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### Article information:

To cite this document:

Peter Mederly Pavel Novacek Jan Topercer, (2003), "Sustainable development assessment: quality and sustainability of life indicators at global, national and regional level", *Foresight*, Vol. 5 Iss 5 pp. 42 - 49

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# Sustainable development assessment: quality and sustainability of life indicators at global, national and regional level

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**Keywords** Sustainable development, Czech Republic

**Abstract** Gross domestic product as an indicator of wealth and therefore quality of life have long been criticised. GDP places too much emphasis on consumption and ignores wealth distribution. Importantly it also takes no account of environmental issues. This article considers the development of an integrated environmental sustainability index and its application in the case of the Czech Republic.

## Introduction

Quality of life research was entrenched as a specific research theme around the year 1960. The criticism of excessive emphasis on consumption and the germs of social alternatives of consumer life style started to appear in modern western societies. Gross domestic product (GDP) is commonly used as a wealth measure. GDP expresses the content of physical flows of "capital, industrial production, services, resources and agricultural product" (Daly and Cobb, 1989). But GDP might not be a good wealth rate measure because it does not take into account:

- the housework value;
- the effect of wealth distribution and income on individual people's wealth;

- ignores affluence decline as a result of the environmental destruction; and
- doubtfully supposes "defensive expenses" as a contribution to affluence (for example, damages removing after an oil tanker crash is counted as a contribution to GDP).

The increasing people's incomes are absorbed in an increasing rate by coverage of the environmental and social expenditures.

Sustainable development, or alternatively, sustainable life style, attempts to achieve the ideals of humanisms and harmony between Man and Nature. This is a life style which seeks for the balance between liberties and rights of each individual and his/her responsibilities towards other people



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and Nature as a whole, including the responsibility towards the next generations (Vavrousek, 2000).

The World Commission on Environment and Development (1987) defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

The main aim of sustainable development is to increase quality of life in long-time horizon with respect to other living beings. But to make sustainable development generally understandable, measurable and manageable, we need to have set of indicators.

According to recommendation of UN Conference on Environment and Development (UNCED), the UN Commission on Sustainable Development had prepared in 1995-1996 set of indicators (Indicators of Sustainable Development) which contains 134 indicators divided into four main areas: social (41), economic (23), environmental (55) and institutional (15). In 1997-1999 these indicators were tested in 22 countries. In 2000 modified set of 57 indicators was proposed, which should serve as instrument to measure progress of individual countries towards sustainable development.

More world organizations worked out some kind of development indicators, especially the World Bank (2000) (World Development Indicators), United Nations Development Programme (Human Development Report), the World Resource Institute (2000) (World Resources), World Health Organization (database Health for All), and OECD (Core Set of Environmental Indicators). But integrated sustainable development indicators are rare until now. This area is too broad and complex and there is also lack of data available and uncertainties in underlying methods of data acquisition and processing.

In 2000-2001 two new approaches appeared to measure world progress towards sustainability – Environmental Sustainability Index (ESI) and UN CSD Dashboard.

### Sustainable development index (global level)

Sustainable Development Index (SD Index) was developed in 2000-2001 by Central European Node of the Millennium Project[1] in the framework of the Global Partnership for Development study (Novacek and Mederly, 2002). The aim of SD Index is aggregated expression of state and development (progress) of individual countries towards sustainable development. This structure of SD Index is constructed as pyramid (see Table I): 58 variables are grouped into 14 indicators (thematic areas). Each two closest indicators are grouped into one major problem area (there are seven major problem areas altogether). From these seven equally important major problem areas, overall SD Index is created. SD Index is calculated for 146 countries, expressed in relative scale 0-1. The higher value of index means better progress towards sustainable development.

