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MEASUREMENT SCALE OF SUBJECTIVE QUALITY OF LIFE IN CROSS-BORDER REGIONS

Summary

The article presents the proposal of the measurement scale of subjective quality of life of the inhabitants living in cross-border regions. In the design of the measurement tool the exploratory and confirmatory factor analyses were used. The exploratory analysis was based on principal components analysis with VARIMAX rotation. In the evaluation of the model fitting the method that was used is the estimation one which combines the generalized least squares method with the maximum likelihood method. Three potential factor models differing in the number of subscales were analysed. The article includes the results of the survey conducted in 2012 within the Polish-German project: "*The quality of life in the border area – strengthening of cross-border flows for the common sustainable development and regional planning*".

Key words: subjective quality of life, measurement scale, cross-border regions

1. Introduction

Border areas, considering their location, are a specific domain of the study of quality of life, especially in the context of cross-border flows, which have their origin, among others, in the observed and perceived by residents living on both sides of the border the differences in the level and quality of life. In this type of research the category of quality of life, which is difficult to define, seems to be even more difficult to measure. Measuring the quality of life should in fact be made on the basis of objective indices (objective quality of life or living conditions), as well as of subjective ones, derived from population surveys. The first measurement, which is an objective dimension of quality of life, describes the factual circumstances, while the second one, as it is a subjective approach, gives the information on the perceived quality of life. As far as the choice of objective indices is often dictated by the quality, reliability and, above all, the availability of statistical and non-statistical data, in the case of the subjective quality of life studies the substantial content of this category remains an open and depending on the purpose and the scope of analyses question, as the studies being carried out in this field show.

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The article presents a tool for measuring the subjective quality of life used in the studies being carried out in the Saxon-Polish border area. The main objective of the paper was to characterize the development of an alternative proposal of subjective quality of life measuring scale in cross-border areas – in other words, to term "the capacity" of this concept in practical tests.

2. Measurement of subjective quality of life

The quality of life is a complex and multi-faceted category, and as such can cause problems concerning the adoption of an unequivocal and accepted "without reservation" definition. Initially, the considerations on the quality of life were the domain of philosophy, sociology and psychology. Over time, this category has become a subject of interest and studies also among representatives of other domains and scientific disciplines, including economists as well as management theorists and practitioners. The very concept of quality of life and attempts to quantify it are different depending on the research methods and measurement tools relevant to the discipline. The review of the definition of quality of life in the social sciences and medicine was performed by Baumann [2006], Trzebiatowski [2011], Wnuk et al. [2013].

The quality of life category appears in the theoretical debates, but is also an object of the interest in the individual scale – of every human, as well as in the collective one – local, regional, etc. A man formulates aims, strives for meeting their needs, fulfils dreams in the hope of a better life, a sense of happiness and satisfaction. High quality of life is, therefore, not only the superior purpose for the concept of sustainable development but also the essence of any activities taken by a human, both by individuals and population as well as social groups.

The quality of life, as a superior purpose of the sustainable development concept, according to T. Borys, is understood as the balanced appreciation and perception of the whole abundance of global quality and co-existence of, within human life, prosperity (quality characteristics of `to have`), well-being (quality characteristics of "to be") as well as bliss (quality characteristics of `to love`). In other words, the quality of human life means the balance of their physical, mental and spiritual (emotional) development [Borys, 2008].

There are some evaluating derivative concepts that are related to the category of quality of life, i.e. objective and subjective quality of life or, as T. Borys emphasises, objectification and subjectivisation of quality of life assessments [Borys, 2002]. In fact, this division expresses the degree of objectivity of measuring various aspects of quality of life. The quality of life in objective terms is a feature of the social environment, autonomous from its perceiving and evaluating by the humans [Rutkowski, 1988]. The objective quality of life is interchangeably defined as living conditions, which, apart from material realm, consist of social and natural environment, health or safety. Improving these conditions does not have to be directly translated to increasing the level of satisfaction. The level of satisfaction (gratification) with life is defined as the subjective quality of life and the relations of this category to the objective

quality are not clearly defined. The subjective sense of satisfaction with the objective conditions of life also depends on the complexity of the quality of life, the so-called relative sense of victimisation and value system [see more: Borys, 2002]. The quality of life in subjective terms is, therefore, determined by the satisfaction that people derive from their own life and its conditions [Rutkowski, 1988]. The subjective form of quality of life is, therefore, an individual matter, depending on the needs, aspirations and perception, that are unique to each person [Rutkowski, 1987; Skrzypek, 2001].

