

eLIF: European Life Index Framework - An Analysis for the Case of European Union Countries

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Abstract—With the continuous evolution of society, the analysis of the quality of life of the population has become an increasingly complex process, for which it is necessary to evaluate not only the factors that measure the financial power and the degree of economic development of the region, but also of those through which it can be appreciated the integration of individuals in society and of their implication within the well-functioning community. The importance of such an analysis is revealed from the implications of the insufficiency or even lack of measures to improve the standard of living has on members of society. Thus, as a result of the need of determining the living conditions, the implementation of the European Life Index Framework has been proposed. The Framework aims to automate the process of determining the quality of life of the population, data which the public authorities can use to easily determine the necessary steps for integrating disadvantaged people, reducing the poverty rate of the population, and improving quality of life. After analyzing the level of quality of life in European Union for the period 2007-2017, we have noticed that in the case of the former communist states, the quality of life standard is lower than that of the states which had a political trajectory outside the influence of the communist dictatorial regime. Also, due to the public policies mainly oriented towards citizens, the Nordic states have registered the highest values of the Quality of Life Index, surpassing even the countries of Continental Europe.

Keywords—*quality of life index; quality of life dimensions; open data quality; eLIF Framework.*

I. INTRODUCTION

Measuring the population's standard of living is an important instrument in determining the degree of development of a region, just as a high level of quality of life reflects both the well-being of individuals as members of society and the well-being of society as a whole [1]. Moreover, a high degree of satisfaction of individuals regarding the level of quality of life has an important influence not only on the increase of the well-being of the population, but also on the economy, by increasing the productivity of the work and the correct remuneration of the personnel, raising both public and private capital investments increasing the number of jobs and improving working conditions, as well as encouraging a healthy lifestyle approach.

Although Gross Domestic Product (GDP) is the most used indicator of economic performance measurement [2][3], it cannot reflect by itself the population's standard of living; measuring living standards being a complex process that must take into account not only the economic but also the social side. Therefore, for the most appropriate calculation of the Quality of Life Index (QoLI), it had been included not only dimensions that include economic and financial indicators, but also dimensions that reflect the degree of security of citizens, the ability of medical units to provide specialized medical assistance, the degree of development of the educational system, the integration of the population in the field of work, the level of relation of the individuals as well as other indicators that have a significant influence on both the economic and social welfare.

The European Life Index Framework (eLIF) [4] is designed as a (semi) automatic QoLI calculation system, relieving specialists from identifying and applying complex sets of calculations. Thus, they have at their disposal a system whose task is to calculate the QoLI level from the perspective of eight objective dimensions and a subjective one, whilst the analysts only have to download the set of data regarding the outcome of the parliamentary elections provided by the International Institute for Democracy and Electoral Assistance (IDEA) and, of course, interpret the final result .

The present case of study considers the analysis of the level of quality of life of the population in the European Union, for each individual Member State, over a period of 11 years, starting with the year of Romania's accession to the European Union (2007), up to the last year for which statistical data are available for most of the analyzed indicators (2017). For a better understanding of the analysis context, we will make a brief presentation of the most important indicators of measurement of the level of development used over time, followed in Section III by a focus on the presentation of the nine economic and social dimensions used for the QoLI calculation.

Further, in Section IV, the intent is to present both the data sets used in the calculation of the standard of living of the population and the sources from which the data were obtained, and then in Section V the topic "quality assessment" will be approached. Thus, it will be performed an analysis of the data sets in order to identify the "quality

issues” and the means used to correct them. Section VI is intended for the presentation of the architecture of the eLIF framework, where we will detail the calculation formulas applied both for determining the QoLI value and for determining the values of the dimensions that fall within its composition. Next, Section VII is intended to present the actual analysis of the standard of living of the European Union population for the 11 years analyzed, and the last section is reserved for exposing of a series of findings regarding the approached subject.

II. STATE OF ART

The GDP is the most used indicator of economic performance measurement [2][3] in the intertemporal and interspatial comparison, expressing the balance of the total economy's production account as the sum of gross value added of the various institutional sectors and the various activity branched and taxes, from which are subtracted the subsidies on products, which are not allocated by the industry [5]. On a different note, as it can be observed in (1), the GDP is the economic indicator calculated from the perspective of the overall volume of consumption expenses, both from the governmental and the private area, of the governmental expenses, of the investments and of the trade balance.

$$GDP = C + Gov + I + Export - Import \quad (1)$$

C = The households' expenses;

Gov = The central and local administration expenses;

I = The value of the investments;

Export = The sum of the expenses made by foreigners for goods and services produces in the country (exported);

Import = The value of the expenses of the residents for goods and services produces outside their country (imported).

From the financial point of view, the GDP reflects the economic development degree of an administrative-territorial unit for a given period of time, usually a semester or a year. Nevertheless, in comparative analysis, in its form, the GDP loses its accuracy because the ratio of the natural or legal persons which generates the GDP may enregister fluctuations even for the same analysed administrative-territorial unit. For this reason, its derivate, the GDP per capita, represents the standard instrument for this kind of analysis. Thus, the assessment of the GDP per capita may be interpreted as being not only an increase of the economic development level, but also an increase of the population's life quality level from various perspectives, as follows:

- a) The increase of consumption may result both from the populations income increase, and from the applications of the governmental measures of stimulation of the consumption increase, increase which can influence the investments level and exports;
- b) The increase of governmental expenses fuels, most of the times, the turnover level of the private area;

- c) The increase of the level of the public and private investments may determine both the labour productivity assessment through re-technologization, through the increase of the employees' abilities, etc., and the assessment of the contractors' turnover;
- d) The assessment of the trade balance may influence the life quality level through the increase of the availability of capital, capital which can be reinvested or used for the employees and/or shareholders fidelity.

Even though the GDP is an indicator often used in intertemporal and interspatial analysis regarding the degree of economic development, it cannot fully reflect the population's standard of living. Thus, starting from the fundamental needs, specialists have identified a wider range of factors which have an important influence on the standard of living [6], that is: i) financial stability; ii) health and safety; iii) interpersonal relationships; iv) the individual role in society; v) personal development.

Another metric for determining the development level of a certain region which has captured the attention of the politic decisions factors [7] has its origins in the year 1990, when United Nations Development Programme (UNDP) launched a new formula, by means of which the result is calculated by considering the factors which influence the richness of human life, and not the economy in which human beings live [8]. Thus, for determining the population's standard of living, the indicator suggested by UNDP, the Human Development Index (HDI) [9], uses the following three dimensions fundamental for the human development [1]:

- a) the population's health status and longevity;
- b) the level of knowledge the citizens have access to;
- c) the access to resources necessary for a decent standard of life.

Even though for the modern man the financial part might represent a factor with a strong influence over the lifestyle adopted, in the HDI calculation, this factor does not have a greater significance than the other two. Therefore, as it can be observed in (2), the three factors which have a significant influence over the richness of human life are aggregated through the means of geographical average, a mathematic procedure which ensures the proportional distribution of the three factors.

$$HDI = \sqrt[n]{Health * Edu * Income} \quad (2)$$

Health = The population's health status and longevity;

Edu = The level of knowledge the citizens have access to;

Income = The level of financial resources to which the individual has access to for sustaining a decent standard of life;

n = The total number of indicators taken into account (three indicators).

The acceptance of the multidimensional nature of the factors which have a significant influence over the life standard which an individual adopts has led to the emergence of a new metric, World Health Organization Quality of Life (WHOQOL) [10]. This new method of determining the population's welfare, implemented by the World Health Organization (WHO) with the aim of identifying and protecting the vulnerable persons, takes into account more dimensions than HDI, that are:

- a) physical domain;
- b) psychological domain;
- c) level of independence;
- d) social relationships;
- e) environment;
- f) spirituality, religion, personal beliefs.

For developing the WHOQOL 15 cultural centers from different countries have participated, which had the role of applying the set of questionnaires realized for this purpose to a sample of 300 people complying to the following structure: i) half the interviewed persons are aged under 45 and the other half are aged over 45; ii) half the sample of people are male and the other half are female; iii) 250 are persons with a disease or impairment and 50 "healthy" respondents. Finally, in order to analyze the variation between different domain predictors for the criterion of quality of life, a regression analysis has been performed [11].

