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A Different View on the Country's Sustainable Development Indicators – Latvia's Example

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Abstract. The contemporary scientific and technical community claims that the new development paradigm will be based on the priority of the universal laws of nature, the principles of ecological economics and the widespread use of digital transformation. The analysis of the sustainable development strategy Latvia 2030 and the presented changes in the value of indicators showed that, it is quite difficult to put together a common unified picture of Latvia's movement towards sustainable development. The main goal of the article is to present a new approach to the assessment of sustainable development and to monitoring system, using a system's power changes analysis method. In the context of a Latvian sustainable development strategy, the authors presented the results of the formalisation of new approach to the sustainable development monitoring, using an invariant coordinate system in units of power (energy flow) in compare with calculated data in monetary terms. Calculations and the initial interpretation of the results of Latvia as well as of the five EU countries from the Baltic Sea region – Denmark, Sweden, Finland, Estonia and Lithuania – were carried out for the period 1990.-2019. The presented indicators of sustainable development show that achieving the strategic goals of Latvia 2030 would be very difficult without any serious internal and external incentives. The results can provide a basis for creation of the development strategy both the country as a whole and each region separately.
Key words: sustainability, indicators, energy flows, power.

Introduction

The concept of sustainable development, which originated more than 50 years ago and has now been approved at the level of leading international government and non-government organisations, is a response to those global risks that humanity first encountered. Sustainability is a way of doing business and living that meets our needs today while still being able to meet them tomorrow. We call this responsible business conduct.

The 70s of the 20th centuries were characterised by the emergence of new liberal economic models, the Jamaican monetary system, the rapid development of a new information technology platform and nuclear energy. As a response to these changes, society has formulated the concept of sustainable development.

Having gone from *The Limits to Growth* in 1972 (Meadows et al., 1972) to *Agenda 2030* in 2015 (Agenda 2030), civilisation again faces the choice of further development. What will the economic model be? What will the currency system be? What awaits civilisation in terms of technology, innovation and energy?

The scientific and technical community claims that the new development paradigm will be based on the priority of the universal laws of nature, the principles of ecological economics and the widespread use of digital transformation.

The authors' research is based on the following critical points:

- Society is forced to make strategic decisions within a frame of reference which depends on political decisions based on biased information.
- There are no methodologies and technologies for measuring the transition to sustainable development based on the natural laws of nature.
- All existing generally accepted criteria for sustainable development do not fully meet the requirements of a systematic approach, and are not fully SMART (specific, measurable, achievable, realistic, timely).

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For fifty years, the concept of sustainable development has been drowned in an ever-increasing volume of indicators and has become a mandatory application in development strategy.

The main goal of the article is to present a new approach to the assessment of sustainable development and a monitoring system, using a system's power changes analysis method.

In the context of Latvian sustainable development strategy, the authors present the results of the formalisation of sustainable development monitoring, using an invariant coordinate system in units of power (energy flow). Calculations and initial interpretation of the calculated data of Latvia as well as the five EU countries from Baltic Sea region – Denmark, Sweden, Finland, Estonia and Lithuania – were carried out for the period 1990–2019.

The system of sustainable development indicators

The purpose of sustainable development indicators is to reflect the economic, social and environmental aspects of meeting the needs of the present generation without limiting the ability of future generations to meet their own needs. In the early 1990s, sustainable development began to be considered through the interaction of the following subject components: environmental integrity, eco-efficiency of economic activity, justice of the state, business and society, and for measurement by the world community – a set of indicators characterising environmental (26 indicators), economic (39 indicators), social (41 indicators) and sustainable (14 indicators) development (UN SDR, 1996).

