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Quality of life evaluation as decision support in public administration for innovation and regions development

Martin ŠANDA[1], Jiří KŘUPKA[2]

Abstract: *This contribution deals with Quality of Life (QL) issues and QL evaluation. The objective of this contribution is to develop a model for QL evaluation for the Czech Republic (CR) regions. This model shall be used for decision-making by regional administrations in the area of grants allocation. These grants shall be grants for innovation and for regional development in selected areas. The objective of the model is to reach fairness and to decrease disparities between individual regions of the CR. Selected methods of Rule-based systems (RBS) shall be used in this model. An important aspect of this model is to define indicators to be used for the QL evaluation and the indicators' weights. These weights have been defined directly by the CR inhabitants by means of a questionnaire-based survey. Wisdom of the Crowd (WoC) approach has been used to acquire the above-mentioned indicators. The objective of the model is to evaluate, based on predefined indicators, the QL in individual regions and based on the results of this evaluation to recommend grants allocation policy for individual regions for development in the given area and thus to reduce disparity between individual regions and by doing that to increase the overall competitiveness of the CR.*

Keywords**:** *decision support, grant allocation, quality of life, wisdom of the crowd*

JEL**:** *C69, I31, O21, R59*

Introduction

Defining the term QL brings about many dilemmas. Various authors, organizations or institutions have various different approaches to QL evaluation. If we deal with definition of QL then we must take into consideration the influence of historic, cultural and social changes taking place in a given society (Royuela et al., 2010). According to Budowski et al. (2016), sociological aspects of QL include both the macro and the micro dimensions, subjective and objective aspects and QL is multidimensional issue. QL must be seen as a subjective evaluation of an individual's life situation. QL can be seen as availability of options from which an individual can choose during his/her life, QL can be monitored by means of two variables – material and non-material parts of human life (Phillips, 2006; Royuela

[1] Ing.; University of Pardubice; Pardubice; Czech Republic; Martin.Sanda@upce.cz

[2] Ing. PhD.; University of Pardubice; Pardubice; Czech Republic; Jiri.Krupka@upce.cz

et al., 2010). As examples of methodologies (approaches) to QL evaluation we can quote: Active Ageing Index (AAI, 2015); Economist Intelligence Unit Limited (EIU, 2017); Eurofound (EF, 2015) or Better Life Index (OECD, 2015).

QL evaluation for the CR regions shows disparities between individual regions in the CR. In the CR territory, there are areas with significant disparities, the origin of which origination is determined by various historical and economic conditions. These differences are expressed in the standard of living, in unemployment rates, number of roads and their conditions, achieved levels of education, the environment and there are also differences between urban and rural areas (Svatošová, 2007; Postránecký, 2010). According to Hudec (2009) and Jánský (2012) the concept of regional disparities is understood as differences in regional development in the areas of economy, environment and social aspects, differences that are so substantial that they are considered harmful and undesirable. Jánský (2012), Palátová (2016), Měrtlová and Prokop (2015) state that individual regions' development and influencing negative regional differences on the level of national and regional policies become step by step more and more discussed issues particularly from the point of view of searching for development factors. Identification of disparities and their further research is the base for regional policy tools development.

Also the CR Government views QL and QL evaluation and disparities among individual regions as an important topic as well as a problem and it deals with this topic in its Resolution No. 669/17 (Vláda ČR, 2017). The objective of this Resolution is restructuring of Ústí nad Labem region, Moravian-Silesian region and Karlovy Vary region. These regions are considered to be regions with lower QL and they are labelled as "neglected regions". The CR Government deals with QL issues also in its document "The Strategic Framework for the Czech Republic 2030" (Vláda ČR, 2017b) where QL and QL growth are among the main objectives. Also the European Commission deals with QL issues - compares QL levels in individual European Union member states.

This paper does not deal solely with QL, but based on the developed model it also further works with the resulting QL evaluation. This is used as a decision-making support tool for public administration the result of which serves as the basis for grants allocation recommendation for a given region's development or as a basis for recommendation for investments into innovations into the selected area. The objective of this model is to achieve fairness, to reduce disparities between individual regions and to improve individual regions' competitiveness.

1. Model for region quality of life evaluation

As described above the model deals with QL evaluation of the CR regions. This model deals with the problem of reaching fairness and of decreasing disparities between individual regions.