**Table I — Basic structure of sustainable development index (SD Index)**

1 Human rights, freedom and equality	A Politics and human rights B Equality
2 Demographic development and life expectancy	C Demographic development D Life expectancy, mortality
3 Health state and health care	E Health care F Diseases and nutrition
4 Education, technologies and information	G Education H Technologies and information sharing
5 Economic development and foreign indebtedness	I Economy K Indebtedness
6 Resource consumption	L Economy – genuine savings M Economy – resource consumption
7 Environmental quality	N Environment – natural resources, land use O Environment – urban and rural problems

The overall SD Index is calculated as arithmetic mean of partial indexes for 58 variables explored.

### Results

First major area covers human rights, freedom and equality. Central thematic topics of this area are:

- *Politics and human rights.* In this group we rated six variables: index of political rights, index of civil liberties, refugees according to country of origin, military expenditure, number of people serving in military forces, number of ratified international environmental agreements.
- *Equality.* We rated three variables: income distribution – GINI index, gender development index, children labour force.

Among the best ten countries there are developed democratic countries: Canada, Japan, Finland, Australia, Austria. The worst situation is in Eritrea, Bosnia and Hercegovina, Angola, Iraq, Cambodia and Korea Democratic Republic.

Second major problem area covers demographic development and life expectancy. Central thematic topics of this area are:

- *Demographic development.* In this group we rated three variables: excessive population growth in 1975-1997, population decline in 1975-1997, population aging.
- *Life expectancy, mortality.* We rated four variables: infant mortality rate, under five mortality rate, maternal mortality rate, life expectancy at birth.

Among the best states there are Norway, Austria, Belgium, France, and Ireland. The last countries are Malawi, Niger, Guinea-Bissau, Zambia, Uganda.

Third major problem area covers health state and health care. Central thematic topics of this area are:

- *Health care.* In this group we rated five variables: health expenditure as percent of GDP, total health expenditure (USD/person), child immunization, number of physicians per 1,000 people, birth attended by skilled health staff.
- *Diseases and nutrition.* We rated six variables: number of tuberculosis cases per 100,000 people, prevalence of HIV, prevalence of child malnutrition, insufficient daily calories intake, excessive daily caloric intake, access to safe water.

The best situation is in Sweden, Canada, Israel, Australia and Finland. The worst situation is in Haiti, Chad, Ethiopia, Burundi and Zaire.

Fourth major problem area monitors education, technologies and information. Central thematic topics of this area are:

- *Education.* In this group we rated three variables: adult literacy rate, combined school enrolment ratio, public expenditures for education.
- *Technologies and information sharing.* We rated five indicators: number of telephone mainlines per person, personal computers per person, Internet hosts, number of daily newspapers per person, number of television sets per person.

Among the best countries there are Sweden, Finland, Denmark, Norway and New Zealand. Among the last countries can be found Burkina Faso, Central Africa, Mozambique, Chad, Mali and Haiti.

Fifth major problem area monitors economic development and foreign indebtedness. Central thematic topics of this area are:

- *Economy.* In this group we rated four variables: GNP per capita, GNP per capita according to purchasing power parity, annual GDP growth, net domestic savings.
- *Foreign indebtedness.* We rated three variables: total per capita external debt, present value of debt as percent of GNP, total debt services.

Among the best countries there are Singapore, Germany, Norway, Ireland and Japan. The worst situation is in Nicaragua, Guinea-Bissau, Zambia, Jordan and Mauritania.

Sixth major problem area monitors resource consumption. There are economically successful countries which do not have sufficient value of this index. On the contrary, there are developing countries with very low value of natural resource consumption (this is tightly connected with industrial underdevelopment). Central thematic topics of this area are:

- *Economy – genuine savings.* In this group we rated four variables: energy depletion, mineral depletion, net forest depletion, CO<sub>2</sub> damage. (Economy – genuine savings means relative expression of consumption, or deterioration of domestic resources with regard to the process of GDP growth.)

- *Economy – resource consumption.* We rated four variables: GDP per unit of energy use, paper consumption, commercial energy use, electric power consumption.