A subjective measurement of quality of life is done according to different systems. They can reflect a simplified approach including two spheres of the quality of life, it is well-being and welfare (also called the spheres of "having" and "being") or three spheres, where next to well-being and welfare, features of "loving" type are also assessed. An analytical approach assumed in this Project including a division into quality of life areas is also quite common.

There is a relatively big group of studies of expert character as well as the ones, which describe experiences of particular territorial government units, within research methodology of the quality of life, on a local level. This literature review was done among others in works edited by Borys and Rogala [2008], and also in a report from research, the so called "desk research" prepared within the Project under the title *The quality of life in the border area - strengthening of cross-border flows for the common sustainable development and regional planning* [Report, 2013]. This wide review of initiatives of the quality of life research, included in these works, constituted a starting point for working out a research questionnaire of the subjective quality of life in Polish-Saxon transborder area. Moreover, a choice of areas and aspects given to subjective assessments of respondents, in accordance with an assumption made by Project's performers, was supposed to be in a possibly highest rank compatible with distinguished areas, for the needs of objective measurement of the quality of life dimension. Objective quality, in a discussed Project, was assessed on the basis of objective indicators, for which data was taken from the sources of public statistics, and the accepted set of indicators included main areas of local governments activities. Because the main aim of conducted survey research was to get answer for a research question concerning subjective assessment of the quality of life and dependency between transborderness of researched area and the subjective quality of life. Questions included into a questionnaire were limited to the ones concerning the most important fields and aspects of the quality of life, which can be directly or indirectly influenced by local authorities through development policy run on a local level. The results of carried out research in accordance with Project's assumptions, would allow to define key problems for territorial government unit and constitute a significant source of information, which could be applied in a process of defining local and regional development priorities, on a level of shaping a general development strategy as well as on a level of policies and sector programs.

3. Stages of constructing the measurement scale of subjective quality of life in cross-border regions

3.1. Characteristics of the data set

In the construction of the scale, there are the data that were collected in the study on cross-border area consisting of two districts: on the Polish side – the district of Zgorzelec, and on the German (Saxon) one – Goerlitz. The study was a part of the Polish-German project: *The quality of life in the border area - strengthening of cross-border flows for the common sustainable development and regional planning.* The research was conducted by PAPI (Paper and Pencil Interview) in the period from November 2012 to February 2013. 873 interviews were carried out. The selection of respondents was purposeful, taking into account the structure of the population by gender, age and place of residence.

Proposed measurement scale, developed by the experts from the Department of Quality and Environmental Management in Wroclaw and Spatial Order Department of the Technical University of Dresden contained 43 items (criteria) relating to the six components of the construct of the subjective quality of life in border areas: healthcare, education, public and social safety, cultural and sporting offers, financial and employment status, place of residence, environment and transport accessibility. The respondents evaluated the individual criteria of the subjective quality of life using a 5-degree rating scale of measurement of the following scale points: "very dissatisfied", "dissatisfied", "rather dissatisfied", "rather satisfied", "satisfied". The components and criteria for the subjective quality of life offered by the team of experts are summarized in table 1.

To get the answer to the question whether the set of 43 criteria can be considered as homogeneous index of a latent variable, it was decided to use an exploratory factor analysis. In order to confirm the validity of the application of the factor model in this case, they assessed the correlation of variables and the significance of these compounds. They applied Bartlett`s correlation matrix sphericity test as well as calculated the KMO (Kaiser-Meyer-Olkin) statistics value for the whole set of data and the MSA (Measure of Sampling Adequacy) statistics for each variable [Bartlett 1950; Kaiser 1970]. The results are presented in table 2.

Bartlett's sphericity test relates to verifying the hypothesis of no significant correlations among the variables (the null hypothesis assumes that the matrix of correlation coefficients among the variables is the unit one). The rejection of the null hypothesis proves the validity of the analysis. The value of Bertlett's statistics was $\lambda^2 = 12682{,}951$ and is statistically significant at least at the level of $a = 0.000$. Therefore, the null hypothesis of no significant correlations among the variables was rejected, which confirms the validity of the assumed analytical approach.

TABLE 1.