Below in Figure 1 there is a diagram of this model where the procedure from the initial phase of problem definition to QL evaluation results is described

including the grant allocation recommendation. Individual processes of the model are described below.

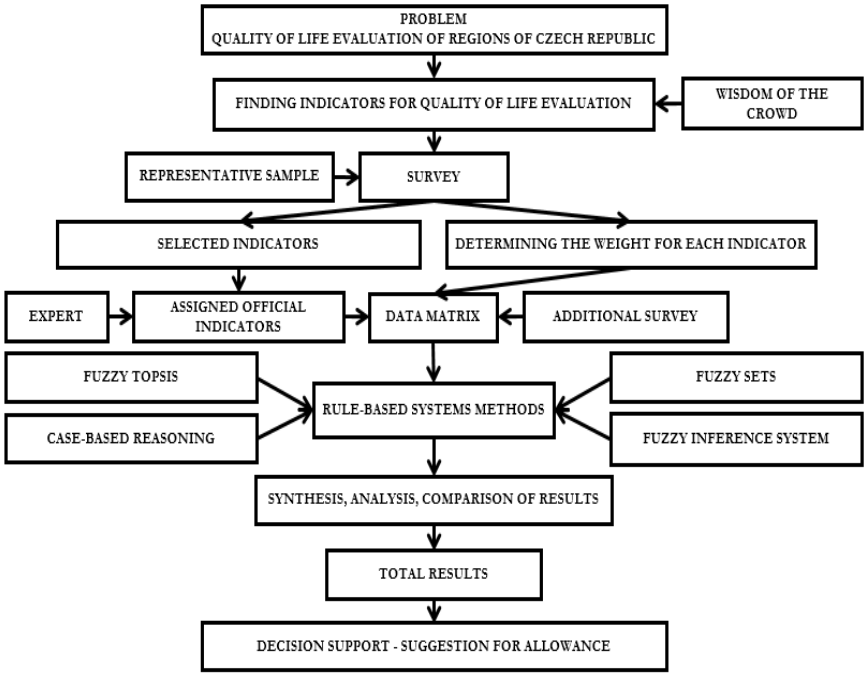

Figure 1. Model for Region's Quality of Life Evaluation
(Source: own construction)

The WoC is one of methods used to find out emergent behaviour – this is behaviour that exists on the level of a system, but it does not have a direct equivalent on the level of parts. WoC is studied for instance by Tetlock et al. (2004) who describes the selection of a hundred of "ordinary people". Their task is to make predictions and to forecast geopolitical events, to monitor the success level of such predictions and to monitor the average prediction of the whole group or in other words exactly the WoC that is then more accurate than predictions by professional reporters. Surowiecki (1967) explains that when problems are solved by individuals those individuals do not have good results, however a summary or an average of individuals forecasts is usually very good, it is nearing the ideal solution or the ideal result. However Surowiecki warns that it is very important that observers and decision-makers are independent and their mistakes uncorrelated and by that elimination of individuals' errors is functional.

1.1. Survey

The first phase of the whole model is to find out indicators for QL evaluation. These indicators shall be found out by a questionnaire survey among the CR inhabitants. Questionnaire survey, used as a tool for data collection, serves as a tool to collect required data from a larger number, larger sample of persons (Disman, 2011; Janoušek et al., 1986). The objective of this survey is to identify indicators for QL of the CR regions' evaluation. These indicators shall be defined, by means of a questionnaire survey, directly by the respondents themselves - inhabitants of the CR. These indicators shall be found out about by the WoC approach. The expected output of this survey is, next to demographic information about the respondents, a list of identified indicators for QL of evaluation and their frequencies. These frequencies express how many respondents have selected the given indicator as important out of their total number.

As stated by Hindls (2007) - with regard to the fact that the base set is very large and very extensive, the base set is the entire CR, the option to choose only some units from the base set have been employed – selection set (sample). The questionnaire survey was executed by professional agency STEM/MARK (2018). Agency has long and extensive experience with research, surveys and public opinion surveys. Based on the cooperation with this agency the basic parameters of the survey have been agreed. Among these parameters were in particular the size of the representative sample, type of selection and the data collection method.

