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## RANKING OF SUBJECTIVE PARAMETERS OF QUALITY OF LIFE OF STUDENTS OF BBS- HEIFAS USING THE AHP METHOD

**Abstract:** *Quality of life is wide, insufficiently explored and defined category. This paper is based on the research of the individual level as the category of each individual. Depending on the age, quality of life indicators, as well as their weight coefficients are changing. The age influences the very choice and evaluation of aforementioned coefficients at a large extent. This case study, as an empirical research, is an attempt to quantify the quality of life indexes of a group of students of Belgrade Business School, by using Thomas L. Saaty's AHP method (Analytic Hierarchy Process). In the survey, the students gave their subjective opinions of the selection and quantification of quality of life indicators. It included over 100 students aged 19-21 years old. Only those students, who by their activities, the results during previous studies and regularity in the teaching process showed interest in acquiring knowledge and skills, were taken into consideration. The obtained indexes of quality of life parameters indicate a high degree of economic security, but interestingly also the sustainability as an important dimension of quality of life of students, which is typical for the quality of life of many European nations. The results provide a starting point for further research and comparison of quality of life indicators of different age, economic, social and other categories of citizens.*

**Keywords:** *Quality of life, AHP method, quality of life parameters.*

### 1. INTRODUCTION

Quality of life can be observed from several aspects, economics, politics, medicine and psychology. As a concept, with a lot of inconsistency, it cannot be precisely defined [1]. Planetary globalization increasingly initiates measurements and researches of quality of life. Quality of life indicators relate to the local community (village, town, municipality, region, country) and express a number of factors based on life in the local community, especially from the aspect of sustainable development [2]. Such indicators may be classified into a group of objective indicators. On the other hand, many studies have been carried out in the direction of the subjective measurements. A personal feeling of wellbeing and a concept of happiness have become an alternative to hard economic indicators [3]. It is clear that "happiness is somewhere in the middle", combining subjective and objective aspects with a clear knowledge of the purposefulness of both. The

research wasn't based on quality of life of general population but on a small group of individuals. For this reason, the authors used the method closer to the measurement of quality of life of individuals, based on the dominance of subjective factors.







### 2. AHP METHOD

Analytic Hierarchy Process (AHP), devised by Thomas Saaty, is a method of solving problems of multi-criteria decision-making and selection of favorable alternative-the decision based on the ranking criteria. AHP is not a statistical procedure, which gives it the possibility of ranking criteria within the existence of only one alternative, or ranking criteria and decision making within the existence of multiple alternatives [4]. The basis represents relative comparison of two criteria (mutually A:B and B:A, and not the comparison of both criteria individually in relation to a known defined size C, i.e. A:C and B:C) Such comparison of criteria and obtaining the size

(weight coefficient of criteria), which may be quantified, enables the ranking criteria. AHP method has the option of ranking intangible criteria [5], which include most of the subjective criteria of quality of life. It is the biggest advantage of AHP method, the possibility of ranking quantitative and qualitative criteria.

In the following example we will try to explain AHP method by relative comparison of 3 weights which are unknown to us, weights A, B and C. Suppose we estimated their masses (approximately) on the basis of their sizes. Interrelationships of the masses are essential, and not the absolute mass (which cannot be obtained by qualitative criteria).

**Table 1 – Comparison of the pairs in the reciprocal structure**

Comparison	 A	 B	 C
 A	1	2	4
 B	1/2	1	2
 C	1/4	1/2	1

In the matrix in Table 1, the weights on the left are compared individually with the weights on the right above. The number of comparison is  $n(n-1)/2$  for the matrix of the order of  $n$  elements. Assume that the comparison value of A: B is 2: 1, then logically, the reverse comparison must be reciprocal, i.e. B: A must equal 1/2. When the weight on the left is compared to itself (from the upper row) the value is 1 (gray cells).

Something which we must take into account is the consistency of the matrix, or in the case of weights, if A is twice the size of B, and B is two times bigger than C, A has to be 4 times bigger than C. Without scales and specific masses we cannot be sure about the consistency of the matrix, resulting in the need of calculating the consistency of criteria. The problem is even more evident in the case of qualitative criteria (e.g. comparison of 3

criteria: (A) distance from the hotel beach compared to (B) the beauty of the beach and (C): the price of the entrance to the beach). The inconsistency in the AHP method is tolerated up to 10% [6].