The best situation is in Namibia, Burkina Faso, The Gambia, Guinea and Guinea-Bissau. Among the last countries there are Canada, Finland, Singapore, Sweden and Norway.

Seventh major problem area monitors environmental quality and environmental problems. Central thematic topics of this area are:

- *Environment – natural resources, land use.* In this group we rated four variables: nationally protected areas, freshwater resources, forest area, arable land area.
- *Environment – urban and rural development.* We rated four variables: population living in agglomeration higher than 1 million, rural population density, growth agglomeration to 1 million, average annual deforestation.

The best situation is in Norway, Central Africa, Finland, Gabon and Latvia. The last countries are Haiti, Bangladesh, Lebanon, Syria, and Pakistan.

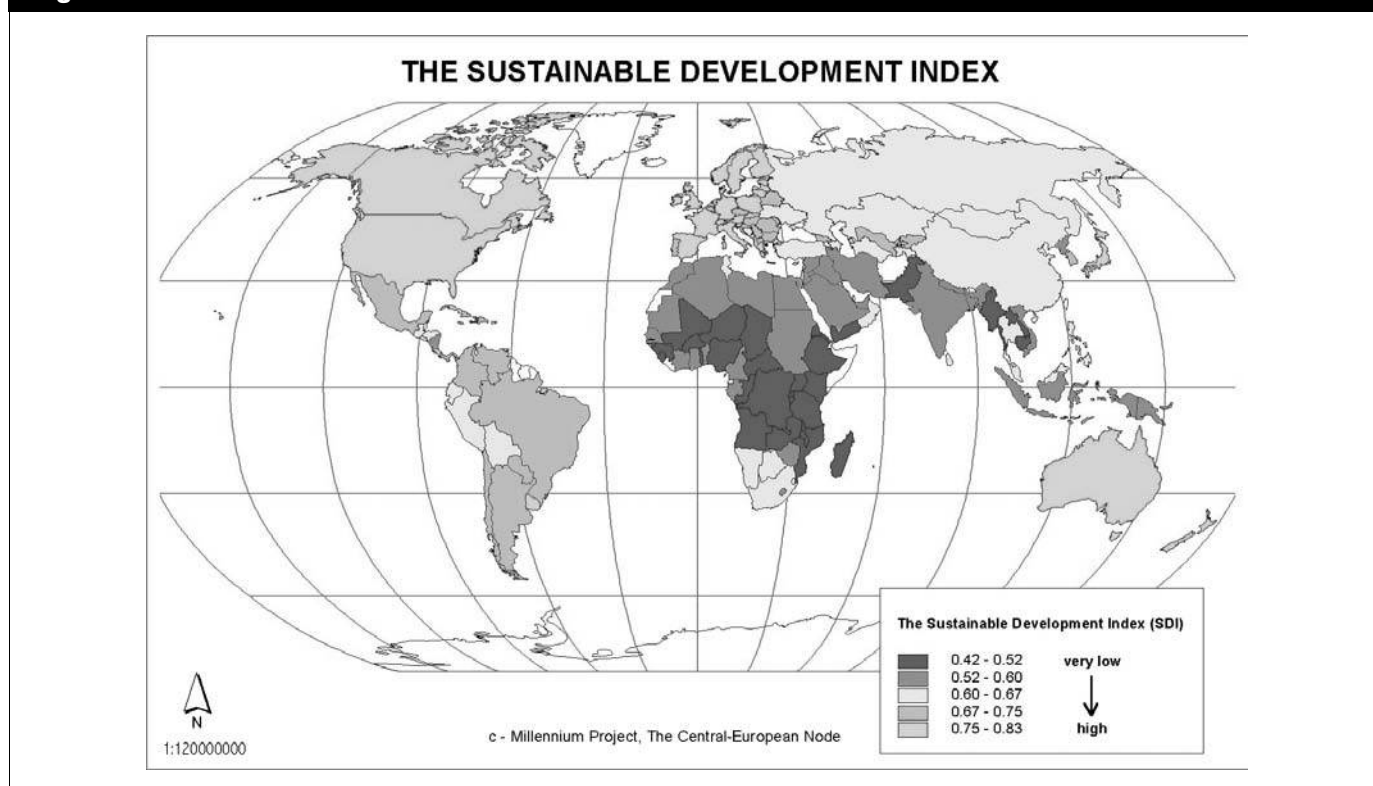
### Overall sustainable development index