The criteria for selecting indicators can be divided into four main thematic categories:

1. What do the indicators really reflect? Indicators can reflect the dynamics of process change, the degree of sensitivity to change, as well as the direction of change (positive or negative).
2. How are the indicators related to the targets? This includes how the indicators correspond to the policy, whether there is a connection with the decisions being made and a focus on the most significant issues.
3. How is the transfer of information ensured? At the same time, it is necessary to know the accessibility for understanding, to evaluate the ease of transmission and the breadth of distribution.
4. How is the availability, reliability and consistency of data over time ensured? In the short term, data acquisition can become a limiting factor.

The issue of measuring sustainable development is extremely important and there are currently several approaches to measuring sustainable development in the world:

- The first is the construction of an integral indicator (index), expressing the essence of the sustainable development of the system as a whole.
- The second is the construction of a set of indicators that reflect certain aspects of the sustainable development of the system under study.

The first approach involves the construction of an integral indicator, on the basis of which one can judge the degree of sustainability of socio-economic development. Aggregation is carried out on the basis of three groups of indicators: economic, social and environmental.

Within the framework of the first approach, various options for the structure of such a system are possible:

- The structure "problem-indicator";
- The structure "goals-tasks-indicators";
- A compact system of key or basic indicators;
- The structure "subject-sub subject-indicator";
- The structure "load-state-response".

The work of the UN Commission on Sustainable Development, presented more than 10 years ago (UN SDR, 1996), was the first comprehensive development of a system of indicators for sustainable development.

The second approach is based on building a system of indicators, each of which reflects certain aspects of sustainable development. Most often, within the framework of the general system, the following subsystems of indicators are distinguished: economic, environmental, social, institutional.

The most striking example of the second approach is a set of 134 indicators designed to assess the social, environmental and economic aspects of sustainable development (Agenda 2030, 2015).

In parallel with indicators of sustainable development, work is underway to develop indices. The index is generalised, it is an aggregate indicator based on several indicators. Indices, in turn, form ratings that reflect the importance or significance of a particular subject or phenomenon.

The requirements for socio-economic indicators necessary for the effective management of advanced sustainable innovative development can be formulated as follows:

1. Socio-economic indicators should be expressed in stable and universal values based on the laws of conservation and development of open socio-economic systems.
2. Basic indicators should be coordinated with all objects and levels of management of sustainable innovative development, including country, region, municipality, industries, enterprises, social groups, population.

3. Key indicators should be expressed both in physically measurable quantities and in cost units (real and nominal).

Problems

The use of indicators is associated with certain difficulties and limitations. The following factors can influence the effectiveness and success of their application:

- The quality and scarcity of data;
- The difference in concepts of values that have developed among different groups of people;
- The period of time required for the qualitative development of a set of sustainability indicators;
- Insufficient completeness of the list of indicators – this limitation is a general problem.

Another problem that manifested itself in the current practice of selecting and forming indicators in accordance with global, regional, national and local levels is an increase in the number of indicators themselves It leads to an increase in the volume of observed and processed information and a decrease in the possibility of aggregation, ease of interpretation and value to the decision maker.

Despite the recognition of the concept of sustainable development in a number of countries and regions, a generally accepted and universally binding definition of sustainable development has not yet been developed and, accordingly, the concept of how to measure sustainable development has not been formulated or formalised. The main drawback of the existing approaches is the lack of a reasonable system of measures that makes it possible to measure different quality resource flows, innovations and efficiency in the designed facilities. If there is no single legal foundation, then neither the number of parameters taken into account, nor the careful selection of experts, nor the complexity of mathematical formulas can provide an objective assessment of the subject's capabilities in accelerating social development. The methodology for constructing indicators of sustainable development is based on heterogeneous, disproportionate measures, and a normalization procedure is used to carry out operations. The normalized indicators are also heterogeneous, since they are heterogeneous values expressed in disparate measures, which gives rise false estimates and, as a result, inefficient management.

Sustainable development strategy – Latvia 2030

The basic principles of Latvia's sustainable development strategy were presented in 2008. The proposals expressed and supported in the expert discussions were used to create a first edition of strategies. In 2009, the Sustainable Development Strategy of Latvia was approved by the Saeima of the Republic of Latvia as the main long-term development planning document of the country (Latvia 2030).