The following methods are used for data collection (STEM/MARK, 2018): Computer Assisted Web Interviewing (CAWI) - this method is based on interviewing verified respondents in the Internet environment; Computer Assisted Personal Interviewing (CAPI) - this method represents personal interviewing and recording responses to a computer; Computer Assisted Telephone Interviewing (CATI) - this method represents interviewing respondents by phone; Pen and Paper Interviewing (PAPI) - in this method the inquirer fills in with the respondent a standardized questionnaire.

For surveys among the CR inhabitants it is usual to use as representative sample the range approximately in the interval 800-1200 respondents, such as for instance in the following surveys: Election Model from May 2017 (VM, 2017) under project Czech Trends' 17 where 1200 respondents were interviewed by means of CATI method from which 813 respondents entered the election model; election model in January 2018 (VM, 2018) in which 1086 respondents participated, the respondents were interviewed by CAPI and PAPI methods.

After consultation with the agency the size of the representative sample was set at 1000 respondents and CAWI method was selected – with online survey. Further it was recommended to execute survey with 50 respondents by means of (PAPI) – respondents interviewed by means of a printed questionnaire. Thus in total 1050 respondents were defined to be the representative sample, this was done by combination of forms (by methods CAWI and PAPI) as stated by Hindls (2007). Since this survey was executed by means of online survey the printed

questionnaires were targeted at respondents in the age category 80+, this was done due to lack of Internet connection and lack of computer skills in this age group. The agency executed the online part of the survey; the printed questionnaires were done by own elaboration.

The recommended size of the sample was verified later by a calculation on the basis of the below mentioned variables (Hindls, 2007; ČSÚ, 2016; Kubanová & Linda, 2006): the size of the basic set N = 10 597 473; confidence interval d = 0.03; confidence level 95 %, α = 0.05; quintal of normed normal distribution $u_{1-\alpha/2}$ = 0.975, that means value 1,96 corresponding with confidence level 95 %; permissible error of estimate r = 0.02. According to application by company Creative Research Systems (2012) the representative sample was, based on the above-stated values, for 1067 inhabitants. According to Hindls (2007) the representative sample was set for 1118 respondents (the same attributes).

The following solved parameter of the survey is the type of respondents. According to Jeřábek (1993) the type of selection can be categorized to: intentional selection, random selection, quota selection and accidental selection. Since this survey deals with the QL evaluation for the CR regions, it is essential and recommendable to choose quota selection of respondents in order to get appropriate representation of the individual regions in the survey. After consultation with the agency the following were selected as parameters for the quota selection: region, sex, age, education and economic activity. The agency then extended the demographic parameters by parameters number of household members, net household income and municipality size. The agency regularly uses these parameters in its surveys.

Prior to the execution of the "master" questionnaire survey it was essential to define the goal of the questionnaire survey – what is to be achieved by this survey and what is the desired output. It was also essential to formulate the questions and to define the overall concept of the questionnaire. This task was discussed with the agency and also consulted with a social policy and sociology expert. The first part of the questionnaire included five demographic questions: "Where do you live-in which region?"; "Please state your sex?"; "How old are you?"; "What is your economic activity?"; "What is your education?". With some questions the possibilities are obvious according to their nature, others were adopted according to (Eder and Faugère, 2017 and Roster et al., 2016).

First came the demographic part due to the quota selection (to prevent the situation that a respondent fills in the questionnaire and then is turned down due to full state of any of the quotas). The WoC approach was solved by means of a text field where the respondent was allowed to fill in his/her opinion-what indicators he/she would select for QL evaluation.

In the next step pilot survey was executed. The objective of this pilot survey was questionnaire survey optimization. In total 53 respondents (42 in the online survey and 11 in the printed survey) took part in the pilot survey that was executed from May 2017 to July 2017. Based on the pilot survey outcomes it was recommended that the text field should be enlarged for the purpose of WoC

approach and also for final comments and remarks. After the amendments were incorporated this questionnaire was ready for questionnaire survey. This survey was executed in January 2018 (CAWI) and 1011 respondents took place in this survey. Then a survey by means of printed questionnaires was executed (PAPI) - it was focused on inhabitants of age 80+. With regard to the age structure of the CR inhabitants (ČSÚ 2016) the number of respondents for this form of survey was set at 42 respondents (4% share from the total of 1053 respondents). For the printed form survey the principle quota was the region from which the interviewed person came.