For the comparison of the two elements on the basis of personal judgment, (instead of the measurable relations) Saaty's scale is used - see Table 2, where the dominant criterion obtains value.

**Table 2 – Saaty's scale of relative importance [7]**

Intensity of importance	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Somewhat more important	Experience and judgement slightly favour one over the other.
5	Much more important	Experience and judgement strongly favour one over the other.
7	Very much more important	Experience and judgement very strongly favour one over the other. Its importance is demonstrated in practice.
9	Absolutely more important.	The evidence favouring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	When compromise is needed

Thomas Saaty has experimentally proven that an individual could compare a maximum of 7-9 criteria to avoid major inconsistencies and confusion. AHP method compares the criteria by pairs and the comparisons are presented in the form of a matrix as in the following example:

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & a_{2n} \\ \dots & 1/a_{23} & \dots & \dots \\ 1/a_{1n} & 1/a_{2n} & \dots & 1 \end{bmatrix}$$

The very comparison A with B functions according to the principle: "What has a bigger influence on the decision-maker" according to the gradation from Saaty's scale.

We must stop here with the explanation of the AHP method. The use of Expert Choice software does not require knowledge of the mathematical method. As input parameters, criteria and their comparisons according to Saaty's scale are sufficient. Mathematical method of calculation of consistency, weight coefficients of criteria, selection of alternatives, etc. are thoroughly explained by Thomas L. Saaty in the Analytical Hierarchy Process [8].

**3. INDICATORS OF LIFE QUALITY**

The very choice of indicators and methods of measurement has a number of common problems, long-term or short-term, objective or subjective, one-dimensional or multi-dimensional nature of the concept, etc. It has been concluded that most authors take three essential dimensions: psychological, physical and social [9]. There are numerous articles and analyzes on the subject of defining the final list of the set parameters and the sizes of the quality of life. Is it even possible to standardize it in the world of big ethical, political, cultural and other peculiarities and differences?

The most common analysis and measurement of quality of life include several areas:

- Education (accessibility, quality, advancement, relation education-employment),
- Leisure (diversity of facilities, availability)
- Economic opportunities (money, income, regular income, economic security). The very material resources have the ability to raise the quality of some of the other quality of life parameters. For example, the possibility of high-quality treatment, the desired education, access to facilities in free time.
- Politics (stability, certainty, legal system, trust)
- Culture-Society (level of public awareness, sustainability, freedom, ecology)
- Health-Health system (subjective personal state and objective state of the health system, accessibility of quality treatment, life-span).

Conventional measure of quality of life, especially in the West, is based on a strong economy and GDP. A growing number of scientists are turning to subjective criteria, which clearly depend on the individual character and temperament. For the selection of quality of life parameters of this research, see more detailed Quality of Life Well-Being in General Medicine, Mental Health and Coaching [10] and The Quality of Life Scale (QOLS): Reliability, Validity, and Utilization [11].

**4. THE RESEARCH**

The very approach to the methodology of research of quality of life involves examining

of subjective attitudes of individuals that result in life satisfaction. Of course, on the other hand, many authors are advocates of the theory of objective indicators. The research included a group of 106 students of 1st year students of Belgrade Business School. Students were surveyed by using two questionnaires. The first contained nine subjective parameters of quality of life. The surveyed students were offered to choose 5 out of 8 parameters (and the ninth possibility was to write down the parameter that they thought it was necessary), which according to them were the most important quality of life indicators. The reason why it was decided to choose 5 parameters was the appearance of inconsistency which, according to some researches of Thomas Saaty, was drastically increasing (within the allowed limits) by simultaneous comparison of more than 5 pairs. The following Table represents the proposed criteria of quality of life in Survey 1.

*Table 3 – Survey 1, quality of life criteria*

1.	The quality of leisure time
2.	Money-material conditions
3.	Advancement in education
4.	Health condition
5.	Personal motivation and energy
6.	Culture of living and sustainability
7.	Politics and political circumstances
8.	Emotional state
9.	

The results of the Survey 1 are presented in the following Table.

*Table 4 – Results of the survey 1*

1.	The quality of free time	61
2.	Money-material conditions	98
3.	Progress in education	67
4.	Health condition	47
5.	Personal motivation and energy	56
6.	Culture of life and sustainability	72
7.	Politics and political conditions	41
8.	Emotional state	22
9.	Different criteria to <20 vote.	61

The first survey reduced 9 criteria to 5. By another survey, all 5 criteria were compared with each other by Tomas Saaty scale. We note that the respondents are only those students who, based on the records of their attendance,

had the percentage of realised exercises / lecture > 50% and at least 1 exam passed (since those are the first year students). The reason for that is the desire of the author to include in the research only active population of students whose primary motivation is attending studies with the aim of acquiring new knowledge and education.