The main idea of sustainable development calls for meeting the needs of the current generation, balancing the interests of public welfare, the environment and economic development, while ensuring compliance with environmental requirements and preservation of natural diversity, so as not to reduce the possibilities of meeting the needs of future generations.

According to *Latvia 2030*, the strategic goals were formulated following that in 2030, Latvia will be a prosperous country of active and responsible citizens. Everyone will be able to feel safe and belong to Latvia; here everyone will be able to realise their goals. The strength of the nation will be rooted in the inherited, familiar and newly created cultural and spiritual values, the richness of the Latvian language and the knowledge of other languages (Latvia 2030).

Table 1

Latvia 2030 main priorities and strategic indicators

N	Latvia 2030 strategic indicators		Latvia 2030 priorities	Agenda 2030 (sequence No.)
1	Population	1	Development of cultural space	
2	GINI index	2	Long-term investment in human capital	10, 3
3	GDP per capita, euro	3	Paradigm shift in education	4
4	Human development index HDI	4	Public participation	17
5	GDP per capita regional diversities	5	Spatial development perspective	11
6	Footprint, ha/capita	6	Nature is the capital of the future	13, 14, 15
7	Global competitiveness index	7	Innovative and eco-efficient economy	8, 9
		8	Innovative management	17

Source: authors' construction

Table 2

Values of Latvia 2030 strategic indicators in 2009, 2019 and 2030

N	Strategic indicators	2009 (in fact)	2019 (in fact)	2030 (planned)	Sources (2009, 2019)
1	Population, mil. capita	2.3	1.9	>2.02	CSP
2	GINI index	38	35	<30	Eurostat
3	GDP per capita, euro	14,000	16,000	>27,000	Eurostat
4	Human development index HDI (ranking)	48	39	<30	UNDATA
5	GDP per capita regional diversities	47	41	<30	Eurostat
6	Footprint, ha/capita	3.5	6.4	<2.5	GFN
7	Global competitiveness index, GCI, (ranking)	68	67	<40	WEF

Source: authors' construction

The main *Latvia 2030* priorities and strategic indicators, according the United Nations' *Agenda 2030* (Agenda 2030, 2015) are presented in Table 1.

Periodic reports on the implementation of the sustainable development strategy (Latvia SDR, 2022) present the dynamics of strategic indicators (Table 2). According to the presented changes in the value of indicators (increase or decrease, approaching or deviating from the planned values), it is quite difficult to put together a common unified picture of Latvia's movement towards sustainable development.

Materials and Methods

Within the framework of the concept of ecological economics (Capra & Jakobsen, 2017) and considering the conclusions of the energy theory of value (Costanza, 2004), in order to formalise the tasks of a transition to sustainable development, a model was developed using the method of analysing changes in power and energy flows in open dynamic social economic systems (Trusina & Jermolajeva, 2021).

The analysis of socio-economic systems is based on the law of conservation of power (Kuznetsov, 2015), which is necessary for the development of the system and ensuring all socio-economic processes. The energy flow (total power) N(t) entering the system over a period of time is equal to the sum of the output flow of useful power P(t) and power losses G(t) in accordance with formula 1:

$$N(t) = P(t) + G(t) \quad (1)$$

There are six main provisions of the model:

1. The definition of sustainable development in energy units of power (Bolshakov, Karibaev & Shamaeva, 2019; Trusina, Jermolajeva & Sloka, 2022).
2. The introduction of the term "power" into the formulation of sustainable development makes it possible to create an invariant coordinate system and units of measurement.
3. The method for calculating and analysing changes in the power of socio-economic systems.

The flow of energy consumed by society or the total power includes all types of energy resources necessary to ensure life, production, technological and other processes. This sum of all consumption flows determines the needs or potential of society (Podolinsky, 2004; Bauer, 2002; Shamaeva, 2019).