Resulting value of sustainable development index (see Figure 1) was calculated as arithmetic mean of all partial indexes of individual variables. A total of 146 countries were evaluated, but number of accessible data for individual countries varied from 27 (Bosnia and Hercegovina) to all 58 variables (nine countries). But overall coverage of data was very good – from maximum number of data points 8.468 we were able to get 7.725 data points (91.2 percent).

Among the most ten developed countries according to overall sustainable development index are Norway, Finland, Canada, Sweden, Switzerland, Austria, New Zealand, Ireland, The Netherlands and Germany.

Ten of the least developed countries according to overall sustainable development index are: Eritrea, Angola, Burundi, Haiti, Ethiopia, Chad, Mozambique, Cambodia, Kenya and Uganda.

SD Index represents one of possible methodological approaches how to quantify and measure progress of individual countries on the way towards sustainable development. The biggest advantage of SD Index is that variables are taken from accessible world data sources which are regularly evaluated and updated. Just two principal data sources had been used – World Development Indicators of the World Bank and UNDP (n.d.) yearbook *Human Development Report*. As supplement we used also Index of Freedom (Freedom House). Therefore it is possible to make time series from last ten years and extrapolate trends for next five years. This can become important instrument for decision making. Disadvantage of SD Index is that it does not work with the best possible set of variables

**Figure 1**

but just with the best available set of variables, which can be found without additional research.

### Quality and sustainability of life in the Czech Republic (national level)

The Czech Republic, as the only country in Central and Eastern Europe, has joined the three-years process of sustainable development indicators testing prepared by the UN Commission on Sustainable Development. But the testing was realized more due to the international commitments than real attempt of politicians or public of the Czech Republic to express and measure sustainability.

We present here our own assessment of the quality and sustainability of life indicators for the Czech Republic (in the period 1990-2000) and the outline of likely trends for the nearest period (to 2006) on the basis of available statistical data. Czech data sources were used (particularly the Czech Statistical Office published data and other official sources, such as the data of the Ministry of Environment). Quality and sustainability of life index was evaluated as a hierarchic index comprising twelve partial indices of the issue areas selected, four main development areas indices, and one integrated index. The issue areas were selected to express all important forces of the Czech society (see Table II).

The indices were calculated at all levels as an arithmetic mean of transformed indicators entering the calculation, for each year separately. The indicators were transformed to

**Table II — Basic structure of quality and sustainability of life index**

1 Political area	A International position
	B Internal security
2 Social area	C Demographic development
	D Standard of living
	E Health state and health care
	F Education, science and research
3 Economic area	G Access to information
	H Economy effectiveness and economic development
	I Indebtedness and balance of economy
4 Environmental area	J Selected economic indicators
	K Consumption of natural resources
	L Quality of the environment

unified scale 0-1 where 0 is the most unfavourable indicator value and 1 is the highest theoretical value.

### Results

#### Political area

The area was assessed on grounds of two issue areas and 16 indicators in total. We documented significantly different development in the international position of the Czech Republic (which was strengthened by the incorporation to



the prominent world institutions, the index development trend of this sub-area was positive) and the area of internal security. The development of the second area was very fluctuating – the rise of criminality and corruption in society affected the trend negatively. The overall index trend development in the political area was stagnant to 2006, with a minor prospect for its amelioration.