Components of subjective quality of life

Components	No.	Items (criteria)
I. Healthcare	x_1	Access to general practitioners (number of outposts, office hours, waiting time, the quality of services).
	x_2	Access to specialized doctors (number of outposts, office hours, waiting time, the quality of services).
	x_3	Functioning of the medical emergency service.
	x_4	Access to pharmacies (number of outposts, opening hours and prices).
II. Education	x_5	Access to and the quality of the nurseries and kindergartens.
	x_6	Access to and the quality of primary schools.
	x_7	Access to and the quality of lower secondary schools
	x_8	Access to and the quality of secondary vocational schools
	x_9	Access to and the quality of general secondary schools.
	x_{10}	Access to and the quality of tertiary schools.
	x_{11}	Adapting schools for the disabled.
	x_{12}	Opportunities and the conditions of education improving or retraining for adults.
III. Public and social safety	x_{13}	Personal safety (at night and during the day).
	x_{14}	Traffic safety.
	x_{15}	Preparing the community for emergencies (floods, droughts, etc.).
	x_{16}	Security of property (flat, car).
	x_{17}	Care for those with special needs (elderly, chronically sick people).
	x_{18}	Help for individuals and dysfunctional families.
	x_{19}	The degree of solidarity with the people being in difficult situations (e.g. long-term unemployed, the homeless).
IV. Cultural and sports offer	x_{20}	Opportunities to participate in sporting events.
	x_{21}	Opportunities to participate in cultural events.
	x_{22}	Access to free sporting and cultural infrastructure.
V. Financial and work status	x_{23}	Personal financial situation (income, savings).
	x_{24}	Current work activity (its attractiveness, work conditions and atmosphere).
	x_{25}	Job security (temporality, the so-called `zero hours` or junk contracts).
	x_{26}	Chances of finding a new attractive job.
	x_{27}	Maintaining the proper balance between work time and leisure time.
	x_{28}	Housing conditions (size, location, condition and housing equipment).
VI. Place of residence, including access to services, assessment of the environment, transport accessibility	x_{29}	Access to the technical infrastructure (water supply and sewerage systems, gas).
	x_{30}	Access to commercial services such as restaurants, repairing services, postal services, etc. (number of outposts, opening hours, prices).
	x_{31}	Access to essential products such as food, clothing, etc. (number of outposts, opening hours, prices).
	x_{32}	Access to the Internet and mobile telephony.
	x_{33}	Access to and the state of green areas (e.g. parks, squares and forests).
	x_{34}	Image of the place of residence (cleanness and aesthetics of public places). Image of the domicile (the and the beauty of public places).
	x_{35}	Drinking water quality.
	x_{36}	Waste management (rubbish collection from households, access to waste containers in public places, possibilities of waste segregation).
	x_{37}	Air quality.
	x_{38}	Climate state level (low noise pollution).
	x_{39}	Possibility of travelling by bicycle, including cycling routes.
	x_{40}	Possibility of travelling by own car or motorcycle (traffic jams, road conditions, access to parking spaces).
	x_{41}	Possibility of travelling around by public transport (bus, train, etc.).
	x_{42}	Transport links to the nearest urban centre.
	x_{43}	Cross-border transport links.

Source: own elaboration.

TABLE 2.

The values of MSA statistics

Variable	MSA statistics	Variable	MSA statistics
x_1	0.802	x_{23}	0.925
x_2	0.731	x_{24}	0.867
x_3	0.760	x_{25}	0.855
x_4	0.809	x_{26}	0.892
x_5	0.851	x_{27}	0.905
x_6	0.807	x_{28}	0.853
x_7	0.850	x_{29}	0.812
x_8	0.893	x_{30}	0.789
x_9	0.872	x_{31}	0.811
x_{10}	0.856	x_{32}	0.856
x_{11}	0.892	x_{33}	0.852
x_{12}	0.901	x_{34}	0.875
x_{13}	0.830	x_{35}	0.816
x_{14}	0.791	x_{36}	0.850
x_{15}	0.817	x_{37}	0.796
x_{16}	0.796	x_{38}	0.803
x_{17}	0.764	x_{39}	0.794
x_{18}	0.786	x_{40}	0.792
x_{19}	0.823	x_{41}	0.762
x_{20}	0.816	x_{42}	0.723
x_{21}	0.817	x_{43}	0.831
x_{22}	0.844	–	–
KMO statistics: 0.835			

Source: own calculations using IBM SPSS Statistics 21.

The KMO and MSA indices allow to perform an initial elimination of variables, among which the correlations are small, and which may cause the extracted factors to be difficult to interpret. The limit values for the KMO and MSA indices were adequately set at the levels of 0.7 and 0.5. The KMO index value was high and amounted to 0.835 at the significance level $a = 0.000$. The result does not imply the reduction of the assumed set of variables. The MSA statistics provided similar recommendations for individual variables. Any case of variable, for which the MSA statistics value was lower than the limit value of 0.5, has not been identified. In the further stages of the measurement scale construction all the variables have been therefore included.