Even though HDI and WHOQOL are two metrics of a great importance to be taken into account in the analysis for determining the level of economic development and population's standard of life, the European Union's Statistical Office (Eurostat) has suggested that, in official reporting, the measurement of the population's welfare will be realized from the perspective of eight objective dimensions and one subjective dimension [12]. This set of dimensions, also known as "8+1 dimensions", being composed by the following:

- a) material and living conditions;
- b) productive or main activity;
- c) health;
- d) education;
- e) leisure and social interactions;
- f) economic and physical safety;
- g) governance and basic rights;
- h) natural and living environment;
- i) overall experience of life.

As far as the sphere of ensuring the data quality is concerned, in literature [13][14][15], the following four main dimensions can be distinguished through which it can be ensured a level high as possible of the quality of data [1]: i) the data accuracy measures the degree of representativeness of the data stored in databases against the real world's elements which they represent; ii) the data consistency refers to the data's property of respecting the integrity constraints;

iii) the information completeness measures the database's capacity of providing complete information to the user's query; iv) the data currency reflects the degree of the data's actualization.

III. QUALITY OF LIFE INDICATORS

Even though GDP has been used for a long period as an intertemporal and interspatial comparison metric of the degree of economic development and the population's life standard [2][3], this indicator offers results strictly from the financial perspective. Therefore, considering the measurement of the life quality transcends the financial aspect, for the calculation of the life standard, scientists have tried to identify and to take into consideration all factors which have an important influence [16]. Thus, starting from the financial aspect and up to the citizens' own opinion, Eurostat groups these factors in 8 dimensions relative to the functional capacities which citizens must have for a decent life standard, and a subjective dimension relative to individuals' personal perspective on the personal achievement of life satisfaction and well-being [12].

A. Material and Living Conditions

Considering the complexity of life, the living standards are associated more like to the real income of the population and with the environment in which they live, rather than the GDP. Therefore, in order to measure these factors which influence the population's standard of living, Eurostat proposes the use of the Material and Living Conditions (MLC) dimension, through which the level of living is reflected, not only from a financial perspective, but also from the point of view of the living conditions.

If the financial aspect can be easily measured by reporting the purchase power of the population, through the determination of the median of incomes and through the identification of the inequality of income distribution (S80/S20 income quintile share ratio), determining the living conditions implies an analysis process of different factors which have a major influence of the individuals' social life. These factors reflect, on the one hand, the environment in which the analysed population lives, and on the other hand, the difficulty of satisfying the basic needs and of a decent living, as well as the individuals' capacity of sustaining the expenses necessary to enable them to have a decent living [1] (contracting mortgage loans, paying bills, purchasing long use goods, traveling inside and outside the frontiers, owning an automobile, etc.).

B. Productive or Main Activity

With the acceptance on wide scale of money as means of exchange, trading goods and services became a simpler process, and the individuals' attention was oriented towards developing and improving personal and professional skills. Therefore, in tandem with the society's evolution, each individual must allocate a significant part of his/her personal time to provision of labour to ensure the financial source

necessary both for sustaining everyday expenses and to engage in different social and professional activities.

Productive or Main Activity (PMA) is a separate dimension, built both from the perspective of the quantity and of the quality of the employment, which envisages the identification of the effects the professional life has on individuals. From the point of view of the quantity, the unemployment and the long-term unemployment rate are two factors which have a significant influence in determining the population's living standard because, as it has been related in the European Committee's Report [17], "people who become unemployed report lower life-evaluations, even after controlling for their lower income, and with little adaptation over time; unemployed people also report a higher prevalence of various negative affects (sadness, stress and pain) and lower levels of positive ones (joy). These subjective measures suggest that the costs of unemployment exceed the income-loss suffered by those who lose their jobs, reflecting the existence of non-pecuniary effects among the unemployed and of fears and anxieties generated by unemployment in the rest of society".

As far as the quality aspect is concerned, the PMA includes a series of entheogen indicators through which can be used to measure the benefits gained as a result of employment, the overqualification of the workforce, the equilibrium between professional and personal life (the number of working hours per week and the proportion of people working night shifts), the discrimination in the workplace, the safety at work. At the same time, besides the indicators which can be identified as being quantitative or qualitative, the PMA also includes two other factors found at the boundary between the two categories, involuntary temporary work and involuntary part-time employment.

C. Health

Health is a dimension which becomes more and more important with increasing age because the prevalence of the chronic diseases tends to increase as we age, by the increase of the life expectancy and the efficiency of the treatments against disease and conditions determine an increasingly stronger bound between the Health dimension and the determination of the population's living standards level [18]. On the other hand, this dimension has also economic prevalence, not only in establishing the budget for prevention and population treatment actions, but also from the human resources perspective, which, if it does not have the capacity necessary for employment, it becomes from a supplier of added value in a beneficiary of treatment services.

Being a complex dimension, more categories of factors are taken into consideration, beginning from the measurement of the healthy food consumption, up to determining the level of health infrastructure. Thus, embedded within this indicator, there are, in the one hand, the proportion of the population consuming daily fruits and vegetables, and on the other hand, the proportion of the population with unhealthy habits. Directly linked with these

factors, there are both the life expectancy at birth and the health expectancy at birth, which measure the average number of years a new-born lives, respectively the average number of healthy years which a new-born lives, as well as the proportion of the population which is involved in physical activities and the effective healthy life, which measure the proportion of the population which considers to be in relatively good and very good health.

Offsetting the indicators which measure the hope of life and healthy life of the population, there are the indicators which measure the proportion of the population which has a long-standing illness or health problem, the proportion of population which cannot afford to support health analysis (including the dental ones), the incidence of the occupational accidents which need medical recovery for more than 4 days, and the proportion of overweight population. As long as the infrastructure is concerned, the number of hospital beds per 100,000 inhabitants and the proportion of medical personnel per 100,000 inhabitants represent veritable instruments to measure the capacity of the medical system to serve the population in the context of insuring the needed treatments.

D. Education

Education, as a dimension which describes the process of assimilation of knowledge and of improving the personal skills, represents the foundation of the human society, having, at the same time, a major impact upon the individuals' life quality [12]. Therefore, a solid level of education can favour the population in identifying and accessing some well-paid jobs, which contribute to the possibility of accessing high quality medical services and to the increase of living conditions. Furthermore, the risk of social exclusion and the poverty level can be diminished, and the degree of the population's implication in the public life, both as simple citizens and as political decision markers, may experience a favourable assessment.

Despite the importance which this dimension plays in the individuals' life, from a scientific point of view, the measurement of the population's educational level represents a complex process, and the mere reporting to the quantitative measure of years of schooling may not have the desired effect due to the fact that this indicator does not reflect the level of accumulated knowledge [19]. Thus, besides measuring the number of years which a student spent inside the education system, it is also necessary to analyse the factors which reflect the knowledge development and the cognitive skills.

E. Leisure and Social Interactions

If the time spent for the professional carrier development represent a sacrifice which each individual has to accept in order to beneficiate of a stable income source, the rest of the time is dedicated to household activities and recreative activities destined to improve the mental and physical health, to improve the self-esteem and self-confidence, to create social support and consolidating family bounds [20]. All these elements are found in the Leisure and Social

Interactions (LSI) dimension, dimension which has the role of determining the evolution of the self-esteem and the degree of participation of the individuals' in society with the help of two categories of indicators: i) indicators of measurement of the degree of the individuals' implication in society; ii) indicators referred to the personal bounding (family, friends, neighbours).

Thus, the degree of participation of the individuals in cultural and sportive activities; the proportion of the population which do not participate at these activities due to financial considerations or lack of infrastructure; the degree of participation of the individuals in the volunteer activities, are all indicators through which it can be determined the degree of the individuals' involvement in society. As far as the second category is concerned, which envisages the estimation of the support which individuals can receive at need, there are used as calculation elements both the proportion of persons which have relatives, friends and neighbours on which to rely for moral, material and financial support, and the proportion of persons which have at least a person with whom may discuss personal matters.

F. Safety

Safety is a state of stability both social and economic [1], which allows individuals to feel free of menaces and to concentrate on the personal and professional activities in which they are engaged. From a wide perspective, the Safety dimension envisages the measurement of the impact which safety risks to which the population is subject to on their welfare, being structured under the following criteria: i) economic safety; ii) physical safety.

As the International Committee of The Red Cross defines it [21], the Economic Safety is reflected through the individuals, households or community's capacity to cover with dignity the expenses generated by the satisfaction of the primary needs. In order to express these factors, in the Economic Safety calculation can be considered, on the one hand, the power of purchase of the retirees and the proportion from the GDP of the expenditure of social protection (administrative expenses only), which reflect the level of the income sources of the elderly persons and of the ones in exceptional situations (unemployed, persons with disabilities, families with low income etc.), and on the other hand, the proportion of the population incapable of coping with some unexpected financial expenses or in arrears.

