# QUALITY OF LIFE EVALUATION IN VISEGRAD GROUP AND PROGRESSION OF EVALUATION IN YEARS 2008 - 2014

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***Abstract:*** *This paper deals with the quality of life (QL) evaluation in Visegrad group (V4) and progression of evaluation in years 2008 - 2014 based on official Eurostat methodology for QL evaluation - QL indicators for the European Union (EU). The set is organised along the nine areas. The data presented here come from several sources from within the European Statistical System, in particular Statistics on Income and Living Conditions, Labour Force Survey), European Health Interview Survey, and administrative sources. QL is evaluated by the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method. The countries of V4 are evaluated by TOPSIS for each year and the result is a ranking of QL countries. Next result is progress of this ranking countries in years 2008 - 2014. This paper shows using software or programming tools for QL evaluation and advantage of this using. One of results is confirmation near cooperating countries of V4, their relationship at very good level and their cohesion between other Europe's countries.*

***Keywords:*** *indicators, quality of life evaluation, TOPSIS, Visegrad group*

***JEL Classification:*** *C15, D89, H83, R58.*

## Introduction

The concept of QL is difficult to define and various authors and various organizations approach to the concept of QL it differently and a wide spectrum of quality of life definitions exists in the literature, for example [2], [7], [11], [13], [16]. For the QL evaluation it is necessary to use indicators, using which you can specific areas or issues of QL quantify. Any such assessment is complex, it is necessary to assemble the various indicators with regard to the subject and evaluation criteria [20]. Because it’s very complicated issue, then is appropriate to "take the help of" software or programming tools such as expert systems, decision making models or just rule-based systems and using special methodologies and methods.

Main goal of this paper is a QL evaluation within the Visegrad Group and progression of this evaluation in the years 2008-2014. Next objectives are to determine the level of development of QL in individual countries and the conjunction of these results due to macroeconomic data, crises, happening in Europe or in the European Union. It will also be interesting to compare the results with other researches and evaluations.

## 1 Quality of life evaluation in Visegrad group

QL evaluation [11], [16] is not a simple matter and often can be this evaluation problematic in many regards, QL can be viewed as availability of options, from which an individual can pick during filling his life [15], [18]. This term refers to human existence, comprehension of meaning of life itself of individual being. QL includes

individual way of life (lifestyle), not only individual living conditions, but also living conditions of wider groups of society as a whole [17].

Ferrans developed in the 1990s a useful taxonomy of QL conceptualisations into six categories: normal life, social utility, happiness/affect, satisfaction with life, achievement of personal goals, and natural capacities. In addition to these six conceptual approaches, we also recognised utility and satisfaction with specific domains as possible conceptualisations. [7], [13]

QL is a dynamic concept and by Atanasová we can be said that QL is that which comprises: "Satisfaction with life, which is subjective and may fluctuate; Multidimensional factors that include everything from a degree of independence, housing and environment, physical health, psychological state, family, education, a sense of optimism to social relations; Cultural perspectives, personal expectations, and goals in life; Availability of physical, mental and social well-being; Personal level of acceptance of our current condition and our ability to regulate negative thoughts and emotions regarding this condition."[2]

Subjective QL [12] is the sum of each individual's subjective inputs, such as opinions, personal system of values, attitudes, adaption, manner of perceiving the environs, etc. Research of subjective QL of people is very complicated - every human life is unmatched and each person has their own individual notion. This unfortunately poses problems such as the willingness of respondents, their uncertainty in responses or their different system of values in job, in family etc. Objective QL [12] can be considered as specific, measurable generally living conditions and living standards achieved by an individual person or whole population. Among the factors influencing the objective QL belong a number of indicators such as average wage, access to health care, access to services and education, quality of the natural environment etc.

QL is evaluated by use of indicators. The evaluation of QL is a difficult thing. Number of similar opinions and approaches [20] exist regarding the relevant set of indicators and the concrete evaluation tools used for this area. For QL evaluation has created numerous methods with different indicators, such as: Active Ageing Index [1]; Economist Intelligence Unit Limited [6]; Eurofound [4]; Better Life Index [14], Czech Statistical Office includes among the QL indicators [3] “changes in demographic developments”, and “security of inhabitants”.