3.2. Results of the dimensionality of the scale

To extract the subscales the exploratory factor analysis was used, that had been conducted using principal components analysis with the VARIMAX rotation. It is the most popular approach in determining the dimensionality of composite measurement scales. Factor analysis results are presented below.

TABLE 3.

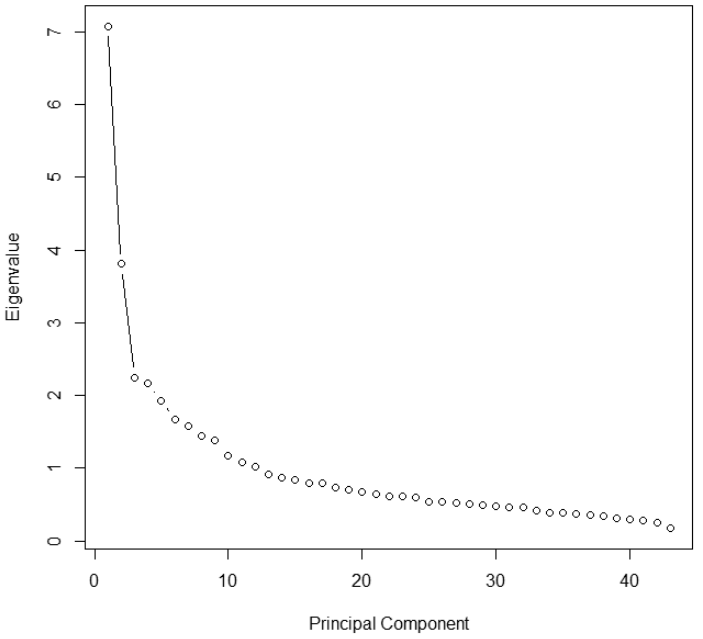
Factor analysis results

Component	Eigenvalue	% of variance	Cumulative %
1	7.077	16.457	16.457
2	3.806	8.851	25.308
3	2.245	5.221	30.529
4	2.164	5.033	35.562
5	1.934	4.498	40.060
6	1.678	3.903	43.962
7	1.578	3.669	47.631
8	1.449	3.370	51.001
9	1.382	3.215	54.216
10	1.173	2.727	56.943
11	1.078	2.507	59.450
12	1.029	2.392	61.843
13	0.917	2.132	63.975
14	0.866	2.013	65.988
15	0.836	1.944	67.932
16	0.796	1.851	69.783
17	0.789	1.835	71.618
18	0.732	1.701	73.319
19	0.702	1.632	74.951
20	0.679	1.580	76.531
21	0.650	1.511	78.042
22	0.614	1.428	79.470
23	0.608	1.413	80.883
24	0.596	1.387	82.270
25	0.545	1.268	83.538
26	0.540	1.257	84.795
27	0.523	1.216	86.011
28	0.506	1.176	87.187
29	0.498	1.158	88.345
30	0.485	1.129	89.474
31	0.467	1.087	90.561
32	0.462	1.073	91.634
33	0.419	0.975	92.609
34	0.396	0.920	93.529
35	0.386	0.898	94.428
36	0.378	0.880	95.308
37	0.359	0.835	96.142
38	0.340	0.791	96.934
39	0.315	0.732	97.665
40	0.301	0.700	98.365
41	0.283	0.657	99.023
42	0.247	0.574	99.596
43	0.174	0.404	100.000

Source: own calculations using IBM SPSS Statistics 21.

FIGURE 1.

Scree test



Source: own calculations using IBM SPSS Statistics 21.

In choosing the number of components the percentage of variance criterion and the scree test [Kim, Mueler 1978] were applied. The scree plot might suggest leaving the 3, 6 and possibly 10 factors (subscales). The 10-factor model was not considered further in the analysis because the analysis of the 10 subscales greatly complicates the measurement model and hinders its substantive interpretation. Furthermore, despite the large number of factors, the model would not meet the percentage of variance criterion, which is often set at a minimum of 60%. The fulfillment of this criterion would require the adoption of 11 factors which would complicate the model increasingly. Therefore, the models that were considered were the 3 and 6-factor ones bearing in mind that they do not meet the percentage of variance criterion. The alternative for them was the third model proposed by the experts (Table 1.). The values of factor loadings for the first two models are presented in tables 4. and 5.

TABLE 4.