Physical Security is the component of the Safety dimension through which it is evaluated the level of protection of the individuals in front of crimes which may affect the physical and mental integrity of the victims or, through which the victims may be illegally dispossessed of personal goods. Such crimes which can be taken into account in the calculation of the physical security level are assaults, kidnaps, sexual violence, robberies and thefts, traffic and consumption of heavy drugs etc.

G. Governance and Basic Rights

Governance and Basic Rights (GBR) incorporates a series of factors which influence the level of the population life standard from the perspective of governance, regulation and guarantee of equal rights between the community's individuals regardless of their health status, financial state, political, religious or cultural orientation. Therefore, for calculating this dimension, can be considered indicators such as employment gender gap and gender pay gap, which measure the existing differences on labour market between generations; the degree of trust the population has in the political and legal system and in Police; parliamentary voter turnout etc.

H. Natural and Living Environment

Pollution represent one of the world's biggest problems due to the fact that its effects are increasingly felt, so that just for the year 2015 it has been estimated that 9 million cases of premature death (16% of all deaths worldwide) have been caused by the effects of pollution [22]. From air pollution cause by consumption of fossil fuel in industries and transportation area, to the pollution of the groundwater as a result of the toxic waste storage and to the acoustic pollution recorded in crowded cities, they all case harmful effects on the surrounding environment and on the population life standards.

Thus, in a world ever more polluted, in which the effects of global warming are felt with an ever more increased intensity, the peoples' need and acknowledgement to protect the surrounding environment become a task ever more important both for the governmental institutions as well as for the nongovernmental organizations. For this, starting from determining the level of chemical and acoustic pollution up to determining the proportion of population which have access at least to one drinkable water source, the Natural and Living Environment (ENV) dimension represents a valuable instrument for determining the level of the quality of the surrounding environment in which individuals live and undergo their activities; results which the political decision factors may use to identify and applicate solutions aimed at conserving and improving the quality of the environment.

I. Overall Experience of Life

The statistical data are collected and prepared to serve as information and analysis resource both for political factors implied in the planification and evaluation of political decisions, as well as for private organizations and population which have the right to be informed regarding the evolution of the society they live in. Nevertheless, because no objective indicators can perfectly measure the described concept, in order to determine the population's living standard, the subjective wellbeing measurement gains a particular importance due to the fact that through this dimension can be realised an overall image of the society groups which perceive the living standards as good or bad [23].

IV. OPEN DATA SOURCES

In a world found in a continuous evolution, in which the speed of the information dissemination is at the distance of a click, and the population becomes more and more consciousness regarding the power of knowledge, ensuring the free access to data becomes a task ever more important for the worldwide institutions. Even though the term open data may imply that it defines those data which are not restricted in use, in their reuse and distribution, some suppliers might have different perspective regarding what openness represents [24]. Thus, even though the access to data is free of charge, the actions of use, reuse, reworking, redistribution and reselling might be limited or restricted through the terms and conditions imposed by the data suppliers [1].

In the governmental area, the Open Government Data initiatives started to fall into place, so that ever more states supply data with free access for users. Nevertheless, even though each state has its own rules and priorities of data publication, the existence of some aggregators as Eurostat facilitates the access of interested persons to sets of public data. Thus, Eurostat make available both a user-friendly interface, as well as an API Server [25], through which the process of obtaining the sets of data can be automated.

For obtaining the data relative to the 8+1 analysed dimensions, the programmatic interface made available by Eurostat has been used, so that the analysis can be easily be extended for any desired period of time. At the same time, due to the fact that the data relative to the parliamentary voter turnout is not available in the Eurostat statistics, these data have been obtained from reliable suppliers as the International Institute for Democracy and Electoral Assistance (IDEA) [26]. The name of all of these data sets can be seen in Table I, where we summarized them in order to make available to the audience the used indicators.

TABLE I. DATA SOURCES.

Dimension Name	Dimension Indicator Name
Material and Living Condition (10 JSON files)	Dwelling Issues Rate
	End Meet Inability Rate
	High Income Rate
	Income Quintile Rate
	Material Deprivation Rate
	Over Occupied Rate
	Poverty Risk
	Purchasing Rate
	Under Occupied Rate
	Low Work Intensity Rate
Productive or Main Activity (9 JSON files)	Average Work Hours
	Employment Rate
	Involuntary Part-Time Rate
	Long Term Unemployment Rate
	Researchers per Ten Thousand Inhabitants
	Temporary Employment Rate
	Unemployment Rate
Working Nights Rate	

Dimension Name	Dimension Indicator Name
Health (12 JSON files)	Fruits and Vegetables Consumption Rate
	Health Personnel per Ten Thousand Inhabitants
	Healthy Life Rate
	Healthy Life Years - Female
	Healthy Life Years - Male
	Hospital Beds per Ten Thousand Inhabitants
	Life Expectancy
	Long Health Issues Rate
	Obese Population Rate
	Smokers Rate
	Unmet Dental Rate
	Unmet Medical Rate
	Work Accidents per Thousand Inhabitants
Education (9 JSON files)	Digital Skills Rate
	Early Education Rate
	Education Rate
	Excluded Rate
	School Dropout Rate
	Students to Teachers Rate
	Training Rate
Zero Foreign Language Rate	
Leisure and Social Interactions (6 JSON files)	Asking Rate
	Discussion Rate
	Getting Together Rate
	Non-participation Rate to Cultural Activities or Sports Events due to important reasons
	Participation Rate to Cultural Activities or Sports Events
	Participation Rate to Voluntary Activities
Economic and Physical Safety (6 JSON files)	Crime Rate
	Offences per Thousand Inhabitants
	Pension Power
	Social Protection Power
	Unexpected Financial Expenses Rate
Nonpayment Rate	
Governance and Basic Rights (4 JSON files, 1 CSV file)	Active Citizenship Rate
	Employment Rate
	Gender Pay Gap
	Parliamentary Elections Participation Rate ^a
Natural and Living Environment (2 JSON files)	Population Trust Rate
	Noise Pollution Rate
Overall Experience of Life (1 JSON file)	Pollution Rate
Auxiliary Dimensions (1 JSON file)	High Life Satisfaction Rate
	Population on 1 January

^a Data set downloaded from the portal of IDEA

V. OPEN DATA QUALITY ASSESSMENT

In the literature, the concept of data quality is referred to as an indicator by which data utility can be measured from the perspective of data consumers [27][28], a broad term used to describe this concept being “fitness for use” [27][29][30]. At the core of the process of measuring the quality of the data are the data producers and the data custodians, whose role is to generate the data, respectively storage them, to ensure the

maintenance and the security of the data, so as the data customers can use them in the provided form or after applying some processes of data aggregation, and data integration [28].

Starting from the significance of the open data concept, we can deduce that open data quality is part of the concept of data quality that concerns the data with free access for use, regardless of the type of license under which they are provided [1]. Regarding the practical way of measuring the quality of open data, the most widespread dimensions in the literature are accuracy, completeness, consistency and timeliness [13][28][31].

A. Data Currency Issue

Data currency or timeliness is an indicator of measuring the quality of the data used to determine the degree of the currency of data in relation to the specific activity for which they are used [15]. As in the case of the API provided by the National Institute of Statistics of Romania, the API provided by Eurostat presents the same deficiency: the update date is available for the data set as entities and not for records from data sets [1]. Therefore, although we may have a reference regarding when to update the data sets, we cannot identify whether they have been modified as a result of adding new records or as a result of updating existing records.

B. Data Inconsistency

The inconsistency of the data can be defined as the lack of data consistency, meaning that state of the data in which the format and value are not in accordance with the chosen data model [32] or which have discontinuities [1]. In the case of the current analysis, the inconsistency of the data is materialized both by the discontinuity in time of the data sets, and by their different format, Eurostat offering a flexible API Server that returns the data sets using the JSON-stat standard [33], while IDEA offers the possibility to export data on the results of parliamentary elections in “xls” format. Thus, as can be seen in Table II, the share of missing data is slightly over 31%, a result determined primarily by the presence of indicators for which data is available only for one year.