V4 reflects the efforts of the countries of the Central European region to work together in a number of fields of common interest within the all-European integration. The Czech Republic (CZ), Hungary (HU), Poland (PL) and Slovakia (SK) have always been part of a single civilization sharing cultural and intellectual values and common roots in diverse religious traditions, which they wish to preserve and further strengthen. Its activities are in no way aimed at isolation or the weakening of ties with the other countries. On the contrary the Group aims at encouraging optimum cooperation with all countries, in particular its neighbours, its ultimate interest being the democratic development in all parts of Europe. [21]

## 2 Methods and methodologies

For QL evaluation in V4 was selected methodologies used on Eurostat - Quality of Life indicators for the EU [5].

### 2.1 Selected methodology and indicators

This methodology includes a total of nine areas, which are described below. For the QL evaluation within V4 and its development in the years it was available for 32 indicators in seven areas in the years 2008 - 2014. Unfortunately, data were not available for all indicators, which this methodology includes. They were selected indicators, which were current or that were available at all of four countries. Selected indicators are described by the following way (**area**: indicator (unit)) [5]. Example of the data matrix for selected areas is in Tab. 1.

- **Material living conditions**: Mean and median income (purchasing power standard), At-risk-of-poverty rate (%), S80/S20 income quintile share ratio (quotient), Severely materially deprived people (%), (In)ability to make ends meet (%), Share of total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames of floor (%), Overcrowding rate (%), Share of people living in under-occupied dwellings (%),
- **Productive or main activity**: Employment rate (%), Unemployment rate (%), Long-term unemployment rate (% of active population), People living in households with very low work intensity (% of total population aged less than 60), Fatal Accidents at work by economic activity (incidence rate), Average number of usual weekly hours of work in main job by economic activity (hour), Population in employment working during unsocial hours, Sundays, frequency is usually (%), Temporary contracts (%),
- **Health**: Life expectancy at birth (years), Healthy life years in absolute value at birth (years), Self-perceived health, good and very good (%), Self-reported unmet needs for medical examination, too expensive or too far to travel or waiting list (%),
- **Education**: Education attainment, Upper secondary, post-secondary non-tertiary and tertiary education (%), Education attainment, Tertiary (%), Early leavers from education and training (% of the population aged 18-24 with at most lower secondary education and not in further education or training), People that participated in education or training in the four preceding weeks (%),
- **Economic and physical safety**: Inability to face unexpected financial expenses (%), Population in arrears, debt (%), Homicide rate, Intentional homicide (Per hundred thousand inhabitants), Crime, violence or vandalism in the area (%),
- **Governance and basic rights**: Gender employment gap (difference between the employment rates of men and women aged 20-64), Gender pay gap in Industry, construction and services, except public administration,

defense, compulsory social security (average gross hourly earnings of male and female paid employees as a percentage of average gross hourly earnings of male paid employees),

- **Natural and living environment**: Pollution, grime or other environmental problems (%), Noise from neighbours or from the street (%).

***Tab. 1: Example of data matrix for selected areas for year 2014***

| **Indicator** | **CZ** | **HU** | **PL** | **SK** |
|---|---|---|---|---|
| Mean and median income | 11.091 | 7.559 | 9.56 | 9.806 |
| At-risk-of-poverty rate | 8.6 | 12.4 | 17.1 | 11 |
| S80/S20 income quintile share ratio | 3.5 | 4.3 | 4.9 | 3.9 |
| Severely materially deprived people | 6.7 | 24 | 10.4 | 9.9 |
| (In)ability to make ends meet | 9.3 | 22.8 | 10.7 | 12.6 |
| Share of total population living … | 9.2 | 26.9 | 9.2 | 7.0 |
| Overcrowding rate | 12.9 | 14.6 | 25.3 | 19.0 |
| Share of people living in under-occupied dwellings | 21.3 | 7.2 | 11.6 | 11.6 |
| Employment rate | 60.4 | 54.1 | 55.6 | 55.1 |
| Unemployment rate | 6.1 | 7.7 | 9.0 | 13.2 |
| Long-term unemployment rate | 2.7 | 3.7 | 3.8 | 9.3 |
| People living in households with very low work intensity | 7.6 | 12.8 | 7.3 | 7.1 |
| Fatal Accidents at work by economic activity | 2.37 | 2.22 | 1.75 | 1.69 |
| Average number of usual weekly hours of work … | 40.4 | 39.8 | 40.7 | 40.5 |
| Population in employment working during unsocial hours | 13.1 | 17.7 | 21.4 | 15.6 |
| Temporary contracts | 7.1 | 9.6 | 22.2 | 7.3 |

*Source: [5]*

For the QL evaluation in V4 and progression of evaluation in years 2008 - 2014 based on official Eurostat methodology for quality of life evaluation was been selected method TOPSIS.

