Measurement of sustainable development in Latvia

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Abstract. **Current paradigm of economic development is sustainable development. Sustainable development is the challenge for governments, companies and households because significant additional investments and innovations, changes in production and consumption habits are required. These changes have to be made because resources are limited and existence of our world is endangered – too much resources are used and too much waste is generated by people. This problem is recognized by the United Nations that set 17 Goals of Sustainable Development in 2015. Review of scientific literature indicates that countries measure their sustainable development in different ways because countries have different development levels, as well as different social, economic and environmental problems. Thus the aim of this research is to identify Latvian approach measuring sustainable development and assess sustainable development in Latvia. Sustainable development in Latvia is measured by indicators defined in Sustainable Development Strategy in Latvia until 2030. The methods applied in this study are literature review and regression analysis. This study reveals Latvian progress in sustainable development and relationship among strategic indicators of sustainable development in Latvia.**

Keywords: Latvia, sustainable development.

I. INTRODUCTION

Sustainable development is current paradigm of economic development. It was formalized in 1995 when the United Nations adopted its 17 Sustainable Development Goals (SDG) [1], [2].

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Analysis of scientific literature shows that countries measure their sustainable development in different ways because countries have different development levels, as well as different social, economic and environmental problems. Thus the aim of this research is to identify Latvian approach measuring sustainable development and assess sustainable development in Latvia. Sustainable development in Latvia is measured by indicators defined in Sustainable Development Strategy in Latvia until 2030. The methods applied in this study are literature review and regression analysis. They help to assess Latvian progress in sustainable development and relationship among strategic indicators of sustainable development in Latvia.

II. MATERIALS AND METHODS

Measurement of economic development is relevant in any country in the world. International organizations (as the United Nations, the World Bank, the International Monetary Fund, the European Union), countries, economists and analysts are dealing with it. The main measure of economic development is Gross Domestic Product (GDP), but since the middle of the 20th of century there is tension to measure economic development with additional indicators and indexes, as inflation, unemployment, Human Development Index etc. [6], [7]. The problem of GDP is that it is not a perfect measure of well-being because it is materialistic indicator of economic performance of country measuring all output, all income

and expenditure in economy but it does not measure quality of environment and quality of human life. For example, the United Nations Development Program (UNDP) is measuring the economic development with the Human Development Index, that was introduced to challenge GDP as the only measure of economic performance of national economy [8]. The Human Development Index eliminates such shortcoming of GDP as inequality and quality of life, including indicators characterizing life expectancy, education and income.

Nowadays we have one other trend in organizing and measuring development. It is sustainable development because mankind has reached the level of development when the world is overpopulated and there is a lack of resources and too much waste is generated. The main definition of sustainable development says that it is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1], [9], [11]. It describes the essence of sustainable development relating it not only with the usage of resources, but also with fundamental economic concept of externalities, as pollution. Governments, firms and households have to move to more sustainable governance, production and consumption practices, e.g. circular economy and "blue" practices, reducing usage or resources and generating less pollution [4], [10].

There is no single method how to measure sustainable development, because not only SDG and its targets are applied, but also other approaches, as Footprint and different sets of indicators. The main problem of applying SDG in measuring sustainable development is that it is challenging to achieve and measure all SDGs together, accounting for the linkages between SDGs and possible synergies or trade-offs, e.g. one way to pursue food security (SDG2) for all would be by increasing food production which could lead to more fertilizer use and thus emissions of nitrous oxide (SDG13) [1]. Countries and regions often choose some SDGs as the highest priorities for particular place to achieve sustainable development [5]. One other good alternative in measuring sustainability is footprint that measures both carbon emissions and usage of resources, as cutting down forests and through agriculture [12]. Usually it is added to other indicators of development, as GDP, Human Development Index etc., representing sustainability.

III. RESULTS AND DISCUSSION

Sustainable development in Latvia is assessed by strategic indicators set in Sustainable Development Strategy in Latvia until 2030. They are 7 indicators:

1) Number of inhabitants (mill.);

2) Gini coefficient;

3) GDP per inhabitant per year (EUR, according to purchasing power parity)

4) Regional differences of GDP per inhabitant – dispersion of regional GDP per inhabitant (%).

