvrđivanje težinskih koeficijenata u višekriterijumskom modelu za analizu lokalnog ekonomskog razvoja na osnovu preferencija grupe eksperata primenom adekvatnih statističkih alata, a zatim i rangiranje lokalnih samouprava prema kvalitetu percipiranog poslovnog ambijenta od strane ekspertske grupe. Pored deskriptivne statistike i testiranja značajnosti razlika, u radu je primenjen višekriterijumski metod Jednostavnih aditivnih težina (*Simple Additive Weights*- SAW).

Ključne reči: Lokalno ekonomsko okruženje, višekriterijumska analiza, težinski koeficijenti, grupno odlučivanje, *SAW* metod

Authors' biographies

Jelena Stanković is an assistant professor at the Faculty of Economics, University of Niš for narrow scientific field Economic statistics, the application of mathematical and statistical methods in economic research. She gained the MSc degree at the Faculty of Economics, University of Belgrade and PhD degree at the Faculty of Economics, University of Niš. In her academic work, she has published two monographs, more than 90 papers in scientific and professional journals and has participated in research conferences at home and abroad. She has been working as a researcher on projects funded by the Ministry of Education, Science and Technological Development of Republic of Serbia, as well as international projects. She participated in numerous seminars and professional training abroad, including specialist training for monitoring and risk analysis in financial institutions organized by FitchRating in 2007 in New York. Key areas of her interest are: quantitative methods in business decision making, methods of optimization of business processes and methods of multi-criteria analysis. She is a member of EWG E-CUBE group under Association of European Operational Research Societies, German Operation Research Society (GOR) and Society of Economists of Niš.

Žarko Popović is the associate professor at the Faculty of Economics in Niš in the field of specialization related to the Mathematics in Economy. He finished his Master degree at the Faculty of Philosophy in Niš, Department of Mathematics, and his PhD at the Faculty of Science in Niš. Considering his scientific research, he is specialized in the field of semi-group theory, as well as the application of mathematical methods and models in ecology, finance and insurance. Until now, he has published one monograph and five textbooks, as well as many scientific papers in international and national journals with review. From the beginning of his scientific career, he is engaged as researcher in projects financed by the Ministry of Education, Science and Technological Development. He was attending many scientific conferences in country and abroad. He was a mentor to three Master papers. He was the member of the Commission for evaluation of three PhD dissertations, four MSc thesis and four Master papers. At the Faculty of Economics conducts teaching at all levels of study in mathematical group of subjects.

Sanja Kostevski graduated from the Faculty of Economics, University of Nis in September 2013, the module Finance, Banking and Insurance. In November 2014, at the same University, she completed a Master's degree in Accounting, Auditing and Financial Management. Currently, she is a PhD student at the Belgrade Banking Academy. She acquired the first working experience during her graduate studies in "Heron Control" in Nis, in the field of accounting and administrative business. In the period from 2013 to 2014, she ended professional training for a period of 10 months in Aachen (Germany), the company "Code4busness Software GmbH", which is engaged in the production of software. Since September 2014, she has been employed in Vienna (Austria) in the accounting sector of the company "Patronjic GMBH".