## 2.2 Method TOPSIS

TOPSIS ranks the available networks based on their scores, with the highest being the best [19]. It is a multiple criteria method to recognize solutions from a limited set of alternatives. The fundamental rule is that the preferred alternative should have the shortest distance from the ideal solution and longest distance from the negative-ideal solution [9]. TOPSIS algorithm is applied to the network interface selection as follows [19], [10]:

- The value of each attribute in the matrix is normalized:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^{2}}} \tag{1}$$

- The matrix is updated with the normalized values.
- Each attribute in the matrix is assigned a weight $w_i$:

$$v_{ij} = w_j \,.r_{ij}, \text{ where } \sum_{j=1}^{n} w_j = 1 \tag{2}$$

- Determine ideal and negative ideal solution.

$$A^+ = [v_1^+, \dots, v_m^+] \; and \; A^- = [v_1^-, \dots, v_m^-] \tag{3}$$

- This step is to find the best and the worst value for each of the attributes, if the attribute is upward then the higher value is the best and if the attribute is downward then the lower value is the best.

$$v_i^+ = max\,\{v_{ij}, j = 1 \dots n\}, \; v_i^- = min\,\{v_{ij}, j = 1 \dots n\},$$
$$v_i^+ = min\,\{v_{ij}, j = 1 \dots n\}, \; v_i^- = max\,\{v_{ij}, j = 1 \dots n\} \tag{4}$$

- The distances for both best ($d^+$) and worst ($d^-$) cases are measured.

$$d_i^+ = \sqrt{\sum_{j=1}^{m}(v_i^+ - v_{ij})^2} \; , d_i^- = \sqrt{\sum_{j=1}^{m}(v_i^- - v_{ij})^2} \tag{5}$$

- The coefficient *c* is calculated based on distances *d* from the best and worst solutions, given by:

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{6}$$

- The case with the highest *c* value is selected (is the best).

In our case are variants (individual countries) ascending sort by values ci and we have solving the problem - ranking of V4 countries QL evaluation. TOPSIS method was used in this way in 32 indicators for all of V4 countries for each of the years 2008 - 2014. The following section presents the results for the CZ, HU, PL and SK in individual years and the progress status of countries within the V4.

## 3 Results

V4 QL evaluation results are shown in Tab. 2 – $c_i$ is results of TOPSIS method and $R_i$ is ranking of countries. As this table shows, the differences between countries are not significant and this fact promotes project of V4, important cooperation which all V4 countries support.

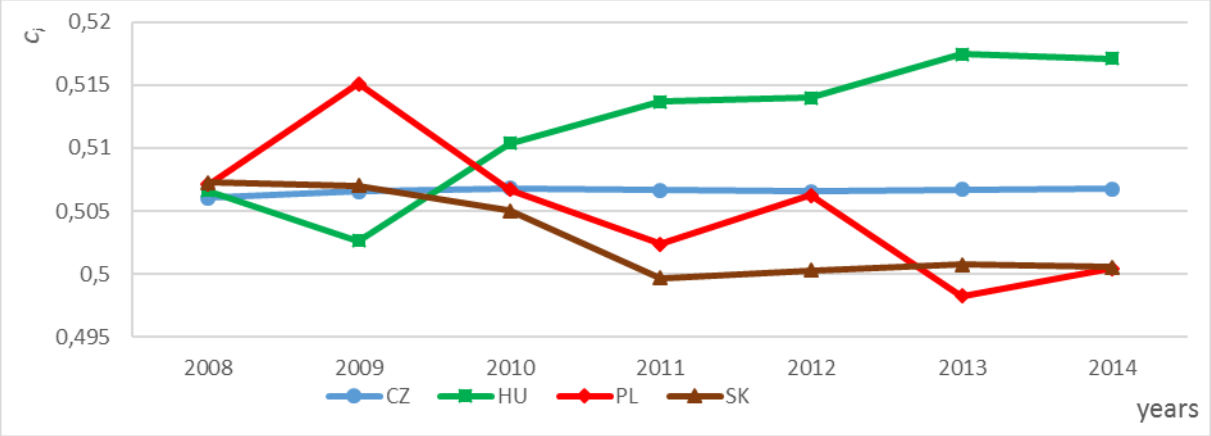
***Tab. 2: Visegrad group's countries ranking 2008-2014***