5) Ecological footprint (ha per inhabitant);

6) Human Development Index (place in the world);

7) Global Competitiveness Index (place in the world).

Authors of this study made analysis of indicators mentioned above to reveal if Latvian development is sustainable and if it is possible to find trends of Latvian economic development. It was chosen to obtain data about not only place, but also score of Latvia in Human Development Index and Global Competitiveness Index to have more comprehensive data. The data that are used in the study are summarized in Table 1.

TABLE 1 DATA SET USED IN THIS STUDY

Year	Number of inhabitants (Mill)	Gini coefficient	GDP per capita (thousand EURO)	Human Development index (score)	Human Development index (place in the world)	Global competitiveness index (score)	Global competitiveness index (place in the world)	Ecological footprint (ha/inhab)	Dispersion of regional (NUTS 3) GDP per inhabitant (%)
2005	2249724	39	9489	0.809	39	4.43	44	5.15	45.9
2006	2227874	35.6	10721	0.816	38	4.29	44	5.65	49.0
2007	2208840	37.5	11881	0.825	36	4.57	36	6.3	44.5
2008	2191810	37.2	11619	0.828	37	4.26	54	4.74	44.3
2009	2162834	36	10129	0.826	39	4.06	68	4.48	42.1
2010	2120504	35	9883	0.824	42	4.14	70	4.41	42.0
2011	2074605	35.8	10326	0.829	41	4.24	64	5	37.6
2012	2044813	35.2	11189	0.832	42	4.35	55	5.05	40.5
2013	2023825	35.5	11532	0.839	40	4.4	52	5.36	43.4
2014	2001468	35.1	11861	0.845	40	4.5	42	5.74	43.6
2015	1986096	34.2	12427	0.849	40	4.45	44	6.18	44.2
2016	1968957	34.3	12838	0.854	39	4.45	49	6.24	43.3
2017	1950116	35.6	13387	0.859	37	4.4	54	6.17	41.7
2018	1934379	35.1	14029	0.863	37	6.2	42	6.41	46.7
2019	1919968	34.5	14476						
2020	1907675		14021						
2021	1893223		14788						
2022	1875757							6.13	

Source: constructed by authors (sources of data – [8], [13]-[16]).

At the beginning the full set of data and they trends were analysed. The units of measurement of data are different and it is not possible to represent them on a single coordinate plane. To be able to do it, indicators were normalized so that they are within the range from 0.5 to 1.5, applying the following formula:

$$X_{norm} = a + b * X$$

$$b = \frac{1}{X_{max} - X_{min}}; \ a = 1.5 - \frac{X_{max}}{X_{max} - X_{min}} \quad (1)$$

where
a; b coefficients of the normalization formula,
x_{max} ; x_{min} maximum and minimum value of the indicator.
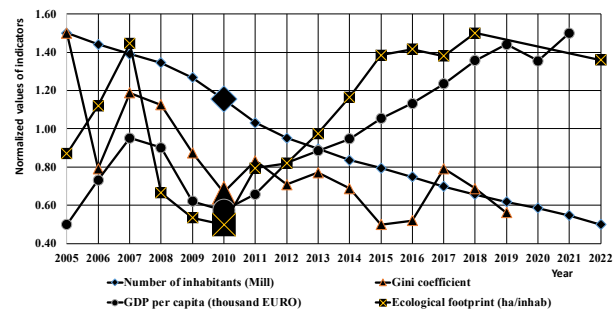

Fig. 1. Data on normalized scale, Latvia.

Such sustainable development indicators of Latvia as Number of inhabitants, Gini coefficient, GDP per capita and Ecological footprint are represented on Fig. 1. They are depicted in normalized values. A single trend throughout the entire time period is only the Number of inhabitants that is decreasing consistently. All other indicators on Fig.1 were strongly affected by recession. A period that is related to crises lasted until 2010. New development trend began in 2010 that is indicated with enlarged markers on Fig.1. This study is focused on studying current development trend of Latvia thus next analysis is done about the period since 2010.