Net power is a function of the level of technological development of the system, the structure of energy consumption and the final consumption of electricity E(t) (Yoo & Hwang, 2016).

4. Quality of life in energy units.

Quality of life (QOL) as an objective function in energy units is defined as the potential for the implementation of increasing opportunities, considering the quality of the environment and the level of technological development. The higher the quality of life, the higher the potential for ensuring the development of the socio-economic system (Jermolajeva & Trusina, 2021).

5. Main indicators of the sustainable development model (Trusina, Jermolajeva & Sloka, 2022): eight socio-economic indicators (Table 3) and five parameters of the sustainable development model (Table 4).

Basic designations in Table 3 and Table 4:

N(t) – full power of final consumption; P(t) – useful power; TAN(t) = (life expectancy) /100 – normalised life expectancy; LM (t) – employees; Environment quality q(t) = G(t) / G(t-1); S-area of the state.

6. The method of analysis of changes in the power of socio-economic systems allows us

Table 3

Designations, formulas and data sources of main socio-economic indicators

N	Indicators	Designations	Units	Source / Formulae
1	Population	M	capita	Eurostat, UNDATA
2	Population changes	dM	%	Eurostat, UNDATA
3	Employees	LM	capita	Eurostat, UNDATA
4	Life expectancy	TA	years	Eurostat, UNDATA
5	GDP per capita	PX	Euro	Eurostat, UNDATA
6	Full power (as consumption) per cap.	D	Wt	D(t) = N(t) / M(t)
7	Electricity part in final consumption	E	%	E(t) = N1-ELEC(t) / N1(t)*100
8	Electricity part production by nuclear	AE	%	Eurostat, UNDATA

Source: authors' construction

Table 4

Main sustainable development model indicators and their calculation

N	Indicators	Designations	Units	Formulae
1	Standard of life	U(t)	Wt	U(t) = P(t) / M(t)
2	Technological efficiency	f	%	f(t) = P(t)/N (t) * 100
3	Productivity	PHP	Wt	PHP = P(t) / LM(t)
4	Quality of life	QoL	Wt	QoL1(t) = U(t) * q(t) * (TA(t) / 100)
5	FOOTS	FT	Wt	FT(t) = G(t) * N(t) / P(t) / S / M(t)

Source: authors' construction

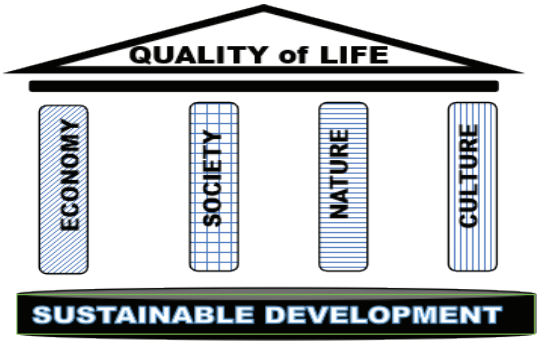

Figure 1. New concept of sustainable development "temple" with pillars

Source: authors' construction

to formulate the level, degree and trends of sustainable development of the system. For example, growth, development, degradation or sustainable development.

7. Within the framework of the proposed model, the "temple" of sustainable development turns 180 degrees (Figure 1). Thus, the foundation of the "temple" (power model) determines the trend of development and becomes the basis for a systematic analysis of sustainable development – the pillars of the economy, society, nature and culture. The pinnacle of this temple is the goal of sustainable development of the system – the quality of life.

Results and Discussion

Within the framework of the proposed model for analysing changes in the power of socio-economic systems, calculations were carried out and the data obtained were presented in the form of tables and graphs.