Factor loadings before and after rotation for the first model

Variable	Component			Component		
	1	2	3	1	2	3
x_1	0.385	0.209	-0.144	0.384	0.044	0.252
x_2	0.285	0.189	-0.032	0.233	0.056	0.246
x_3	0.252	0.115	-0.180	0.311	-0.008	0.111
x_4	0.328	0.080	-0.218	0.389	0.036	0.093
x_5	0.481	-0.190	0.456	0.001	**0.660**	0.200
x_6	0.592	-0.371	0.370	0.130	**0.778**	0.052
x_7	0.589	-0.413	0.371	0.125	**0.799**	0.017
x_8	0.583	-0.404	0.287	0.181	**0.743**	-0.013
x_9	0.585	-0.404	0.302	0.172	**0.753**	-0.006
x_{10}	0.464	-0.220	0.373	0.046	**0.618**	0.135
x_{11}	0.459	-0.339	0.180	0.173	**0.571**	-0.047
x_{12}	0.460	-0.245	0.093	0.242	**0.471**	-0.003
x_{13}	0.285	0.295	-0.035	0.241	-0.003	0.334
x_{14}	0.289	0.319	0.108	0.143	0.067	0.414
x_{15}	0.304	0.115	0.134	0.123	0.202	0.260
x_{16}	0.349	0.221	-0.052	0.293	0.068	0.288
x_{17}	0.247	0.212	0.148	0.080	0.122	0.327
x_{18}	0.443	-0.154	-0.156	0.413	0.270	-0.036
x_{19}	0.476	-0.060	-0.061	0.373	0.293	0.093
x_{20}	0.459	0.075	-0.149	0.432	0.160	0.164
x_{21}	0.416	0.213	-0.119	0.388	0.075	0.277
x_{22}	0.386	0.010	-0.214	0.423	0.113	0.057
x_{23}	0.505	0.051	-0.217	**0.511**	0.162	0.132
x_{24}	0.517	-0.219	-0.286	**0.554**	0.278	-0.118
x_{25}	0.571	-0.201	-0.258	**0.572**	0.317	-0.073
x_{26}	0.526	-0.085	-0.203	**0.508**	0.258	0.032
x_{27}	0.526	-0.262	-0.278	**0.552**	0.311	-0.148
x_{28}	0.374	0.193	-0.214	0.425	0.006	0.206
x_{29}	0.323	0.299	-0.245	0.417	-0.101	0.264
x_{30}	0.435	0.152	-0.382	**0.585**	-0.028	0.124
x_{31}	0.461	0.072	-0.360	**0.583**	0.043	0.075
x_{32}	0.435	-0.004	-0.270	**0.497**	0.119	0.039
x_{33}	0.270	0.508	0.080	0.160	-0.063	**0.555**
x_{34}	0.292	0.529	0.164	0.117	-0.013	**0.615**
x_{35}	0.075	0.540	0.281	-0.118	-0.088	**0.595**
x_{36}	0.173	0.602	0.279	-0.044	-0.061	**0.682**
x_{37}	0.151	0.579	0.220	-0.019	-0.095	**0.630**
x_{38}	0.177	0.597	0.176	0.032	-0.115	**0.636**
x_{39}	0.321	0.221	0.248	0.061	0.220	0.402
x_{40}	0.304	0.284	0.187	0.096	0.140	0.424
x_{41}	0.323	0.180	0.057	0.195	0.135	0.289
x_{42}	0.318	0.259	0.059	0.195	0.090	0.354
x_{43}	0.381	0.072	-0.024	0.287	0.184	0.185

Source: own calculations using IBM SPSS Statistics 21.

TABLE 5.