### **Social area**

The area was assessed on grounds of five issue areas and 38 indicators in total. There was an obvious negative trend (which was caused by the absolute decrease of population in the Czech Republic) in the area of demographic development. Development in other issue areas was fluctuating; the standard of living decline in 1991-1992 was followed by a steady increase of the index value, and by its significant decrease in 1998 (particularly due to unemployment rise). The index development in the issue areas of health state and health care, education, science and research, was fluctuating as well. The access to information had a positive trend over the whole period observed.

With respect to the fluctuating development of the majority of standard of living indicators in the Czech Republic, the overall index of this area was stagnant, with a trend of a very slight increase for the next period to 2006.

### **Economic area**

The area was assessed on grounds of three issue areas and 18 indicators in total. Economic development and effectiveness (after the initial drop in 1991) exhibits increase to 1996 and, on the contrary, decline in 1997-1998. Significantly unfavourable index development was in the issue area of indebtedness of economy, its market balance and balance of national supply, where was the dominance of negative development of the whole period of 1990-2000.

The mentioned facts caused a stagnant overall index development trend in the economic area – its value for the year 2000 was almost at the same level as in 1990. The development trend to 2006 is very slightly positive and comes out of the prospects of a slight rise of economy and its key-indicators.

### **Environmental area**

The area was assessed on grounds of two issue areas and 29 indicators in total. The indicators of the environmental pollution improved, in particular, the waste production decreased. A less positive development was possible to record in the area of investments to the environmental conservation, where the total amount of investment decreased. In the issue area of natural resources consumption, the initial index value rise in the period 1990-1994 (caused by the production decline in particular) was followed by a stagnant trend to 2000.

The overall index development in the environmental area in the period 1990-2000 was positive, in spite of certain

stagnation in 1995-1997 and 2000. The expected index development trend to 2006 is positive as well.

### **Overall quality and sustainability of life index**

The period 1990-1992 was characteristic for a stagnant quality and sustainability of life index. The stagnation was mainly caused by the unfavourable economic development. On the contrary, in the case of the environmental area was reported steeply positive development.

The period of the first four years of independent Czech Republic (1993-1996) was characteristic for its quality and sustainability of life index value increase, which was particularly influenced by the positive development in the economic and political area. On the contrary, the environmental area after the initial rise reported stagnation, as well as the development in the social area.

The quality and sustainability of life index reported a significant decline in the period 1997-1998, which was caused by negative trend of nearly all indexes of the main areas, with the exception of the environmental area.

The year 1999 seemed to be crucial because of positive trends starting in quality and sustainability of life index values – all development areas of society reported an improvement of the index value. The index value improved only partially in 2000 (see Figure 2).