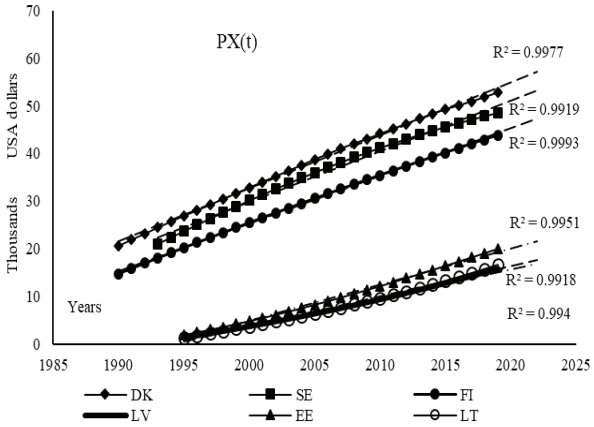

Figure 2. Changes of GDP per capita of Denmark (DK), Sweden (SE), Finland (FI), Latvia (LV), Lithuania (LT), Estonia (EE), period 1990–2019, euro.

Source: authors' construction

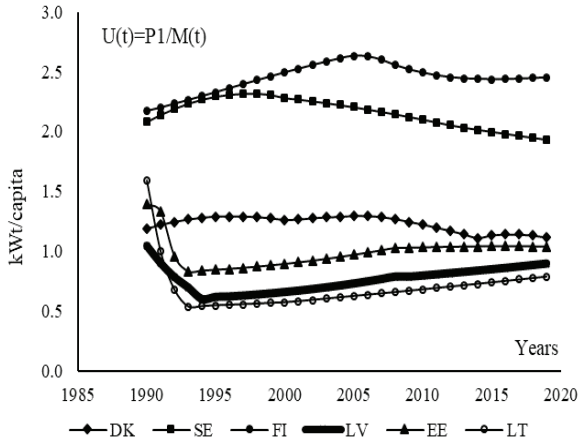

Figure 3. Changes of standard of life (useful power per capita) U(t) of Denmark (DK), Sweden (SE), Finland (FI), Latvia (LV), Lithuania (LT), Estonia (EE), period 1990–2019, euro.

Source: authors' construction

The data of the central statistical office of the EU (Eurostat database), the World Bank (World Bank database) and the United Nations Organization (UNDATA) were used for calculations.

Calculations and initial interpretation of the calculated data of Latvia as well as of the five EU countries from Baltic Sea region – Denmark, Sweden, Finland, Estonia and Lithuania – were carried out for the period 1990–2019.

The growth of the GDP per capita for the period 1995–2019 has a linear tendency for all selected countries with rather high coefficients of determination with values about $R^2 = 0.99$ (see Figure 2). According to the value of GDP per capita, the selected countries can be divided into two groups: countries with a higher value – Finland, Sweden and Denmark with the highest value, and countries with a low GDP per capita – Latvia, Lithuania and Estonia.

Changes of standard of life (useful power per capita) U(t) of selected countries in the period 1990–2019 are presented in Figure 3.

The standard of living (or useful energy per capita) for Finland, Sweden and Denmark is on a downward trend, and Denmark is moving from the first place to third, closer to Estonia. This signals a decrease in the potential for sustainable development.

The standard of living indicators for Latvia, Lithuania and Estonia has a characteristic trajectory of changes for Eastern European countries – a sharp decrease by 2–2.2 times from 1990 to 1996. Until 2019, the standard of living was not restored and had a slight upward trend.

Long-term deindustrialisation in Latvia and other selected countries has led to serious depopulation.