Agency monitored the Demographic characteristics already in the course of the quota based survey and thus the representative sample of the CR inhabitants was guaranteed – in Table 1 there is illustration of distribution by regions. Questionnaires filled in in the printed form did not have any dramatic impact and did not change any characteristics.

Table 1. Demographic Characteristics - Regions

Region (sign)	**frequency**	**frequency** (in %)	**Region** (sign)	**frequency**	**frequency** (in %)
Prague (PRA)	127	12,06 %	Hradec Králové (KHK)	55	5,22 %
Plzeň (PLZ)	56	5,32 %	Karlovy Vary (KVA)	30	2,85 %
Liberec (LIB)	39	3,70 %	Ústí nad Labem (UST)	80	7,60 %
Pardubice (PAK)	54	5,13 %	South Moravian (JHM)	117	11,11 %
Vysočina (VYS)	53	5,03 %	Central Bohemian (STC)	127	12,06 %
Olomouc (OLO)	69	6,55 %	South Bohemian (JHC)	63	5,98 %
Zlín (ZLN)	60	5,70 %	Moravian-Silesian (MSZ)	123	11,68 %

(*Source:* own construction by STEM/MARK, 2018b)

The result of this survey is matrix N ($m \times n$), where $m = 1, 2, ..., 1053$ and $n = 1, 2, ..., 10$; where m expresses the number of respondents and n represents the number of attributes (questions) in the following way: n_1 is region; n_2 is sex; n_3 is age; n_4 is economic activity; n_5 is education; n_6 is number o persons in household; n_7 is size of municipality; n_8 is household income; n_9 is WoC; n_{10} is space for comments.

1.2. Indicators for quality of life evaluation

Based on the already executed survey (both in the on-line and printed form) and based on the processing of the acquired data in total 40 indicators were defined for the WoC approach.

List of acquired indicators (size of indicator): Gross domestic product (I-1); Average wage (I-2); Unemployment rate (I-3); Safety, crime rate (I-4); Health services, medical care; (I-5); Education (I-6); Tourism (I-7); Lifespan (I-8); Nature, green areas (I-9); Average pension (I-10); Environment, Ecology (I-11); Level of education (I-12); Quality of Air (I-13); Employment (I-14); Houses for seniors (I-15); Housing (I-16); Money, Wealth (I-17); Culture (I-18); Foodstuff - price, quality (I-19); Health (I-20); Standard of Living (I-21); Satisfaction (I-22); Policy/Politics (I-23); Transport (I-24); Type of employment (I-25); Economics, National Economy (I-26); Safety (I-27); Sports, activities (I-28); Love (I-29); Inner Balance (I-30); Family (I-31); Social environment, feelings (I-32); Interpersonal relations (I-33); Freedom, free decision-making (I-34); Happiness (I-35); Level of Education (I-36); Health services (I-37); Lifestyle, food diet (I-38); Infrastructure (I-39); Services, Public property (I-40).

"Official" indicators had to be added to those indicators that had been defined by the WoC approach. The official indicators were measured or identified by some special survey or by a public opinion survey. The Czech Statistical Office (CZSO) was the main source of these indicators (ČSÚ, 2017). However the source was also for instance Institute Of health Information and Statistics of the Czech Republic, (ÚZIS, 2016), project Place for Life (PfL, 2016) or Integrated Portal of the Ministry of Labour and Social Affairs (MPSV, 2017). The official indicators are stated below in this text in Table 2. These indicators were added to those indicators that had been defined by the respondents on the basis of consultations with the CZSO employees and with the social policy and sociology expert.

Column „Weight" illustrates the frequency of the individual indicators; column „Type" expresses the characteristics of the indicator – if it is an indicator of maximization character (higher value is a better value) or an indicator of minimization character. Column „Area" illustrates categorization of indicators into areas: area A - Satisfaction; B – Transport and safety; C - Environment; D - Education; E – Labour market, finance; F – Leisure time activities, culture; G - Health, social area; H – Economy, policy/politics.