| | **CZ** | | **HU** | | **PL** | | **SK** | |
|---|---|---|---|---|---|---|---|---|
| | $c_i$ | $R_i$ | $c_i$ | $R_i$ | $c_i$ | $R_i$ | $c_i$ | $R_i$ |
| **2008** | 0.506056 | 4 | 0.506611 | 3 | 0.507107 | 2 | 0.507235 | 1 |
| **2009** | 0.506535 | 3 | 0.502642 | 4 | 0.515101 | 1 | 0.507008 | 2 |
| **2010** | 0.506808 | 2 | 0.510376 | 1 | 0.506677 | 3 | 0.505017 | 4 |
| **2011** | 0.506672 | 2 | 0.513701 | 1 | 0.502361 | 3 | 0.499681 | 4 |
| **2012** | 0.506529 | 2 | 0.513983 | 1 | 0.506256 | 3 | 0.500283 | 4 |
| **2013** | 0.506725 | 2 | 0.517433 | 1 | 0.498229 | 4 | 0.500738 | 3 |
| **2014** | 0.506739 | 2 | 0.517080 | 1 | 0.500448 | 3 | 0.500518 | 4 |

*Source: own construction*

If we look at individual values in individual years, we can see the development of the Czech Republic and a relatively stable position in last years. We can show results better, then we will demonstrate facts on figure. Fig. 1 represents the values for individual countries of V4 countries in years 2008-2014. It is worth emphasizing the blue line of Czech Republic, which is also relatively constant over the years and they are the other countries that have different development (trend). In the long term the best results is reaching in Hungary.

***Fig. 1: Values of variable $c_i$ for V4 countries in 2008-2014***




*Source: own construction*

## Discussion

You can see trend of CZ and next countries of V4 in Fig. 1. This figure shows a comparison and progression of V4 countries in QL evaluation in years 2008 – 2014 and visualized progress of the ranking of countries within the V4 in 2008 - 2014 too. You can see that the difference between countries is small and this results support idea of V4 and good relationship within countries.

The figure shows changes in the years of global economic crisis around 2008 - CZ was not do well in 2008 and 2009, but unlike other states is trend of QL evaluation stable. Conversely HU after 2009 significantly improves and this trend holds until recent years, HU's good position confirms for example in its research Hajduová et al. [8], where are best from V4 too. In the opposite situation than HU, SK, the results of which will improve until recent years. PL shows the biggest fluctuation of all countries.

In the following years the situation is improving and it will be interesting to watch this trend over the coming years 2015+ and follow up eg. effect of refugee crisis.

## Conclusion

QL evaluation is very difficult problem and for solving of this problematic exist a lot of approaches and methodologies. This paper confirmed above said facts about QL evaluation and supports advantage of used rule-based systems, expert systems, multi criteria decision making systems and method of system engineering is useful for solving problems of QL evaluation.

This paper shows near cooperating countries of V4, their relationship at very good level and their cohesion between other Europe's countries, which is confirmed by the results of methods TOPSIS (small differences of V4 countries).

Possibilities for further development of this problem is compared with values of EU28 countries or compared with neighbouring states of V4. Certainly it would also be interesting to examine the long-term trend not only from 2015+, but also before year 2008. As an added incentive for editing and development this problem for greater sensitivity is question of the weight of individual indicators (eventually of areas). The next incentive can be added other approaches or methodologies, for example modification algorithm TOPSIS to fuzzy TOPSIS.

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**References**

[1] Active Ageing Index. *Concept, Methodology and Final Results.* 2015. Available at WWW: http://www1.unece.org/stat/platform/display/AAI/V.+Methodology.

[2] ATANASOVA, I., KARASHTRANOVA, E. A Novel Approach for Quality of Life Evaluation: Rule-Based Expert System. *Social Indicators Research*. 2016, 128(2), 709-722. DOI: 10.1007/s11205-015-1052-0. ISSN 0303-8300.