For example, in the case of the Overall Experience of Life dimension, which has a single indicator - the High Satisfaction Rate, the total number of values expected to be present in a data set without discontinuities is 308 (28 countries * 11 years). However, because values are available only for the year 2013, the share of missing data is very high, reaching about 91% $\left(\frac{28 \text{ countries} * 10 \text{ years}}{28 \text{ countries} * 11 \text{ years}} * 100\right)$ of the total data. For other data sets, the periods with discontinuities may be shorter, but the lack of data even for a single year for a state prevents us from determining the QoLI value for that particular state.

Therefore, to correct the data discontinuity, the present study proposes that the value for missing years be supplemented with the value of the previous year, and if for any previous year there is no value, the value of the following year will be assigned. The advantage of using this approach

instead of calculating the average of the series [1] is that the value thus calculated is closer to “truth”, that is, the average of the series can be much higher or much lower compared to the fluctuation of the values from one year to the following.

TABLE II. ENTRIES STATISTICS.

Dimension Name	Available Values	Expected Values ^a	Missing Data (%)
Material and Living Condition	3,352	3,388	1.06
Productive or Main Activity	2,449	2,464	0.61
Health	2,951	4,004	26.30
Education	1,985	2,464	19.44
Leisure and Social Interactions	448	4,312	89.61
Economic and Physical Safety	2,786	3,080	9.55
Governance and Basic Rights	1,088	2,464	55.84
Natural and Living Environment	610	616	0.97
Overall Experience of Life	28	308	90.91
Auxiliary Dimensions	532	560	5.18
TOTAL	16,229	23,660	31.41

^a The total number of entries that should exist for the data set to be complete

As for the format of the data sets, if in the case of those provided by Eurostat a standard format is used which allows quickly querying and processing of data, the same cannot be said about the data set provided by IDEA. The latter is saved in “xls” format, having all data stored in string type columns. Moreover, the percentage data is presented as a numerical value followed by the percentage sign “%”, which requires that, before converting to numerical format, a cleaning operation of the values is performed so that they can be used in mathematical operations.

C. Lack of Data

Determining the level of quality of life of the population involves the study of economic, financial and social phenomena and processes in which individuals are engaged and which influences their lives. To this end, identifying official sources and data sets which reflect the factors of influence is the first step in conducting such an analysis. Unfortunately, although Eurostat provides a wide range of data sets from different fields of activity and areas of interest, some data sets are not complete, making it impossible to perform a comparative analysis in time and space.

By incomplete data sets are defined the ones for which data from at least one country is missing for the entire analyzed period of time (2007-2017). Thus, considering the principle listed in the previous subsection regarding the completion, in Table III we find name of data sets that were completely excluded from the QoLI calculation.

VI. THE FRAMEWORK ARCHITECTURE

Determining the level of quality of life of the population is a complex process which, due to the impact it can have in determining and applying social and economic policies, has attracted the attention of more and more researchers. Having as a starting point a series of indicators that, over time, have gained visibility in this direction, the eLIF [4] has been developed to provide specialists with a complex (semi) automatic solution for calculating Quality of Life Index from the perspective of 8 objective dimensions and a subjective one. Thus, the persons interested in carrying out analyzes regarding the state of living of the population are relieved from identifying and implementing the QoLI calculation formulas; the only tasks being to download the data set regarding the outcome of the parliamentary elections provided by IDEA and to interpret the obtained results.

Regarding the design architecture of the eLIF framework, as can be seen from Figure 1, the architecture is conceived in four steps: i) data preprocessing; ii) calculating the values of the QoLI dimensions; iii) preliminary analysis of the result; iv) presentation of the result.

Data processing, as a preliminary step in calculating QoLI dimensions, it begins by identifying official sources and data sets that reflect the main factors that influences the quality of life. Based on both the sources and the data sets, as well as the analysis carried out in the previous sections, the following step is to trace the 8+1 dimensions that have a major influence on the quality of life of the population, and then the attention is focused on identifying and implementing the data structure on which the subsequent calculations will be performed.

TABLE III. THE LACK OF DATA BY COUNTRIES FOR ALL OF THE ANALYZED PERIOD.

Index Name	Missing Data by Countries
The share of population exposed to air pollution	Malta
The share of population connected to public water supply	Italy Latvia Slovenia United Kingdom
The share of population who consumes alcohol daily	France
The share of population who did aerobic and muscle-strengthening exercises	Belgium Netherlands
The share of population who declared that are over-qualified employees	Denmark Ireland Netherland
The share of population having neither a bath, nor a shower, nor indoor flushing toilet in their household	Sweden

Before performing the actual calculations, an important step for any analysis is data preparation, that is to say processing them to meet the own needs. This process involves both performing various corrections on the data (cleaning the data, converting the numerical values into percentage values, consolidating several indicators into one

etc.), as well as filling in the missing data with a replacement value using the approach presented in the previous section.

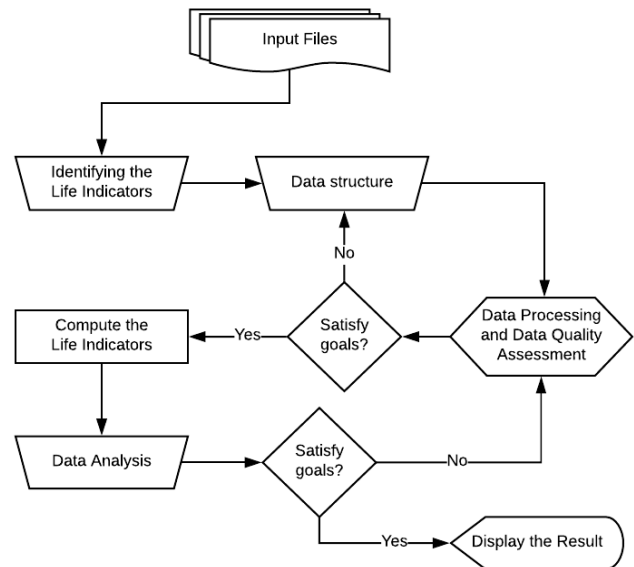


Figure 1. The framework architecture.

However, if during this process it is found that the data structure no longer corresponds to the practical reality, the procedure returns to the (re)design stage of the data structure, and later (re)processing. Subsequently, after processing the data extracted from the official sources, we proceed to *calculating the values of the 8+1 QoLI dimensions*, a stage in which the formulas for calculating the dimensions reach the final form and are applied to the processed data in order to generate the analysis data.

The third stage, *preliminary data analysis*, is an intermediate stage for presenting the final result, with the purpose of identifying potential errors and discrepancies in the process of calculating the indicators [1]. For example, End Meet Inability Rate, Material Deprivation Rate, Unemployment Rate, Unmet Dental / Medical Rate, School Dropout Rate etc. are indicators which have a negative influence on the calculation of the dimensions they belong to, which requires in the final formula the use of synthetic indicators that determine the weight of the population that is not affected (R - Reversed Rate), using the calculation formula set out in Figure 2.

```

    Function getReversedRate (value)
    return 100 - value;
    
```

Figure 2. Function for getting the Reversed Rate.

Thus, after correcting the values of the indicators that have a significant influence in determining the level of quality of life, the flow of operations returns to the processing of the data to recalculate the final values of the QoLI dimensions. Finally, the last stage, *displaying of results*, allows users to extract the final result broken down by countries and years both for the generic QoLI indicator and for the dimensions

that compose it. The actual calculation of these values is performed by applying the logarithmic function to the product of the indicators / dimensions related to the measured metric as in (3).

$$indicator = \ln(p) \quad (3)$$

p = The product of dimensions/indicators.

In the case of QoLI, the value is calculated as a result of applying the logarithmic function previously presented over the product of all the dimensions that compose it as in (4).

$$p = \frac{MLC * PMA * Health * Education * LSI * Safety * GBR * Environment * Overall Exp}{Overall Exp} \quad (4)$$

MLC = Material and Living Conditions dimension;
PMA = Productive or Main Activity dimension;
Health = Health dimension;
Education = Education dimension;
LSI = Leisure and Social Interactions dimension;
Safety = Safety dimension;
Environment = Natural and Living Environment dimension;
Overall Exp = Overall Experience of Life dimension.

The use of the logarithmic function for the calculation of the final result is required by the asymmetrical character of the dimensions that belong to QoLI, respectively of the indicators that belong to the composition of the QoLI dimensions, so that it can be avoided the case when a low value indicator has to be compensated by another high value indicator [1]. After a closer analysis, in contrast to the paper [1], in which, for the calculation of the indicators, it has been chosen to extract the root of the order n , we considered that the logarithmic function is a truer instrument because, as J. Martin Bland and Douglas G Altman acknowledge [34], data transformation through logarithmic function offers the most interpretable results even after applying the anti-log function to cancel the logarithmic calculation result. Thus, using the logarithmic function to calculate the QoLI result we assure that a 1% change in one dimension will have the same impact as the 1% change in any other dimension.