The reason why the indicators are subdivided into the individual areas is partial QL evaluation for these area and further identification of average or bellow average areas to which a grant for development or innovation could be directed in the given region. The indicators were divided into areas based on consultations with the CZSO officers and with a sociology expert. These indicators shall be further used for the purpose of construction of a data matrix and for the qL evaluation by means of RBS.

Table 2. Assigned Indicators – Wisdom of the Crowd

Sign	**Official indicator** (unit)	Weight	Type	Area
I-21	Project "Place for life" (%)	5.04 %	max	A
I-22	Satisfaction, quality of life (% of population)	8.21 %	max	A
I-29	Love (scale 1 to 10; 10 is best)	3.76 %	max	A
I-30	Inner balance (scale 1 to 10; 10 is best)	8.51 %	max	A
I-31	Family (scale 1 to 10; 10 is best)	21.36 %	max	A
I-33	Interpersonal relationships (scale 1 to 10; 10 is best)	14.84 %	max	A
I-35	Happiness (scale 1 to 10; 10 is best)	3.56 %	max	A
I-4	Crime Index (Crimes per 10.000 inhabitants)	5.64 %	min	B
I-24	Length of operated railway lines, roads and motorways, navigable inland waterways regularly used for transport (per km2 of region)	6.53 %	max	B
I-27	Safety around residence after nightfall (% of dissatisfied population)	2.08 %	min	B
I-9	Share of woody area and agricultural land (% area of region)	3.86 %	max	C
I-11	Coefficient of ecological stability (share of stable/unstable ecosystems)	9.59 %	max	C
I-13	Specific emissions of air pollutants (tonnes per km2)	3.96 %	min	C
I-6	Index of education availability (educational facilities per 1000 inhabitants)	2.57 %	max	D
I-12	Share of university educated working inhabitants (% of population)	1.19 %	max	D
I-36	Research and development expenditure (thous. CZK per capita)	5.84 %	max	D
I-2	Medians of gross monthly wage (CZK)	19,78 %	max	E
I-3	Unemployment rate (%)	1,38 %	min	E
I-10	Average pension (CZK)	2,67 %	max	E
I-14	Number of job applicant (applicant per one job position)	2,37 %	min	E
I-17	Households managed with money without problems (% of households)	20,97 %	max	E
I-25	Labor costs: social enjoyment/benefits (CZK/month per 1 employee)	17,51 %	max	E
I-7	Average number of overnight stays (share overnight stays tourists)	0,99 %	max	F
I-18	Organized cultural events (events per 1000 inhabitants)	13,25 %	max	F
I-28	Czech Union of Sports (number of sport clubs per municipality)	2,67 %	max	F
I-39	Equipment of municipalities (technical, cultural and sports facilities per municipality)	6,63 %	max	F
I-5	Number of physician (physician per 1000 inhabitants)	7,91 %	max	G
I-8	Life expectancy (age)	2,08 %	max	G
I-15	Number of beds in houses for seniors (beds per pensioners)	0,79 %	max	G
I-20	Health status (% of population, that are feeling healthy)	34,12 %	max	G
I-32	Social Security (Number of benefits paid per capita)	2,47 %	max	G
I-37	Health establishments (per 1000 inhabitants)	2,67 %	max	G

(Source: own construction by STEM/MARK, 2018b)

However, as it is obvious from Table 2 the official indicator were not assigned to in total six indicators since these are very subjective indicators that are not measured in a standard situation and neither were a subject to any public opinion surveys. For this reason an additional survey was executed, the objective of this survey was to find out values for the stated indicators for the individual regions. For this additional survey the same structure of the questionnaire was used. Below are stated statements for finding out the values of six indicators: I-29: „I show enough love/affection to my close people (and it is returned by my close people).“; I-30: „I feel calm and balanced, I do not have any significant problems in my life right now).“; I-31: „I can rely on my family and on my close people, my family provides good base for me, I can rely on them.“; I-33: „I rate Interpersonal relations in society (esteem, respect, friendship, assistance) to be on a good level.“; I-34: „I feel free, I can freely express my opinions and attitudes.“; I-35: „I have luck in my life“. In total 516 respondents participated in the additional survey. Similar as with the “main” survey the representative sample of respondents was used. Data matrix is constructed for the individual regions and indicators - values of "official" indicators were constructed by (ČSÚ, 2017; ÚZIS, 2016; PfL, 2016; MPSV, 2017) and by some special survey etc.