Factor loadings before and after rotation for the second model

Variable	Component						Component					
	1	2	3	4	5	6	1	2	3	4	5	6
x_1	0.385	0.209	-0.144	0.287	0.351	-0.175	0.074	0.104	0.098	-0.060	**0.595**	0.256
x_2	0.285	0.189	-0.032	0.318	0.364	-0.042	0.056	0.098	0.063	-0.064	**0.574**	0.057
x_3	0.252	0.115	-0.180	0.116	0.476	-0.119	0.010	-0.087	-0.058	0.030	**0.549**	0.223
x_4	0.328	0.080	-0.218	0.271	0.208	-0.331	0.101	0.032	0.134	-0.184	0.419	0.386
x_5	0.481	-0.190	0.456	0.168	-0.031	-0.069	**0.659**	0.174	0.128	-0.020	0.130	-0.109
x_6	0.592	-0.371	0.370	-0.039	-0.009	-0.181	**0.795**	-0.003	0.094	0.091	0.051	0.088
x_7	0.589	-0.413	0.371	-0.093	0.032	-0.210	**0.822**	-0.055	0.043	0.108	0.044	0.116
x_8	0.583	-0.404	0.287	-0.088	0.051	-0.159	**0.752**	-0.097	0.084	0.138	0.072	0.121
x_9	0.585	-0.404	0.302	-0.110	-0.010	-0.205	**0.774**	-0.064	0.084	0.124	0.013	0.155
x_{10}	0.464	-0.220	0.373	0.037	-0.127	-0.086	**0.622**	0.134	0.140	0.050	-0.009	-0.020
x_{11}	0.459	-0.339	0.180	0.073	0.133	-0.023	**0.546**	-0.142	0.143	0.068	0.195	0.001
x_{12}	0.460	-0.245	0.093	0.003	-0.041	0.002	0.445	-0.051	0.230	0.141	0.067	0.068
x_{13}	0.285	0.295	-0.035	0.124	0.297	0.091	-0.027	0.164	0.036	0.157	**0.477**	0.031
x_{14}	0.289	0.319	0.108	0.183	0.121	0.199	0.020	0.302	0.129	0.154	0.368	-0.127
x_{15}	0.304	0.115	0.134	0.223	0.293	0.159	0.154	0.102	0.073	0.088	**0.463**	-0.150
x_{16}	0.349	0.221	-0.052	0.091	0.400	0.142	0.025	0.061	0.032	0.231	**0.550**	0.020
x_{17}	0.247	0.212	0.148	0.243	0.287	0.175	0.076	0.176	0.045	0.074	**0.472**	-0.181
x_{18}	0.443	-0.154	-0.156	-0.070	0.306	0.123	0.212	-0.241	0.141	0.310	0.351	0.125
x_{19}	0.476	-0.060	-0.061	-0.041	0.248	0.205	0.220	-0.107	0.173	0.351	0.353	0.030
x_{20}	0.459	0.075	-0.149	-0.298	0.065	0.224	0.092	-0.007	0.161	**0.552**	0.142	0.153
x_{21}	0.416	0.213	-0.119	-0.332	-0.018	0.152	0.036	0.142	0.108	**0.534**	0.077	0.204
x_{22}	0.386	0.010	-0.214	-0.283	-0.022	0.217	0.046	-0.063	0.213	**0.492**	0.043	0.162
x_{23}	0.505	0.051	-0.217	0.135	-0.002	-0.010	0.141	0.065	0.371	0.136	0.279	0.256
x_{24}	0.517	-0.219	-0.286	0.331	-0.372	0.192	0.188	-0.035	**0.798**	0.038	0.031	0.084
x_{25}	0.571	-0.201	-0.258	0.349	-0.359	0.209	0.222	-0.004	**0.815**	0.060	0.072	0.070
x_{26}	0.526	-0.085	-0.203	0.268	-0.272	0.278	0.155	0.050	**0.695**	0.158	0.118	0.008
x_{27}	0.526	-0.262	-0.278	0.268	-0.329	0.165	0.227	-0.084	**0.744**	0.068	0.026	0.112
x_{28}	0.374	0.193	-0.214	0.269	-0.174	-0.031	0.000	0.237	0.433	-0.015	0.192	0.215
x_{29}	0.323	0.299	-0.245	-0.018	-0.098	-0.396	-0.002	0.278	0.107	-0.001	0.115	**0.564**
x_{30}	0.435	0.152	-0.382	-0.304	-0.097	-0.356	0.052	0.085	0.116	0.255	0.009	**0.706**
x_{31}	0.461	0.072	-0.360	-0.304	-0.051	-0.395	0.128	0.025	0.094	0.233	0.029	**0.719**
x_{32}	0.435	-0.004	-0.270	-0.289	-0.052	-0.250	0.166	-0.018	0.114	0.269	0.005	**0.545**
x_{33}	0.270	0.508	0.080	-0.005	-0.194	-0.204	0.006	**0.581**	0.037	0.076	0.065	0.259
x_{34}	0.292	0.529	0.164	-0.045	-0.185	-0.128	0.040	**0.619**	0.011	0.152	0.065	0.179
x_{35}	0.075	0.540	0.281	0.184	-0.187	-0.021	-0.055	**0.651**	0.008	-0.051	0.081	-0.092
x_{36}	0.173	0.602	0.279	0.079	-0.166	-0.104	-0.006	**0.707**	-0.045	0.034	0.100	0.036
x_{37}	0.151	0.579	0.220	0.068	-0.122	-0.056	-0.054	**0.636**	-0.038	0.061	0.123	0.024
x_{38}	0.177	0.597	0.176	0.079	-0.166	-0.094	-0.065	**0.660**	0.004	0.046	0.110	0.085
x_{39}	0.321	0.221	0.248	-0.161	-0.101	0.291	0.155	0.319	0.083	0.417	0.028	-0.166
x_{40}	0.304	0.284	0.187	-0.122	-0.243	0.240	0.090	0.404	0.164	0.359	-0.051	-0.098
x_{41}	0.323	0.180	0.057	-0.416	0.150	0.151	0.103	0.097	-0.127	**0.549**	0.109	0.091
x_{42}	0.318	0.259	0.059	-0.434	0.049	0.230	0.043	0.185	-0.072	**0.607**	0.049	0.050
x_{43}	0.381	0.072	-0.024	-0.434	0.049	0.277	0.111	0.010	0.036	**0.633**	0.032	0.059