The following indicators of quality of life are given for a ranking in the second part of the research (sorted by number of votes).

All the selected indicators were compared to each other,  $n(n-1) / 2$  pairs, that is,  $5(5-1) / 2 = 10$  comparisons in the following list of pairs.

**Table 5–5 elected criteria**

2.	Money-material conditions	98
6.	Culture of life and sustainability	72
3.	Progress in education	67
1.	The quality of free time	61
5.	Personal motivation and energy	56

More dominant criteria of the selected pairs receive value by Saaty's scale based on the intensity of validity. The second one (in the same pair) by default has the reciprocal value.

**Table 6 - Comparison of the quality of life parameters pairs**

Money-material conditions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Culture of life and sustainability
Money-material conditions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Progress in education
Money-material conditions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	The quality of free time
Money-material conditions	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Personal motivation and energy
Culture of life and sustainability	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Progress in education
Culture of life and sustainability	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	The quality of free time
Culture of life and sustainability	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Personal motivation and energy
Progress in education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	The quality of free time
Progress in education	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Personal motivation and energy
The quality of free time	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Personal motivation and energy

The results of comparison are summarized and then entered into the decision support software Expert Choice 2000. For reasons of calculating average values, although Saaty's scale defines an integer, decimal values are obtained, for which there is no possibility of entering Expert Choice 2000.

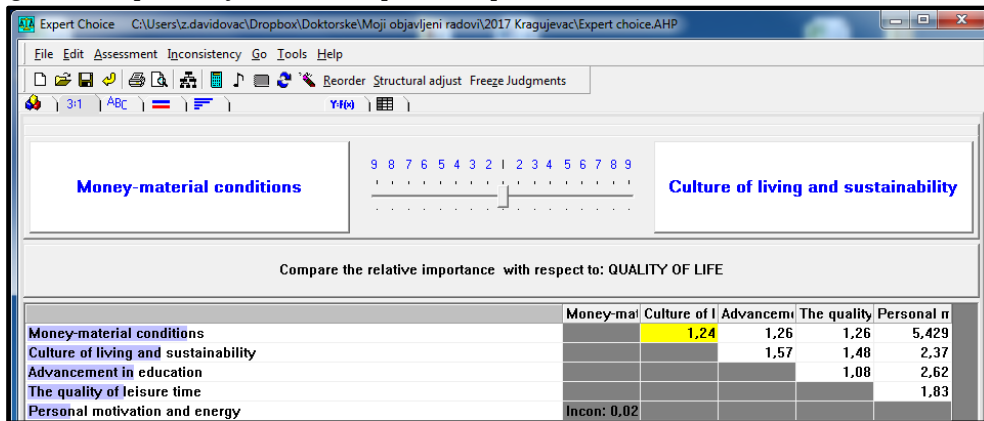
**5. EXPERT CHOICE**

Software platform for supporting multi criteria decision making, Expert Choice, is based on AHP method. International companies, the users of Expert choice software, are: Boeing, Roche, Deloitte, JPMorgan [12] etc. The essence is to compare pairs (numerically, graphically or verbally) on the basis of Saaty's Scale, and then the software itself by mathematical method calculates firstly coefficient of consistency and weight indexes,

in other words, ranks the criteria. Ranking of alternative decisions and sensitivity analysis are the possibilities of this software, but for this research they are not needed. No matter the fact that Satie's scale only defines the integer values, a mathematical method calculates the weight

coefficients from the entered numeric decimal values. Figure 1 shows a 5x5 matrix (five parameters). Gray cells are the reciprocal of the white cells to the decimal value obtained by summing the data from the Survey 2.