1.3. Indicators for quality of life evaluation

The model worked with RBS methods: Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and its fuzzy modification, Fuzzy Inference System (FIS) and Case-based Reasoning (CBR). Fuzzy logic was also used for the solution - fuzzy sets (FSs) were defined for QL evaluation. A graphical image of the defined FSs for total evaluation is in the Figure 2.

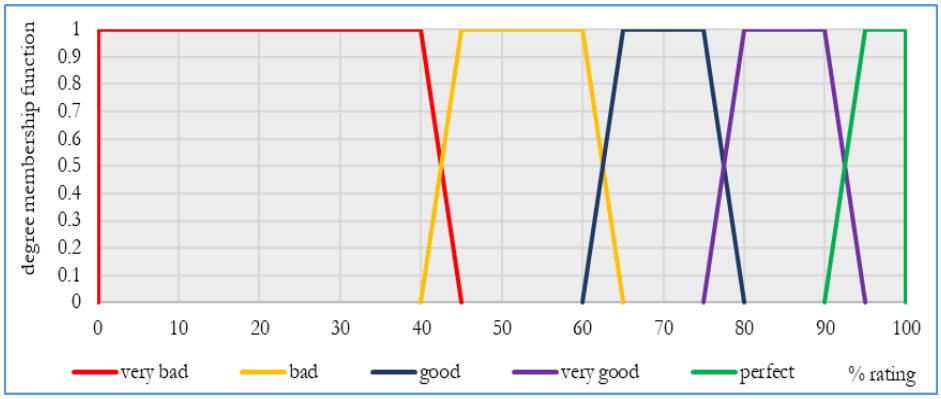

Figure 2. Fuzzy sets for total evaluation
(Source: own construction)

Based on previous work in this field QL were defined 4 FSs for area evaluation and 5 FSs for total QL evaluation - described below. Based on experimental FIS settings (Šanda and Křupka, 2017), it was the optimal solving trapezoidal shape of membership function in the form [a b c d] Mathworks (2017), where parameters a and d locate the "feet" of the trapezoid and the parameters b and c locate the "shoulders". Defined FSs and their linguistic variables for areas evaluation: very bad [0 0 0.4 0.45], bad [0.4 0.45 0.6 0.65], good [0.6 0.65 0.8 0.85], very good [0.8 0.85 1 1.2]. Defined FSs and their linguistic variables for total evaluation: very bad [0 0 0.4 0.45], bad [0.4 0.45 0.6 0.65], good [0.6 0.65 0.75 0.8], very good [0.75 0.8 0.9 0.95] and perfect [0.9 0.95 1 1].

General structure of FIS is used for the resolution according to Bělohlávek et al. (2002); Zadeh (2015). Before its own QL evaluation with FIS usage, it is necessary to resolve: normalized matrix, define the rules and fuzzy sets for the QL evaluation, Mamdani type of FIS was used. Based on experimental FIS settings (Šanda and Křupka, 2017), it was the optimal solving method Centre of Gravity used in defuzzification. Inputs to FIS-area are indicators, output is QL evaluation of area; inputs to FIS-TOTAL are outputs from FIS of areas, output is total QL evaluation. - see in Figure 3.

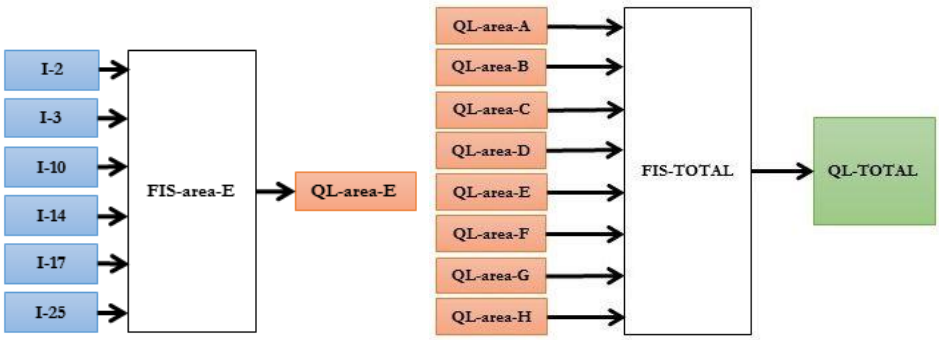

Figure 3. Hierarchy structure of FIS for QL-area-E (left); for QL-TOTAL evaluation (right)
(Source: own construction)

The number of rules depends on the number of criteria in the individual area (for area E is 6) and the number of defined FSs (for areas 4), for area E it is 4^5, a total 4096 rules. Example of rule of area E: Rule54: If (I-2 is very-good) and (I-3 is very-good) and (I-10 is very-good) and (I-14 is very-bad) and (I-17 is good) and (I-25 is good) then (QL-area-E is good).