Source: own calculations using IBM SPSS Statistics 21.

Analyzing the matrix of rotated components for the 3-factor model it can be noticed that for nearly half of the criteria (21 of 43) factor loadings are not statistically significant (they are below the acceptable level of 0.5). This means that 21 criteria are not specific to any of the separated subscales and poorly correlate with them. Therefore, these variables ought to be removed from the measurement scale. It should also be noted that the interpretation of the first subscale is not clear. This is because it com-

bines the assessment of the financial and employment situation with the one of the access to commercial services, indispensable products as well as to the Internet and mobile networks. The second and third subscale can be defined respectively as "education" and "the environment".

In the 6-factor model for the eight criteria statistically significant factor loadings were not observed. The first three subscales are unequivocal to interpret and can be defined as: "education", "environment" and "employment status". The interpretation of the other subscales is less unequivocal. The fourth subscale integrates the assessment of the aspects of culture and sporting offer and the one of the access to public transport. The fifth subscale includes the criteria for health care and public and social safety. The last one contains the evaluation criteria for access to services. The interpretation of the subscales is therefore similar to the third model adopted by experts.

The next step of the analysis was to assess the reliability of the separate subscales within the three factor models. The coefficient that was used is Cronbach's alpha, which is based on the coefficients of the correlation of all scale items with the overall result of the scale. The results are summarized in table 6.

TABLE 6.

Reliability of measurement

	Reliability		
	Model 1 (α=0.835)	Model 2 (α=0.845)	Model 3 (α=0.874)
Subscale 1	0.787	0.857	0.656
Subscale 2	0.856	0.784	0.856
Subscale 3	0.784	0.838	0.667
Subscale 4	-	0.698	0.724
Subscale 5	-	0.639	0.804
Subscale 6	-	0.714	0.762

Source: own calculations using IBM SPSS Statistics 21.

In the assessment of scale reliability using Cronbach's alpha it is essential that the number of the survey samples and the number of the items scale affect its value. The larger the number of the scale items is, the higher the value of coefficient position may be. In the present case the accuracy of full scale for the three models is high (the highest for model 3, but recall that it contained the largest number of items which could have an impact on the high value of the coefficient). In addition, in the case of the first two models there are the subscales for which the value of the coefficient is higher than for the whole scale despite a much smaller number of items comprising these subscales (subscale 2 for model 1 and subscale 1 for model 2). In the other cases, the reliability of the subscales can be considered as satisfactory, bearing in mind that they are composed of a much smaller number of items than the complex ones.

3.3. Results of the assessment of measurement models fit

In the final stage the degree of fit of three models to empirical data were compared. Theoretical accuracy of the models was tested by means of confirmatory factor analysis. The method that was applied is the estimation one, which combines generalized least squares method with the method of maximum likelihood. In order to choose the model that most closely matches the data, values of several common goodness of fit indices were calculated. The results of confirmatory factor analysis for the three models are listed in table 7.

TABLE 7.

Goodness of fit indexes

Indexes*	Model 1	Model 2	Model 3
χ^2 statistics	1808.84	2877.36	**5344.35**
$\frac{\chi^2}{df}$ ratio	8.655	**5.460**	6.214
GFI (Goodness-of-Fit Index)	**0.831**	0.823	0.731
AGFI (Adjusted Goodness-of-Fit Index)	0.796	**0.800**	0.704
RMSEA (Root Mean Square Error of Approximation)	0.098	**0.076**	0.09
Akaike information criterion	**2.131**	3.386	6.198
Gamma Index	0.846	**0.847**	0.756
Bayes information criterion	**2.368**	3.752	6.661
NFI (Normed Fit Index)	**0.754**	0.716	0.586
NNFI (Non-Normed Fit Index)	**0.751**	0.738	0.608
CFI (Comparative Fit Index)	**0.775**	0.754	0.626

* The most advantageous values of each index are shown in bold.