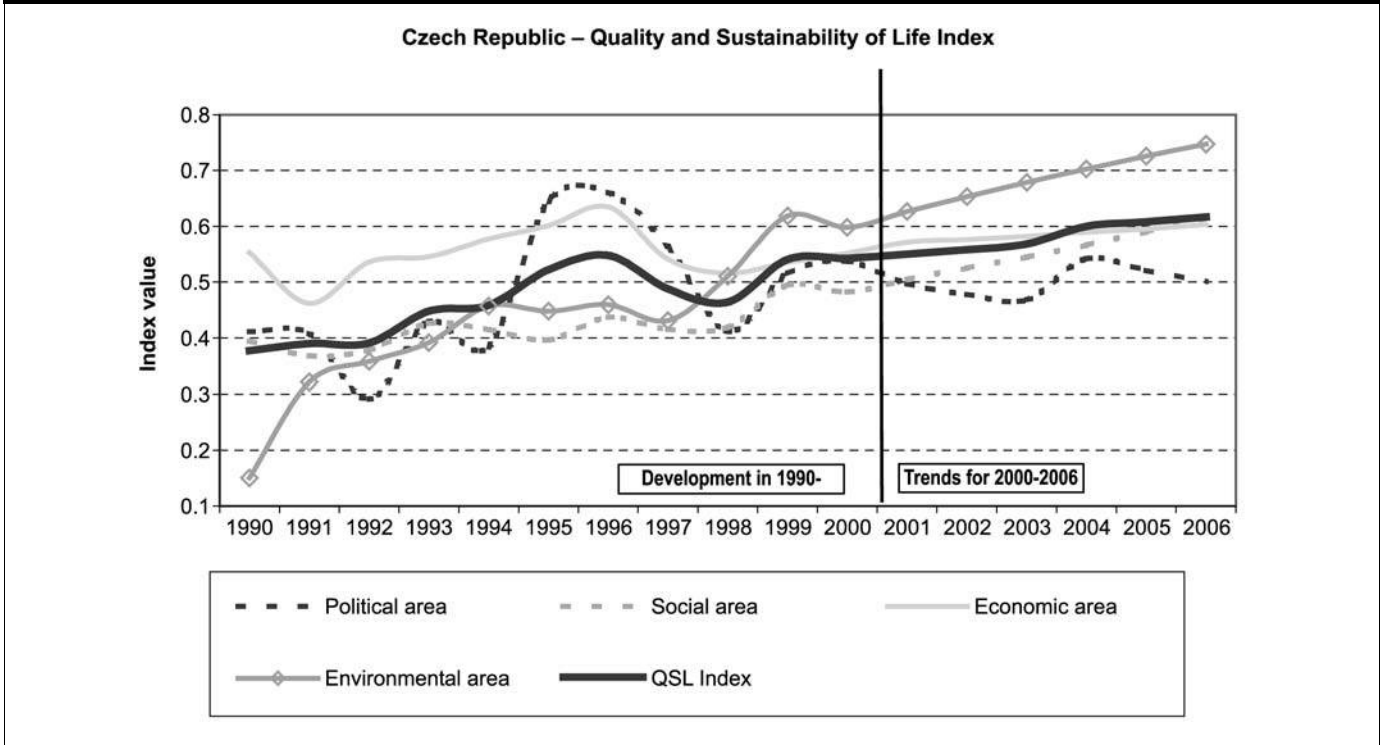
The future trend estimation of the quality and sustainability of life index for the period to 2006 is positive; the index value could improve, the main factors of the improvement could be the environmental, and after certain period, social area as well. On the contrary, a stagnant and fluctuating development is expected in political area, mainly due to negative trends in the area of the internal security.