CBR is according to (Aamodt & Plaza, 1994; Watson, 1997) based on previous experiences that serve as the basis for the evaluation of a given problem. CBR can be described in the following steps: Retrieve (finding as much as possible similar cases to the input case); Reuse (use again the solution for the most similar case); Revise (repair of correction of the proposed solution); Retain (keeping this

input problem and its solution). It is a learning process that solves problems based on the already solved problems. CBR differs from other models also by its increasing permanent learning - when there is yet another problem solved it immediately becomes available for dealing with further (future) problems. CBR is thus utilized for dealing with a new problem via remembering previous similar situations and re-utilization of these information and knowledge for the actual situation. CBR works on similarity basis - distance of the nearest neighbour.

TOPSIS method is according to Chen & Hwang (1992); Senouci et al. (2016) one of the multi-criterial decision algorithm, which is based on the option selection. It is assumed the maximization character of all criteria. TOPSIS ranks the subjects according to the score, when the highest is the best resolution. The basic rule is that, the preferred alternative should have the shortest distance from the ideal resolution and the longest distance from the negative – the worst resolution. In the created model was used the extension of TOPSIS - fuzzy TOPSIS (fTOPSIS), where defined FSs were used.

2. Results of quality of life evaluation, suggestion for grant allocation - decision support

Bellow in Table 3 there are results of the QL evaluation for the individual methods. When comparing the results we find the same trend, similar evaluation for the individual regions respectively. However, there is a difference in the level of the value – while with the fTOPSIS method the average value QL is 61.43% and the median is 62.04%, with CBR 67.43% and 67.71%, with FIS 71.02% and 73.35%, that means much higher values. As it is clear from Table 5 the advantage of the model is the "suppression" of quantity – as it is with PRA (not even the above-average value of some indicators, such as GDP, did not lead to overall above-average evaluation). The "AGG" column represents the result of a comparison of the RBS methods.

Table 3. Results of quality of life evaluation; Suggestion for grant allocation

Regions	Methods (% ranking)			Methods (% suggestion)			AGG (% suggestion)
	fTOPSIS	FIS	CBR	fTOPSIS	FIS	CBR	
MSZ	53.10	64.80	55.97	15	10	15	13.33
STC	62.46	74.20	70.80	10	5	5	6.67
JHC	61.69	74.18	71.28	10	5	5	6.67
PLZ	75.89	76.31	73.88	5	5	5	5.00
KVA	51.43	65.78	61.52	15	10	10	11.67
UST	42.18	58.46	58.78	20	15	15	16.67
LIB	59.75	74.21	65.85	15	5	10	10.00
KHK	78.27	76.89	74.95	5	5	5	5.00

Regions	Methods (% ranking)			Methods (% suggestion)			AGG (% suggestion)
	fTOPSIS	FIS	CBR	fTOPSIS	FIS	CBR	
PAK	67.04	75.30	72.85	10	5	5	6.67
VYS	58.16	69.24	67.30	15	10	10	11.67
JHM	63.55	72.51	68.12	10	5	10	8.33
OLO	62.38	71.66	66.85	10	5	10	8.33
ZLN	64.01	75.64	69.63	10	5	10	8.33
PRA	60.06	65.14	66.30	10	10	10	10.00

(Source: own construction)

Suggestion for grant allocation – decision-making support for public administration for regions development, for reducing disparities between individual regions (in those areas that the evaluation illustrated as problematic) – is included in Table 3. These suggestion are based on EIU (2017), in Table 5.