The problem remains the same as before because the values of indicators are very different therefore it is necessary to use a unified graphic system for this analysis. It was chosen to use Temp of increase for base year 2010 as the most suitable method for this case. The calculation is as follows:

$$T_{xm\ base} = \frac{X_m - X_{base}}{X_{base}}\ \%;\qquad (2)$$

where

X_m current value of indicator,

$X_{base} = X_{2010}$ value of indicator in the base year 2010

For graphical analysis, it would be good to place all data on one coordinate plane but it is problematic because there are 9 indicators in total. It was decided to divide all indicators into 2 groups. In the first group there are such indicators as Number of inhabitants, GDP per capita, Gini coefficient un Ecological footprint. Results can be seen on Fig. 2. The figure shows the temp of increase in relations to the base year in 2010 and trend lines are added. Equations and coefficients of determination are visible on trend lines which gives information about an issue which part of the trend can be explained with the trend lines.
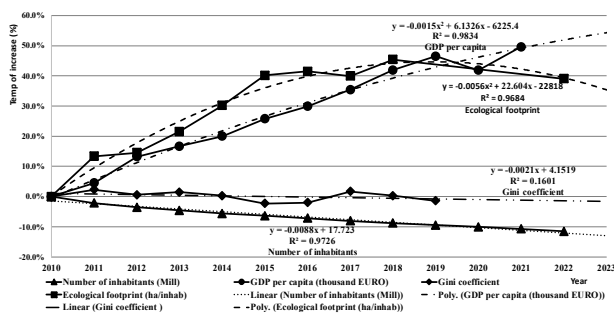

Fig. 2. Sustainable development indicators in Latvia (first group of indicators).

Data about GDP and Ecological footprint have positive trends. GDP continue to grow but its growth rate slows down. The coefficient of determination is 0.9834 and therefore, the quadratic relationship can explain 98.34% of trend. The Ecological Footprint is also developing prospectively. It should ideally be as small as possible. In the beginning, its growth rate increased and now it tends to the value of 2010. Using the quadratic relationship for the trend shows that it explains 96.84% of trend. The trend of decreasing inhabitants can be explained as negative.

However, the Gini coefficient does not have any tendency, and it is indicated by the value of the determination coefficient of 0.1601. Looking at the Fig.2, it is also understandable, because there are simple fluctuations around the 0 line.

The second group of indicators includes Global competitiveness index (score), Global competitiveness index (place in the world), Human development index (score), Human development index (place in the world), Dispersion of regional GDP per inhabitant (NUTS 3). They are represented in Fig. 3.
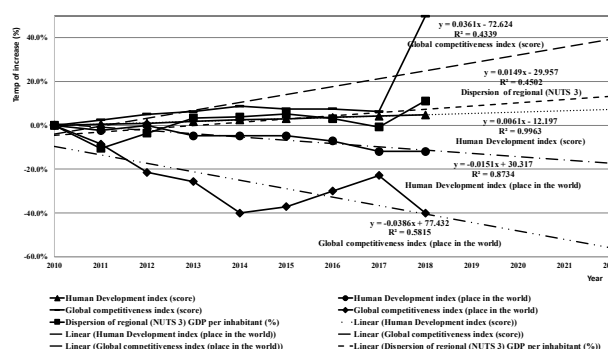

Fig. 3. Sustainable development indicators in Latvia (second group of indicators).

There is a pronounced trend only for both indicators in the case of Human development index: regarding its score, the coefficient of determination is 0.9963, but in the case of place in the world, it is 0.8734. Of course, both indicators measure practically the same thing. The Global competitiveness index also has two versions: score and place in the world. However, there has not been a strict trend here, although the direction is in the direction of development. Latvia has reached the group of developed countries here where changes are already difficult to achieve.

The indicator Dispersion of regional GDP per inhabitant (NUTS 3) also has no pronounced trend, which is indicated by the coefficient of determination 0.4502. The graph shows that there are fluctuations around the 0 state or close to it.

IV. CONCLUSIONS

Strategic indicators that are found in Sustainable Development Strategy in Latvia until 2030 can be used to assess direction of economic development and trends of sustainable development.

The analysis of development indicators shows that Latvia has perspective development in relations to most indicators, except number of inhabitants. The decrease in population may affect other development indicators in the future changing development trend.

This study reveals that Latvia has entered a period of sustainable development. The main indicators of sustainable development are GDP and Ecological

footprint. Positive trends can be observed here, because in 2020 a state has been reached when resource consumption begins to decrease, as GDP increases.

The next study could be devoted to comparing the Baltic States and at least one large developed country.

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