### **Regional aspects of life quality in the Czech Republic**

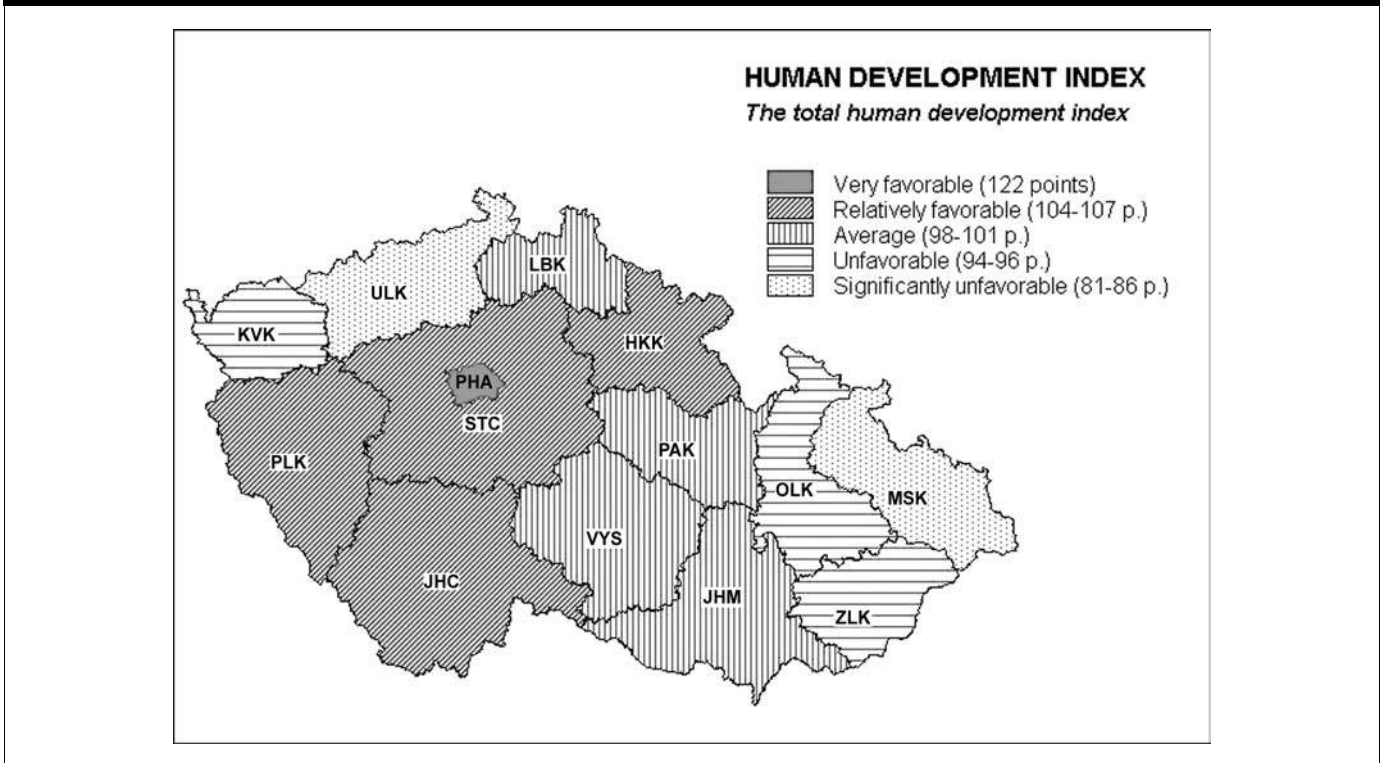
Although the Czech Republic is classified as a developed country with high quality of life (this fact is expressed for example by the value of the Human Development Index (see Figure 3) prepared each year by the UN Development Programme), one overall indicator assessed at national level cannot express sufficiently the differences in individual areas (especially in the social and economic area), as well as in individual regions. Space units in our study at regional level have been set by the administrative division of the Czech Republic – regions, which are the bases of statistical data sampling (14 regions corresponding to the third level of the European Union “Classification of Statistic Space Units” – NUTS). Our task was to set up the regional life quality index for the year 2000.

The average of the given indicator of the Czech Republic (representing 100 percent) was used as a comparative level for all the regions. Individual regions attained the level higher than 100 percent in the case the value of the given indicator in relation to the quality of life was more favourable than the

**Figure 2**



**Figure 3**



national average and, on the contrary, lower than 100 percent in the opposite case.

Quality of life in the Czech regions is understood as a total of social, economic, community and environmental conditions, which enable one to live a long, healthy and creative life in adequate social and economic conditions. This definition corresponds to the human development concept of the United Nations Development Programme (Human Development Report).

The regional Quality of Life Index in the Czech Republic is structured as follows:

- (1) Long and healthy life expectations:
  - Demographic expectations – three indicators.
  - Health and people's safety – seven indicators.
  - Quality of the environment – five indicators.
- (2) Creative life with sufficient education expectations:
  - System of education and learning level – five indicators.
  - Family and social cohesion – four indicators.
  - Employment and opportunities of social acceptance – four indicators.
- (3) Adequate standards of living expectations:
  - Economic effectiveness of each region – four indicators.
  - Social status of people – four indicators.