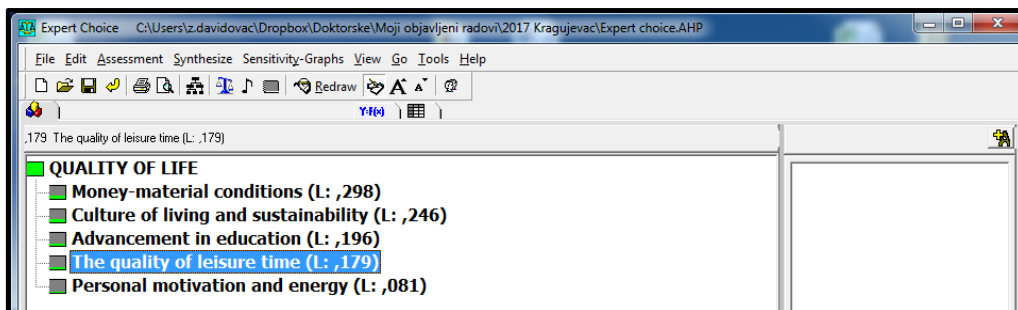
Figure 1- Comparison of the criteria in pairs in Expert CHOICE 2000



Consistency coefficient is 0.02, i.e. less than 0.1 which indicates that the comparison pairs would be consistent. Each of the criteria

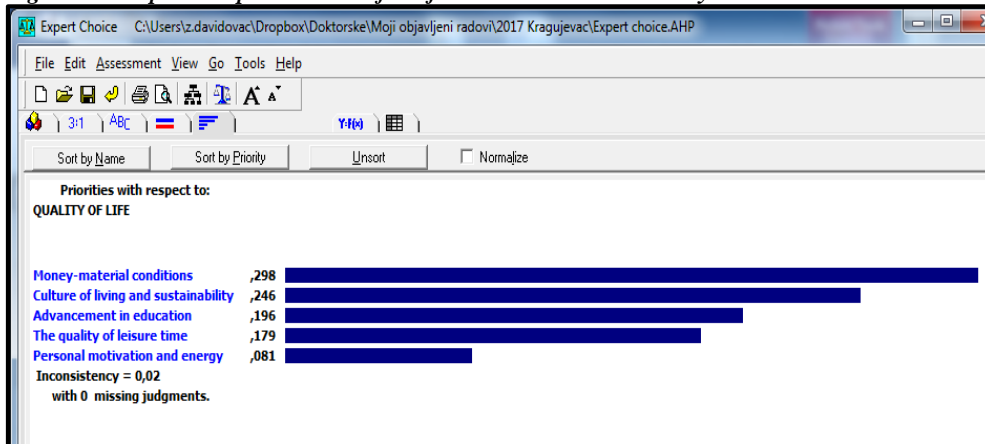
of quality of life obtain the weight coefficient by which it can be ranked.

Figure 2 - Weights criteria in Expert Choice 2000



The results can also be presented graphically in the software Expert Choice 2000 (Figure 3).

Figure 3 - Graphical representation of the final results and consistency



## 6. THE RESULTS

The first part of the research study involved a choice of 5 parameters of the basket of 9. The emphasis in the study was not the selection criteria. The results obtained by the software offered indicators ranked by their weight coefficients. The ranking method by comparing the pairs of parameters and then as a significant, the determination of consistency the very subjective views, gives additional weight to the results. Relationships of all criteria among themselves, gave great precision to their relationships. The results provide a starting point for further research and comparison of the indicators of quality of life of different age, economic, social and other categories of citizens.

In the concrete results, money, as an economic factor, is dominant. Even before the start of the study research, there were assumptions that it would be the dominant factor. What is interesting is the ranking from second to fifth place. Students as a special group of young people (with the focus on the year, 19-21), in the population both in social and intellectual development, showed high level of maturity by favoring economic parameters, education and culture of life and sustainability. Basing its development on the premises of the quality of life, the EU has developed a new strategy, which components are:

(1) "The strategic goal is "become the

most competitive and dynamic knowledge-based economy, capable of sustainable economic growth with more and better jobs and greater social cohesion".

(2) "Inclusion of new countries in the EU on the basis of recognition the differences in culture, living conditions, and so on, and their gradual prevalence." [2].

By this said above, the starting premise has been proved: that the quality of life is a wide, comprehensive notion - from individual, collective, regional, organizational, up to world level. The rules from the individual level are transferred to a higher level which means that each research of an individual has its contribution to science.

## 7. CONCLUSION

The role of the indicators of quality of life is the useful, practical and necessary instrument of sampling the common values, aspirations and needs of both individuals and larger or smaller population and business organizations. Research of the quality of life is one aspect of human scientific work, taking care of the population, but it is also an indicator of progress in the organization, economy, health and education. It can (and should) be a weight control of public speech of politicians, as an indicator that clearly reflects a sense of citizens' quality of life. Scientific methods should constantly be improved in order to reach the right measures of quality of life.

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