A. Material and Living Conditions

MLC is one of the most complex dimensions taken into account when determining the level of quality of life of the population, because, besides determining the financial conditions of the population, through this dimension, the level of living conditions of the population can also be determined. In order to determine the MLC value, the calculation of the product of all the indicators related to this dimension is considered as in (5), followed by the application of the logarithmic function over this product.

$$p = R(DWI Rate) * R(EMI Rate) * High Income Rate * R(Quintile Rate) * R(Deprivation Rate) * R(Over O Rate) * R(Poverty Risk Rate) * PPS Rate * Under O Rate * R(WI Rate) \quad (5)$$

DWI Rate = Proportion of the population living in dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames of floor (%);

EMI Rate = Proportion of the households making ends meet with difficulty and great difficulty (%);

High Income Rate = Proportion of the population having income of 130% of median income or more (%);

Quintile Rate = Inequality of income distribution (S80/S20 income quintile share ratio) (%);

Deprivation Rate = Severe material deprivation rate (%);

Over O Rate = Overcrowding rate (%);

Poverty Risk Rate = At-risk-of-poverty rate (%);

PPS Rate = Purchasing Power Standard as percent of the European Union countries (%);

Under O Rate = Share of people living in under-occupied dwellings (%);

WI Rate = Share of people up to 59 years living in households with very low work intensity (%).

B. Productive or Main Activity

As a dimension that measures the quality of life from the perspective of the professional side of individuals, Productive or Main Activity includes a series of indicators regarding the worked hours, the type of the accepted work contracts and the share of the unemployed population. Thus, for the calculation of this dimension, the logarithmic formula will be applied to the product of the indicators found in the PMA composition as presented in (5), with the mention that the Average Work Hours (AWH) indicator will be processed to determine the weight of the number of hours worked at every 12 hours per day over a week according to (6).

$$p = C(AWH) * Emp Rate * R(Inv Part Time) * R(L T Unemp Rate) * R(Nights Rate) * Researchers Rate * R(Temp Emp Rate) * R(Unemp Rate) \quad (5)$$

$$C(AWH) = (12 \text{ hours} * 7 \text{ days}) - AWH \quad (6)$$

AWH = Average number of usual weekly hours of work in main job worked by full-time employed persons aged 15 years or over (number of hours);

Emp Rate = Percentage of employed people aged from 15 to 64 years (%);

Inv Part Time = Involuntary part-time employment as percentage of the total part-time employment (%);

L T Unemp Rate = Percentage of long-term unemployed people aged from 15 to 74 years (%);
 Nights Rate = Percentage of the total employment aged from 15 to 64 years who are working at nights (%);
 Researchers Rate = Full-time equivalent researchers per ten thousand inhabitants;
 Temp Emp Rate = Percentage of total employment who are working based on temporary contracts (%);
 Unemp Rate = Percentage of labour force aged 15-74 years who are unemployed (%).

C. Health

Health is one of the dimensions that has always been a reference for the scientific world in the process of determining the standard of living of the population, carrying out a wide range of analysis of the implication of the level of health on the respondents [35][36][37]. As can be seen in (7), for the current analysis we considered a series of factors that have an important influence on the population both from the perspective of the health system's ability to provide specialized healthcare as well as the perspective of the population to adopt a healthy lifestyle.

Thus, there can be identified both indicators that measure the lifestyle of the population (Fruits and Vegetables Consumption Rate, Obese Population Rate, Smokers Rate) as well as indicators that show the access of the population to health services (Health Personnel, Hospital Beds) and that estimate the expectations regarding the level of health of the respondents (Healthy Life Rate, Life Expectancy, Work Accidents, etc.).

$$p = \frac{R(\text{Obese Rate}) * FV \text{ Rate} * \text{Personnel Ratio} * HL \text{ Rate} * HLY \text{ Female} * HLY \text{ Male} * H \text{ Beds} * Life \text{ Expectancy} * R(LTH \text{ Issues Rate}) * R(\text{Smokers Rate}) * R(UDS) * R(UMS) * R(WA \text{ Rate})}{(7)}$$

Obese Rate = Percentage of people who are obese (%);
 FV Rate = Share of population that consumes fruits and vegetable daily (%);
 Personnel Rate = Health personnel (medical doctors; nurses and midwives; dentists; pharmacists; physiotherapists) per hundred thousand inhabitants;
 HL Rate = Share of people aged 16 years and over who are self-perceiving very good or good health;
 HLY Female = Female health expectancy at birth;
 HLY Male = Male health expectancy at birth;
 H Beds = Hospital beds per hundred thousand inhabitants;
 Life Expectancy = The number of remaining years a person is expected to live at birth or at a certain age;
 LTH Issues Rate = Share of people aged 16 years or over having a long-standing illness or health problem;
 Smokers Rate = Share of people who smoke cigarettes daily;

UDS = Share of people who self-reported unmet needs for dental examination;
 UMS = Share of people who self-reported unmet needs for medical examination;
 WA Rate = Work accidents per ten thousand inhabitants.

D. Education

Even if the short-term impact within the Education dimension is not no visible, as a primary factor in the development of both society as a whole and of individuals in private, this dimension has a significant influence on establishing the standard of quality of life. Thus, in the long term, through a solid education system, which takes into account both group and individual needs, the influence of education can be reflected both by the development of the individual character of the population and by the good training of professionals; whom can then be integrated more easily into the field of work. As in the calculation formulas of the other dimensions, Education is calculated by applying the logarithmic function presented in (3) to the product of the indicators specific to this dimension as presented in (8).

$$p = \frac{\text{Digital Skills} * \text{Early Edu Rate} * R(\text{Excluded Rate}) * R(\text{School Dropout Rate}) * \text{Students Rate} * \text{Pupils Rate} * \text{Training Rate} * \text{NKFL Rate}}{(8)}$$

Digital Skills = The share of people (aged from 16 to 74 years) who have basic or above basic overall digital skills (%);
 Early Edu Rate = The share of pupils aged between 4 years old and the starting age of compulsory education who are participating in early childhood education (%);
 Excluded Rate = The share of people (aged from 18 to 24 years) neither in employment nor in education and training (%);
 School Dropout Rate = The share of people (from 18 to 24 years) who leave education and training early (%);
 Students Rate = The share of people (aged from 15 to 64 years) who are participating in tertiary education level (%);
 Pupils Rate = Ratio of pupils to teachers for primary and secondary education (%);
 Training Rate = The share of people (aged from 25 to 64 years) who are participating in education and training in the last 4 weeks (%);
 NKFL Rate = The share of people (from 25 to 64 years) who don't know any foreign language (self-reported).

E. Leisure and Social Interactions

As the leisure time is related to social activities, in calculating this dimension are taken into consideration both the indicators that reflect the moral support that the population can receive from close persons, and the indicators by which the social activity of the individuals is reflected.

Thus, the general calculation formula presented in (3) applies over the product of all these indicators as in (9).

$$p = \text{Asking Rate} * \text{Discussion Rate} * \text{Getting Together Rate} * \text{R(Non Participation Rate)} * \text{Social Activities Rate} * \text{Voluntary Activities Rate} \quad (9)$$

Asking Rate = The share of people (aged 16 years or over) who have someone to ask for help (moral, material or financial) from family, relatives, friends or neighbors (%);

Discussion Rate = The share of people (aged 16 years or over) who have someone to discuss personal matters (%);

Getting Together Rate = The share of people (aged 16 years or over) getting together with friends at least once a week (%);

Non Participation Rate = The share of people (aged 16 years or over) who are not involved in cultural activities or sports events during the previous 12 months due to financial reasons or due to a lack of facilities (%);

Social Activities Rate = The share of people (aged 16 years or over) who are involved in any cultural or sport activities in the last 12 months (%);

Voluntary Activities Rate = The share of people (aged 16 years or over) who are involved in formal or informal voluntary activities (%).