## Results

### Long and healthy life expectations

Following indicators were assessed:

- *Demographic expectations* – natural population increase per 1,000 people, immigration increase per 1,000 people, and life expectancy at birth.
- *Health and safety of people* – overall mortality rate per 11,000 people, infant mortality rate per 1,000 birth, average percentage of work incapacity, number of people per one physician, number of beds in hospitals and expert medical institutes per 1,000 people, number of ascertained criminal acts per 1,000 people, clarification of criminal acts in percent.

Quality of the environment – population density per 1km<sup>2</sup>, proportion of urban population in percent, proportion of forest area in percent, protected areas in percent of the overall area, measurable emissions of solid substances, SO<sub>2</sub>, NO<sub>x</sub>, CO, C<sub>x</sub>H<sub>y</sub> in total per km<sup>2</sup>.

When assessing this area of life quality for the year 2000 in total, particularly favourable situation was in regions Jihocesky and Kralovehradecky (the index value was 115). Below the average was region Ustecky (91) and particularly unfavourable situation was in region Moravskoslezsky (84) and in the capital – Prague (82).

### Creative life with sufficient education expectations

These indicators were assessed:

- *System of education and learning level* – proportion of secondary schools students from the overall number of inhabitants in productive age, proportion of grammar

school students per the overall number of secondary school students, proportion of people with university education in adult population, proportion of employees in tertiary sphere per overall employees number.

- *Family and social cohesion* – number of marriages per 1000 people, number of divorces per 100 marriages, number of abortions per 1,000 birth, proportion of women with university education.
- *Work and opportunities of social acceptance* – unemployment rate (registered) in percent, number of employment applicants for one work position, proportion of the graduated and the youthful per unsuccessful applicants in percent, proportion of economically active people in percent.

When assessing this area of life quality for the year 2000 in total, the situation was relatively differenced. The capital – Prague – achieved the most favourable values (index value was 141). Very unfavourable situation was in regions Moravskoslezsky (81) and particularly in region Ustecky (74).

### Adequate standards of living expectations

These indicators were assessed:

- *Economic effectiveness of region* – gross national product per capita, number of businessmen per 1,000 people, gained material and non-material investments per capita, length of railway and road network in km per km<sup>2</sup>.
- *Social status of people* – average gross month wages in Czech crowns, average pension in Czech crowns, number of given building permits per 1000 people, people in evidence of the socially disadvantaged per 1000 people.

When assessing this area of life quality, which expresses mainly the economic and the social situation of people, for the year 2000 – the situation was again the best in the capital Prague that achieved the most favourable values (index value was 143). The worst situation was in region Moravskoslezsky (77).

### Overall regional quality of life index

The value of the overall regional quality of life index of the Czech Republic was obtained by combination of the three partial indexes mentioned above. The capital Prague achieved the best results (the index value is 122). Situation was relatively favourable in regions Jihocesky (107), Kralovehradecky and Stredocesky (105) and Plzensky (104). Regions Liberecky (101), Pardubicky (100), Vysocina (99) and Jihomoravsky (98) achieved the average values. The situation is less favourable in regions Olomoucky and Zlinsky (both 96) and Karlovarsky (94). According to the calculated index, the situation was particularly unfavourable in region Ustecky (86) and particularly in region Moravskoslezsky (81).

Results of the work at regional level suggest the following conclusions:



- Contemporary quality of life in regions of the Czech Republic was markedly different in Prague (there was significantly higher than in all the other regions). In two boundary regions – Moravskoslezsky and partially Ustecky, the quality of life was markedly lower. Other regions were relatively homogeneous regarding the quality of life index.
- The overall variability rate of regional differences increased during the 1990s.

It is necessary to interpret the results such as the overall quality of life in the Czech Republic regions did not decrease, rather than the contrary. However, the differences between more prosperous and less prosperous regions constantly increased. This fact was obvious particularly in relation of Prague to other regions.

The results predict that there is a need of a complex and balanced regional policy of the state, which should focus on the goal-directed and effective support of the dragging-back regions. ■

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