Source: own calculations using IBM SPSS Statistics 21.

The recommendations that were used in the analysis of fit indices are included in the following studies: Akaike [1974], Bentler and Bonnet [1980], Jöreskog and Sörbom [1981], McDonald [1988], Steiger [1990], Rigdon [1996], Hu and Bentler [1999], Sztemberg-Lewandowska [2008]. Fit indices did not give a clear indication as to the choice of model. Only one of the indices (χ^2 statistics) pointed to the choice of the model proposed by the experts. However, considering the sensitivity of this index to the size of the sample, the alternative indices, listed in table 7, were also analysed.

The values of these indices suggested the choice of the first or second model. For both models the values of AGFI and Gamma indices were basically identical. In the case of GFI, NFI, NNFI and CFI indices the differences were also small. Considering the above results, it was decided that the scale of quality of life measuring in cross-border areas should be composed of six subscales represented by the second model. Such a choice was a compromise between the stock of information being explained by the model and its complexity. It should be noticeable that the first model is responsible

for explaining only 31% of the total variance. The second one explains 44% of the variance while the number of sub-scales is acceptable. The interpretation of the sub-scales also appears to be coherent and substantively justified. The subscales along with the criteria are listed in table 8.

TABLE 8.

Measurement scale of subjective quality of life in cross-border regions

Sub-scales	Items (criteria)
Education	Access to and the quality of the nurseries and kindergartens. Access to and the quality of primary schools. Access to and the quality of lower secondary schools Access to and the quality of secondary vocational schools Access to and the quality of general secondary schools. Access to and the quality of tertiary schools. Adapting schools for the disabled.
Environment	Access to and the state of green areas (e.g. parks, squares and forests). Image of the place of residence (cleanness and aesthetics of public places). Drinking water quality. Waste management (rubbish collection from households, access to waste containers in public places, possibilities of waste segregation). Air quality. Climate state level (low noise pollution).
Work status	Current work activity (its attractiveness, work conditions and atmosphere). Job security (temporality, the so-called `zero hours` or junk contracts). Chances of finding a new attractive job. Maintaining the proper balance between work time and leisure time.
Cultural and sports offer and transport accessibility	Opportunities to participate in sporting events. Opportunities to participate in cultural events. Access to free sporting and cultural infrastructure. Possibility of travelling around by public transport (bus, train, etc.). Transport links to the nearest urban centre. Cross-border transport links.
Healthcare, public and social safety	Access to general practitioners (number of outposts, office hours, waiting time, the quality of services). Access to specialized doctors (number of outposts, office hours, waiting time, the quality of services). Functioning of the medical emergency service. Personal safety (at night and during the day). Preparing the community for emergencies (floods, droughts, etc.). Security of property (flat, car). Care for those with special needs (elderly, chronically sick people).
Access to services	Access to the technical infrastructure (water supply and sewerage systems, gas). Access to commercial services such as restaurants, repairing services, postal services, etc. (number of outposts, opening hours, prices). Access to essential products such as food, clothing, etc. (number of outposts, opening hours, prices). Access to the Internet and mobile telephony.

Source: own elaboration.

4. Conclusion

The article presents a proposal for measurement scale which enables to measure the subjective quality of life of the inhabitants of cross-border regions. The results of the researches using factor analysis show that within the category of subjective quality of life six components (subscales) can be extracted: "education", "environment", "work status", "cultural and sports offer and transport accessibility", "healthcare, public and social safety", "access to services". The subscales are characterized by satisfactory reliability of measurement. The initial set of items was possible to reduce by 9 items which allowed to simplify the measurement model. It is very significant in terms of cost reduction of the research being conducted through direct interviews. It also allows to reduce the risk of the respondent's resignation from the participation in the study.

The authors are aware that the proposed measurement model is not a universal tool. Diversified social and economic structure of other cross-border regions can cause that the application of the scale will require its modification. Therefore, the authors of the article are hoping that the proposed solution will be an inspiration for further studies on the impact of the cross-border regions on the quality of life of their inhabitants and the measure of this quality. The researches that will be taken in this area may still further enhance the fit of the measurement model to empirical data.

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