Table 4. Grant (thous. CZK); Suggestion for grant allocation – areas

Regions	Budget (thous. CZK)	AGG (% suggestion)	Grant (thous. CZK)	Suggestion for grant allocation - areas
MSZ	119 256	13.33	15 897	areas B, C
STC	150 553	6.67	10 042	areas A, C
JHC	97 570	6.67	6 508	areas B, F
PLZ	105 780	5.00	5 289	areas B, D, F
KVA	66 973	11.67	7 816	areas C, D
UST	92 151	16.67	15 362	areas A, D, E, H
LIB	56 678	10.00	5 668	areas C, G
KHK	116 405	5.00	5 820	area H
PAK	87 011	6.67	5 804	areas F, G
VYS	142 622	11.67	16 644	areas A, D, F
JHM	227 384	8.33	18 941	areas B, E, F
OLO	114 799	8.33	9 563	areas A, E, H
ZLN	70 592	8.33	5 880	area E
PRA	1 081 919	10.00	108 192	areas B, C

(Source: own construction)

Table 5. Suggestion for grant allocation

QL evaluation – rating (%)	80 – 100	70 – 80	60 – 70	50 – 60	50 or less
Suggested grant (%)	0	5	10	15	20

(Source: EIU, 2017)

In this model there is a recommendation, expressed in percentages, for grant allocation defined as a percentage from 10% capital expenditures (column "Budget" in Table 4). In case we work with the results of the evaluation and with the recommendation (Table 3), with the final amount of subsidy for regional development, then the investment into innovations in the region is expressed by the column "Grant" in Table 4, column "Suggestion for grant allocation - areas" then expresses those areas that were evaluated as below average and those areas to which the grant should be provided.

3. Conclusions

This model is specific in its approach to finding out the indicators – WoC and by its final recommendation for the grant allocation. When results of this QL evaluation model are compared with Government Resolution no. ČR 669/17 (Vláda ČR, 2017) it can be stated that the model corresponds with the actual situation and it has captured the "neglected regions" in the same way as it is stated in the government ruling. The results also correspond, with the exception of PRA, with other evaluations (Holanová and Kunc, 2016; CT 2016). This model also shows the variety and the specifics of the regions – with some regions there is more average areas, with some regions there are one or two significantly below average areas. The model is thus valuable exactly as a decision-making support tool for public administration, as a background document for grant allocation for a given region development, investments into innovations in its "problematic areas and for increasing its competitiveness. The benefit of the model is in the identification of its weak and below-average areas to which it is desirable to invest. For instance, in case of the Moravsko-slezský regions there is recommendation to invest into development and innovations in the areas of transport, safety and environment – in concrete words to support lifespan of full health period by reducing the harm made by risk substances and noise, to increase health education and to support creation of healthy environment and services supporting and promoting health; created system of institutionalized care for the environment; wide spectrum of nature types based on various natural conditions and based on historical ways of agriculture production (Vláda ČR, 2017b).

This model taken to a more general level can be utilized also on other evaluation levels – for instance evaluation of NUTS2 region where EU could directly define an operation program, but also in other areas, for instance evaluation of company performance, company processes optimization. The processing of the results of this questionnaire survey has brought about an interesting idea about indicators' database – from known official indicators (CZSO, other organizations and institutions, public opinion polls and similar) a database would be constructed, this database would be available prior to the questionnaire survey and respondents would get "help" in formulation of the exact indicators.

Further work on this topic – it is recommended to utilize other approaches for finding out indicators by the CR inhabitants such as for instance "evolution

principle" or definition of important indicators from pre-defined list and also utilization of more methods of Rule-based systems, system engineering for QL evaluation (for instance Rule-based reasoning, Analytic hierarchy process) and their much wider comparison, synthesis and analysis. The evolution principle (unlike the WoC –where the important condition is the fact that people express their opinions independently from each other) works with the fact that people see the responses of the people interviewed before them, they can mark one of the already stated possibilities or they can add their own "new" indicators. The list of the already stated indicators shall be regularly updated, each time any new respondent fills in the questionnaire and it shall also include regular % frequency (this will express what percent of those who have filled in the questionnaire selected the given indicator as important). The approach of defining important indicators would work with the already defined list of indicators (including indicators selected from various other methodologies and approaches). The objective here is that people select from the list any number of indicators they find important (so potentially they can select all indicators, one indicator or even no indicator). The result shall be the list of indicators with defined significance expressed as their weight.

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