[3] Český statistický úřad. *Vybrané parametry kvality života*. 2013. Available at WWW: https://www.czso.cz/documents/10180/20549839/32019214a04.pdf/69443b4d-947f-4866-abbe-80a9fa1b9915?version=1.0.

[4] Eurofound. *Surveys Eurofound*. 2015. Available at WWW: http://www.eurofound.europa.eu/surveys.

[5] Eurostat: Quality of life (QOL). *Eurostat: Your key to European statistic*. 2016. European Commission. Available at WWW: http://ec.europa.eu/eurostat/web/gdp-and-beyond/quality-of-life/data.

[6] EIU. Liveability Ranking and Overview. *In The Economist Intelligence Unit*. (2015) Available at WWW: http://www.investtoronto.ca/InvestAssets/PDF/Reports/EIU-Liveability-Ranking-and-Overview-August-2015.pdf.

[7] FERRANS, C.E. Development of a conceptual model of quality of life. *Scholarly Inquiry for Nursing Practice*. 1996. 10(3), 293–304

[8] HAJDUOVÁ, Z., ANDREJOVSKÝ, P., BESLEROVÁ, S.. Development of Quality of Life Economic Indicators with Regard to the Environment. *Procedia - Social and Behavioral Sciences*. 2014, 110, 747-754. ISSN 18770428.

[9] CHEN S.J., HWANG C.L. Fuzzy Multiple Attribute Decision-Making: Methods and Applications. 1992. Springer-Verlag, New York.

[10] JAHANSHAHLOO G.R., HOSSEINZADEH L.F., IZADIKHAH M. Extension of the TOPSIS method for decisionmaking problems with fuzzy data. *Appl. Mathematics Comput*. 2006. 181, 1544-1551.

[11] MANDYS, J., JIRAVA, P., KAŠPAROVÁ, M., KŘUPKA, J. Determinants of quality of life within a region. *In: Recent Advances in Environment, Ecosystems and Development. In Energy and Environmental Engineering Series,* 2009. WSEAS Press, Atheny, pp. 229-234.

[12] MEDERLY, P., TOPERCER, J., NOVÁČEK, P. Indikátory kvality života a udržitelného rozvoje. *In UK FSV CESES,* 2004. ISBN 80-239-4389-8.

[13] MEISELMAN, H.L. Quality of life, well-being and wellness: Measuring subjective health for foods and other products. *Food Quality and Preference*. 2016, 54, 101-109. DOI: 10.1016/j.foodqual.2016.05.009. ISSN 09503293.

[14] OECD. Better Life Index – Edition 2015. Available at WWW: http://stats.oecd.org/Index.aspx?DataSetCode=BLI#.

[15] PHILLIPS, D. *Quality of Life: Concept, Policy and Practice*. 2006. London: Routledge. 276 p. ISBN 978-0-415-32355-0.

[16] QLRU. The quality of life model. *In Quality of life research unit.* 2011. University Toronto, Toronto. Available at WWW: http://www.utoronto.ca/qol/qol_model.htm.

[17] RAPLEY, M. Quality of Life Research: A Critical Introduction. *In SAGE*, 2003, pages 286, London. ISBN 978-0-7619-5456-9.

[18] ROYUELA, V., MORENO, R., VAYÁ, E. Influence of Quality of Life on Urban Growth: A Case Study of Barcelona. *In Regional Studies*. 2010. 44(5), 551–567. ISSN 0034-3404 (Print), 1360-0591 (Online).

[19] SENOUCI, M.A., HOCEINI S., MELLOUK A. Utility function-based TOPSIS for network interface selection in Heterogeneous Wireless Networks. *2016 IEEE International Conference on Communications (ICC)*. IEEE, 2016, 1-6. DOI: 10.1109/ICC.2016.7511563. ISBN 978-1-4799-6664-6. Available at WWW: http://ieeexplore.ieee.org/lpdocs/epic03/wrapper.htm?arnumber=7511563.

[20] ŠANDA, M., KŘUPKA, J. Rule-based System for Quality of Life Evaluation in Socio-Cultural Field. *In Proceedings of the 11th International Joint Conference on Software Technologies (ICSOFT 2016)* - Volume 1: ICSOFT-EA, pp. 342-347. ISBN: 978-989-758-194-6.

[21] Visegrad group. *International Visegrad Fund*. 2016. Available at WWW: http://www.visegradgroup.eu/.

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