In accordance with the methodology and Tables 3 and 4, the main indicators were calculated for

Table 5

Socio-economic indicators of Denmark (DK), Sweden (SE), Finland (FI), Latvia (LV), Lithuania (LT), Estonia (EE) in 2019

N	Indicators	Design.	Units	DK	SE	FI	EE	LV	LT
1	Population, 10^6	M	capita	6	10	5	1	2	3
2	Population changes 2009.–2019.	dM	%	17	15	7	-6	-19	-21
3	Employees, 10^6	LM	capita	2.8	5.0	2.5	0.6	0.9	1.3
4	Life expectancy	TA	years	81	83	82	79	76	77
5	GDP per capita, 10^3	PX	euro	53	49	44	23	16	16
6	Electricity part in final consumption	E	%	19	32	29	22	15	19
7	Electricity part production by nuclear	AE	%	00	85	35	00	00	00

Source: author's construction

Table 6

Sustainable development parameters of model for Denmark (DK), Sweden (SE), Finland (FI), Latvia (LV), Lithuania (LT), Estonia (EE) in 2019

N	2019	Design.	Units	DK	SE	FI	EE	LV	LT
1	Full power per capita	D	kWt	3	5	7	3	3	2
2	Standard of life	U	kWt	1.1	1.9	2.5	1.0	0.9	0.9
3	FOOTS	FT	kWt	16	2	4	15	10	9
4	Technological excellence	f	%	35	42	41	35	33	33
5	Quality of life	QoL	kWt	1.0	1.5	2.0	1.0	0.7	0.6
6	Productivity	PHP	kWt	5.6	8.0	4.1	2.2	1.8	1.7

Source: authors' construction

Table 7

Additional sustainable development parameters according to the strategy Latvia 2030 in 2019

2019	Designations	Units	DK	SE	FI	EE	LV	LT
Footprint	x	Gha/cap	7	6	6	8	6	6
HDI, x 1000	HDI	x	948	947	940	890	863	875
GCI, x 10	GCI	x	812	812	802	709	670	684

Source: authors' construction

Denmark (DK), Sweden (SE), Finland (FI), Latvia (LV), Lithuania (LT) and Estonia (EE) in 2019. The data is presented in Tables 5, 6 and 7. Within 15 years after joining the EU in 2019, Latvia's socio-economic indicator values are different and lower by 2 and more times from its of Finland and Sweden. The dynamics and level of values for 2019 of the parameters of sustainable development correspond to a stagnation state. In this case, serious internal and external incentives are needed in order for Latvia to enter such a sustainable development trajectory that would allow, if not to achieve, then at least to approach the achievable indicators set by *Latvia 2030*. At first, it requires new initiatives and more collaboration among educators, academics, policymakers and practitioners in order to modernise the education and training systems (Bikse et. al., 2022).

Within 10 years, Latvia lost almost 20 percent of its population. This also indicates a low potential for sustainability. Achieving the strategic goals of *Latvia 2030* would be very difficult.

The values of sustainable development parameters in Finland and Sweden confirm that the great development potential of the countries of the Baltic

region lies in the development of nuclear energy and the further promotion of an innovative high-tech economy based on high-density energy sources.

Conclusions

The new paradigm of the sustainable development of modern civilisation will be based on the priority of the universal laws of nature, the principles of ecological economics and the widespread use of digital transformation.

The system's power changes analysis model and corresponding indicators can be transformed into the basis of a system analysis of the traditional pillars of sustainable development – the economy, society and nature. The pinnacle of this temple is the goal of sustainable development of the system – the quality of life.

The proposed methodology is based on the law of conservation of the system's power (or the energy flows) that is necessary for the development and provision of all processes of the socio-economic system.

Within the framework of the proposed invariant coordinate system in energy units, a basic system of indicators for monitoring natural socio-economic system's sustainable development has been developed.

Core indicators were calculated and initially interpreted for Denmark, Sweden, Finland, Latvia, Lithuania and Estonia in 2019.

Based on the results of the analysis of Latvia's sustainable development strategy until 2030 and the presented changes in the values of the indicators, it is rather difficult to draw up a general unified picture of Latvia's movement towards sustainable development. The analysis shows that the achievement of the strategic goals of *Latvia 2030* would be very difficult without any serious internal and external incentives.

The new methodology can become the basis for building a future development strategy for both the country as a whole and each region separately.

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