F. Safety

The Safety dimension is of particular importance because it can determine the degree of safety of the population, both physically and financially. Therefore, for the calculation of this dimension, the product of the indicators that compose it will be used as in (10), with the mention that the indicators Pension Power and Social Protection Power will be corrected by dividing them by 100 as in (11).

$$p = \text{R(Crime Rate)} * \text{C(Pension Power)} * \text{C(Social Protection Power)} * \text{R(Unexpected Rate)} * \text{R(Non Payment Rate)} * \text{R(Offences Rate)} \quad (10)$$

$$C(\text{value}) = \frac{\text{value}}{100} \quad (11)$$

Crime Rate = The share of the population who perceived there was crime, violence or vandalism in the area where they live (%);

Pension Power = The average pension (Purchasing Power Standard per inhabitant);

Social Protection Power = Social protection expenditure (Purchasing Power Standard per inhabitant);

Unexpected Rate = The share of the population unable to face unexpected financial expenses (%);

Non Payment Rate = The share of the population in arrears on mortgage or rent, utility bills or hire purchase (%);

Offences Rate = Recorded offences (assault, robbery, sexual offences, theft, unlawful offences) per thousand inhabitants.

G. Natural and Living Environment

Natural and Living Environment is the only one dimension that, for calculating the Quality of Life Index, takes into account indicators through which the state of the surrounding environment is reflected. Although green space per capita is an important indicator for measuring the mental health of individuals [38][39], in the absence of an official data set, two other indicators that measure the quality of the environment will be taken into consideration, namely: noise pollution, and respectively pollution. In order to determine the quality index of the environment, the aggregation of these indicators is performed in a similar way to the aggregation of the other dimensions' indicators, by applying the logarithmic function over the product of the related indicators as in (12).

$$p = \frac{\text{R(Noise Pollution Rate)} * \text{R(Pollution Rate)}}{\text{R(Pollution Rate)}} \quad (12)$$

Noise Pollution Rate = Share of population reporting noise from neighbours or from the street (%);

Pollution Rate = Share of population exposed to Pollution, grime or other environmental problems (%).

H. Overall Experience of Life

Unlike the other eight statistical dimensions of measuring the quality of life from the perspective of the objective functional capacities of individuals, the Overall Experience is the only dimension that takes into account people's choices, priorities and values [12]. Thus, the calculation of this dimension is done by means of a single indicator that measures the proportion of the population that experiences a high quality of life level, as in (13).

$$\text{Overall Exp} = \ln(\text{High Satisfaction Rate}) \quad (13)$$

High Satisfaction Rate = Share of population rating their overall life satisfaction as high (%).

VII. DATA USAGE

Estimating the level of quality of life is a complex process that involves monitoring not only of the economic, financial and environmental indicators through which the economic development and financial power of the population is reflected, but also the social indicators which reflect the degree of interrelationship of individuals in society. The importance of estimating this indicator stands in the very dimensions that come within its composition, being useful both to the government decision makers who have the legal levers for combating poverty and raising the standard of living of the population, as well as the other actors in the

society interested in following the annual evolution of the degree of economic and social development of the European Union Member States [1].

The present analysis aims to determine the level of quality of life of the population of European Union, starting with 2007, the year of Romania's accession to the European Union, until 2017, the last year for which statistical data are available for most of the analyzed indicators. Thus, we envisage the production of statistics that provide the interested parties with data on both top Member States that record a considerable advance and those with a lower level of quality of life in comparison with the other Member States.

Given that the final result of the study materializes into a comparative analysis of the quality of life for the 28 European Union Member States, for a period of 11 years (2007-2017), the final result of the data processing will be presented both in table form, through Table IV and in visual form, through Figure 3 and Figure 4. As it can be seen, the result of the calculation for determining the quality of life of the population can be divided into two sections, depending on the political ideology on which the states were governed before the 1990s. Thus, in the former communist states (Bulgaria, Czech Republic, Cyprus, Croatia, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Hungary) as well as in four other states outside the sphere of influence of the communist regime (Greece, Malta, Portugal, Spain) a low level of quality of life of the population can be identified; most of the states that did not have a significant influence of the communist doctrine, registering a high level of quality of life of the population throughout the analyzed period of time.

One of the pillars of a modern society that has a significant influence on both the personal as well as on the professional life of individuals, is education, because, through continuous learning and improvement of their abilities, the members of society can more easily develop and benefit from interpersonal relationships and they can achieve better results in the field in which they operate. Unfortunately, although, theoretically, the early integration of children in the education system should enable them to develop their personal capacities and abilities, in practice, the quality of the education system has a determining influence. In this regard we can see that for the analysed period, although in Bulgaria and Romania the share of pupils aged between 4 years old and the starting age of compulsory education does not register values lower than 83%, in Finland, country where one of the best education systems in the world is found [40][41][42], this indicator starts below 70%, exceeding the 80% threshold only starting with 2012. At the same time, the participation rate of the adult population (adults between the ages of 25 and 64) in training courses reaches, in the Scandinavian countries, even over 30%, whereas, in the vast majority of the former communist states, this indicator does not even reach the 10% limit; in Bulgaria and Romania are registered the lowest values in the whole European Union, with values below the 3% threshold.

As in any economy, the quality of the education system is directly reflected through the level of purchasing power of individuals, more precisely, through the level of income in relation to their own needs; the population with a higher level of qualification can register a higher value of the remuneration of the work performed and, implicitly, the value of the future retirement pension will be higher. Thus, regarding the financial security of the population, we can see that, in the countries of the former communist bloc, both the purchasing power of the population and the general capacity of individuals to deal with unexpected expenses, register lower values than the countries in which the influence of the communist regime was not so great. Similar trends are also identified in other indicators that measure the financial stability and living conditions of the population such as inequality of income distribution (S80/S20 income quintile share ratio), severe material deprivation rate, share of people living in over-occupied dwellings, etc.

As regards health, a particular situation is encountered in the case of Bulgaria and Romania, in the meaning that, although in these two countries the level of life expectancy at birth indicator has some of the lowest values in the whole European Union unlike the countries outside the former communist bloc that registered the highest values, regarding the share of people (aged 16 years or over) having a long-standing illness or health problem, the situation is completely different, in the meaning that in Bulgaria and Romania have been registered the lowest share of the population with long-standing illness or health problem, being followed just a few places away by Denmark, while Finland is the country of the European Union where the highest proportion of such cases has been reported. Therefore, although the lowest life expectancy registered in the European Union is in Bulgaria and Romania, the resident population lives most of their lives without serious health problems and without incurable or very difficult to treat diseases, while, in Finland, one of the most developed countries, the population often faces such problems throughout their lives.

However, it should be noted that although the two countries at the end of the QoLI ranking have the lowest share of people suffering from serious illnesses, at the same time have the highest share of population who, for financial reasons or related to the distance at which the medical units are located, cannot benefit from the specialized treatment. This phenomenon is prevalent in the former communist countries that had a different trajectory of economic and social development compared to the western countries.

Neither with regard to the active involvement of population in the life of society, the countries of the former communist bloc do not register exemplary values, since in most of these states the level of involvement is below 17%. In Romania and Bulgaria have being registered the lowest rates, 3.2%, respectively 5.2%, while in developed countries the share of the population involved in volunteering activities can reach just over 30%, and in Scandinavian countries, even up to almost 40%. A similar statistic is also reflected in the

share of the population engaged in cultural or sporting activities. From this perspective, Romania and Bulgaria are also on the last two places, with values below the 30% threshold (Bulgaria rising to 31.9% in 2015), while most of the other former communist states registering values between 40% and 70%. On the other side, the countries where the influence of the communist doctrine did not have such an important impact, the share of the population participating in various cultural and sporting activities exceeds 70%, the top being occupied by the Scandinavian countries with values of over 80% registered over the whole time period taken into consideration.

Analysing the trends that the indicators that make up the QoLI ranking registered during 2007-2017, we can notice that the European Union is divided into three important groups divided according to the economic and social evolution of each country. The first group is made up of the majority of the former communist states that, in the process of transition from a dictatorial regime to an open regime, have faced various specific challenges such as guaranteeing and protecting the rights, destructuring of oppressive institutions, liberalizing the market, strengthening relations with The West, attracting foreign capital, etc. Thus, as can be seen in Figure 4, the last places are occupied by Bulgaria and Romania, which, for the entire analyzed period, maintained their last places (28th and respectively 27th), followed by Latvia, which until 2011 ranked 26th. After 2012, against the background of applying the limiting measures of the negative effects of the public debt crisis (freezing wages and eliminating bonuses in the public sector; raising and introducing new taxes; reducing salaries and pensions, etc.) [43], Greece was to record a significant decrease in the quality of life, bringing the country to the 26th place, while Latvia was to rise of one place, occupying the 25th at the end of the analyzed period.

The second largest group is mainly made up of Western countries, which have always had a trajectory oriented towards freedom. Although they are not in the top of the ranking, the experience of a lasting democracy serves as a support for a stronger economy, thus, the success of these countries may be determined by several public policies implemented over time, of which we list the following [44]:

- reducing variations and conditions for granting different levels of social protection such as unemployment benefit, social assistance etc.;
- orientation towards programs for induction within the field of work of young people, women and workers with limited abilities;
- emphasizing on policies for balancing professional and personal life.

Finally, the podium is occupied by the Nordic countries (Denmark, Finland, Sweden, Norway - which is not a member of the European Union) which have always had a very high quality of life compared to other European

countries due to their ability to quickly adapt to new political, economic and social changes. The Nordic model of development can be characterized from the perspective of the following three key features [45]:

- stateness: the Nordic political classes understand better than the other European countries that the state does not have to be an oppressive apparatus;
- universalism: financial services and benefits are not only aimed at the needy, but also extend to the middle class;
- equality: equal opportunities are one of the values that the Nordics emphasize upon, thus, the Nordic countries have a high level of gender equality.

In the end, based on the evolution of the QoLI indicator of the states at the end of the ranking presented in Figure 4, we can see that they are registering an upward trend, with the exception of Greece, which, due to the public debt crisis, was forced to apply a series of austerity measures so as to avoid a potential bankruptcy of the whole country. Continuing at this rate, with the help of both the expertise of the developed countries and with the free sources of funding that the European Union offers to the Member States in order to cover the development gaps between regions (European funds), the less developed countries have the chance to quickly recover some of this gap. However, even if from 2013 the growth rate has become more and more rapid, for a solid development, these states must rethink the long-term development strategy, taking Poland as example, a country which has managed to become an important industrial center in Central and Eastern Europe, and Finland which made every effort to restructure the education system starting from the Swedish model.

On the other side of the ranking, the struggle is no longer carried out strictly in the direction of improving the quality of life of the population, but, rather, toward identifying and offering new opportunities and toward implementing measures to protect the people in difficulty. Thus, as can be seen from Figure 3, the evolution of the developed countries is slower, sometimes with a negative trend, with the exception of the states that are at the base of the ranking of the most developed countries. From this perspective, developed countries need to focus on improving their own systems, on importing and implementing solutions that work in other states (e.g. the Swedish model of education system implemented in Finland etc.) and on supporting disadvantaged countries because, in a globalized economy, the mutual development allows the fruition of the relations between partners.

Thus, having identified the areas where the standard of quality of life is low, political drivers can take the necessary measures to reduce the disparities between high-growth countries and those with low-growth. At the same time, non-governmental factors have at their disposal a set of data that allows them to monitor the activity of the decision-makers regarding the reduction of the gaps registered between the European Union Member States.

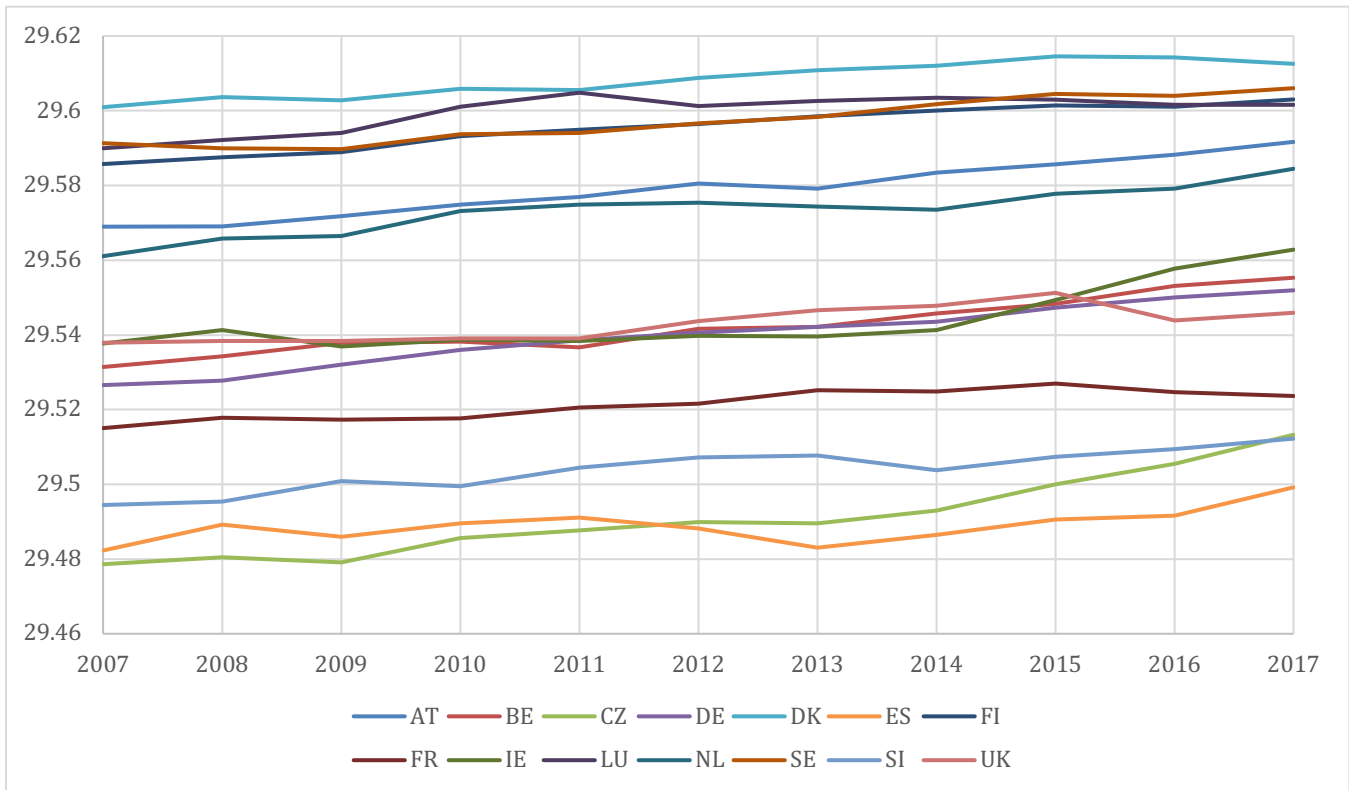


Figure 3. The highest levels of QoLI by years and countries.

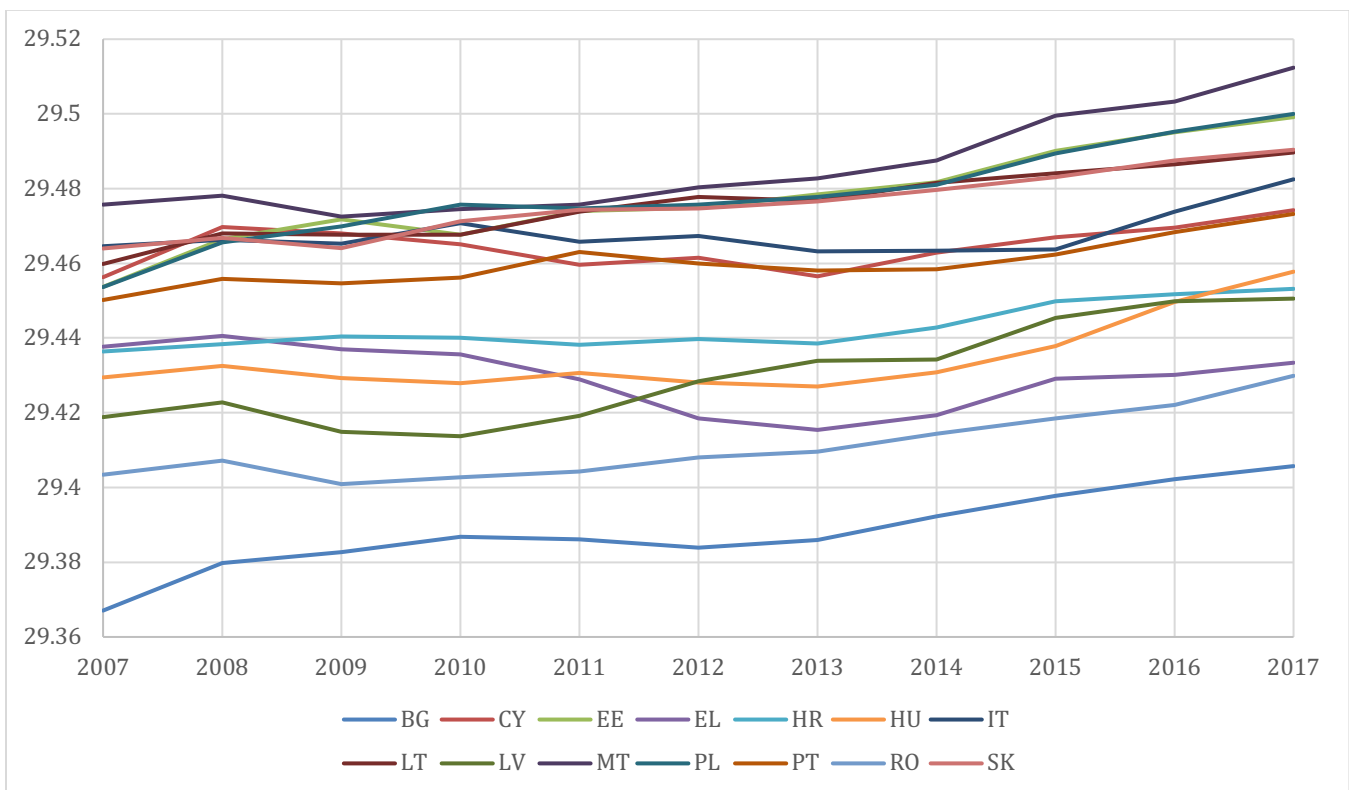


Figure 4. The lowest levels of QoLI by years and countries.

TABLE IV. THE QUALITY OF LIFE INDEX BY YEARS AND COUNTRIES.

Country \ Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
[AT] Austria	29.5690	29.5690	29.5718	29.5749	29.5769	29.5804	29.5792	29.5835	29.5856	29.5882	29.5917
[BE] Belgium	29.5314	29.5342	29.5379	29.5382	29.5366	29.5416	29.5422	29.5458	29.5483	29.5531	29.5553
[BG] Bulgaria	29.3671	29.3797	29.3826	29.3869	29.3861	29.3839	29.3860	29.3923	29.3978	29.4022	29.4057
[CY] Cyprus	29.4563	29.4698	29.4680	29.4651	29.4597	29.4616	29.4566	29.4629	29.4670	29.4695	29.4742
[CZ] Czechia	29.4786	29.4805	29.4791	29.4857	29.4876	29.4899	29.4896	29.4929	29.5001	29.5055	29.5133
[DE] Germany	29.5266	29.5278	29.5321	29.5360	29.5385	29.5407	29.5421	29.5436	29.5474	29.5500	29.5519
[DK] Denmark	29.6009	29.6037	29.6028	29.6059	29.6056	29.6087	29.6109	29.6120	29.6145	29.6142	29.6125
[EE] Estonia	29.4537	29.4665	29.4719	29.4677	29.4739	29.4748	29.4784	29.4818	29.4902	29.4950	29.4991
[EL] Greece	29.4376	29.4406	29.4369	29.4357	29.4290	29.4186	29.4154	29.4194	29.4291	29.4301	29.4335
[ES] Spain	29.4823	29.4891	29.4859	29.4895	29.4911	29.4881	29.4830	29.4864	29.4906	29.4916	29.4992
[FI] Finland	29.5857	29.5875	29.5889	29.5931	29.5949	29.5965	29.5985	29.6000	29.6014	29.6011	29.6030
[FR] France	29.5150	29.5178	29.5173	29.5177	29.5206	29.5216	29.5252	29.5249	29.5270	29.5247	29.5236
[HR] Croatia	29.4364	29.4384	29.4404	29.4401	29.4381	29.4398	29.4386	29.4428	29.4498	29.4517	29.4532
[HU] Hungary	29.4295	29.4326	29.4293	29.4279	29.4306	29.4281	29.4270	29.4309	29.4378	29.4497	29.4578
[IE] Ireland	29.5376	29.5412	29.5369	29.5387	29.5384	29.5398	29.5395	29.5413	29.5494	29.5577	29.5628
[IT] Italy	29.4646	29.4663	29.4653	29.4708	29.4659	29.4673	29.4632	29.4634	29.4638	29.4738	29.4825
[LT] Lithuania	29.4598	29.4680	29.4677	29.4676	29.4738	29.4778	29.4768	29.4815	29.4841	29.4865	29.4897
[LU] Luxembourg	29.5899	29.5922	29.5941	29.6010	29.6048	29.6013	29.6026	29.6036	29.6030	29.6016	29.6016
[LV] Latvia	29.4189	29.4227	29.4149	29.4137	29.4192	29.4284	29.4339	29.4342	29.4453	29.4498	29.4506
[MT] Malta	29.4756	29.4782	29.4725	29.4745	29.4757	29.4803	29.4827	29.4876	29.4996	29.5034	29.5124
[NL] Netherlands	29.5611	29.5657	29.5664	29.5732	29.5748	29.5753	29.5743	29.5736	29.5778	29.5792	29.5845
[PL] Poland	29.4536	29.4656	29.4700	29.4758	29.4746	29.4758	29.4777	29.4810	29.4894	29.4953	29.5000
[PT] Portugal	29.4502	29.4558	29.4546	29.4562	29.4630	29.4599	29.4580	29.4585	29.4624	29.4684	29.4732
[RO] Romania	29.4034	29.4072	29.4009	29.4028	29.4043	29.4080	29.4096	29.4144	29.4185	29.4221	29.4299
[SE] Sweden	29.5914	29.5899	29.5897	29.5937	29.5940	29.5966	29.5983	29.6017	29.6045	29.6040	29.6060
[SI] Slovenia	29.4945	29.4953	29.5008	29.4994	29.5045	29.5072	29.5078	29.5037	29.5074	29.5094	29.5122
[SK] Slovakia	29.4640	29.4667	29.4641	29.4712	29.4743	29.4748	29.4766	29.4796	29.4830	29.4875	29.4904
[UK] United Kingdom	29.5379	29.5383	29.5384	29.5391	29.5391	29.5437	29.5465	29.5479	29.5512	29.5438	29.5459

VIII. CONCLUSION

The analysis of the standard of living of the population is a complex process that should not be limited only to determining the degree of economic development of the analyzed area but should be extended also to the social side by determining the degree of satisfaction that the analyzed group shows in society. Therefore, in addition to the economic and financial spheres that reflect the degree of economic development and the financial situation, when calculating the Quality of Life Index, analysts must also consider social indicators that reflect the level of contentment

of individuals, the level of employee training and the degree of absorption in the field of work, the level of security that the state offers to the members within its society, the confidence of individuals amongst their peers and within the state institutions, etc.

By analyzing the data sets presented above, it can be noticed that the eastern part of the European Union, together with several states in the northern area, presents the lowest QoLI values; all these states having a common denominator: having been governed by a communist dictatorial regime until the 1990s. Unlike the countries of Continental Europe and Scandinavia, the lack of a modern vision, and the

transition from the communist era to the democratic one, can be a determining factor in terms of slower development. However, it is important to note that, although the former communist states had an additional impediment in the path to a harmonious development, for the analyzed period of time, all these states have a general upward trend of the QoLI level.

Therefore, the consolidation of the dimensions from both the economic and financial spheres as well as from the social one, in a single complex indicator such as QoLI, allows to carry out complex analysis regarding the level of development of some regions and the degree of population satisfaction. Thus, with the eLIF framework [4], through which the values of the quality of life index can be calculated for a given period, political factors have the possibility to identify the disadvantaged states that must be supported in order to achieve one of the objectives of the European Union, that of strengthening the economic, social and territorial cohesion and solidarity between Member States.

Also, this framework allows both non-governmental organizations to supervise the involvement of the government sphere in applying measures to increase the standard of living of the population, as well as to economic operators to identify areas with potential for development. Another important feature of the framework is its adaptability, which can be easily extended to any level of administrative detail by including in the analyzed list the name of the administrative unit targeted, whether it is a city, region, country or other form of administration, provided that the administrative unit is of the same type (it would not be feasible to compare the QoLI values recorded in counties with those of the regions or the values of any other types of different administrative units).

Regarding the further development direction, three main objectives will be considered: i) automatic integration of the results of the parliamentary elections data set, so as to fully automate the calculation process; ii) identification of alternative reliable data sources for completing the data sets excluded from the analysis (presented in Table III); iii) integrating both the QoLI result and the result of the dimensions that compose it into an information system similar to Visit Romanian Museums [46] touristic information system.

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