Concepts of sustainable development in ecological and economic systems

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Abstract. This article focuses on the perspectives of ecological and economic systems to contribute to sustainable development goals. The main idea of this research is to describe the meanings of ecologic and economic systems for the realization of sustainable development ideas. One of the main assumptions relies on the interconnection of social, economic and environmental contexts that form such systems and create sustainable challenges in different areas to deal with. Therefore, this article, first, analyzes the phenomenon of urbanisation and the risks for the realization of sustainable ideas through the context of megapolises. Secondly, the article concentrates on the migration phenomenon and represents the ways that foster or block the realization of sustainable solutions. Thirdly, the article explains the risks in the area of consumption with its changing trends, attitudes and system of values within the growing attention to the sustainability discussion. Special attention is given to the category of balance in sustainability that is, if destroyed, hampers the realization of sustainable strategies.

1 Introduction

The discussion on sustainable development and necessary social, technological and economic changes still plays a significant role in the global world. Various approaches to ecological and economic systems receive the implication in the cases of global and local companies. Social and economic scholars contribute research results to the ideas on how to deal with sustainable challenges. In these conditions, the main question that still requires a thorough answer is the question of an appropriate balance – between sustainable pillars, of needed resources and human needs as well as possible solutions and negative environmental impact.

The concept of sustainable development can be understood as the governance of social, economic and ecological resources with their potential utilisation in the form of goods and services. The sustainability discussion is not a new phenomenon in the global discourse; for

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several decades scientists, politicians, and opinion leaders have disputed regarding the best ways to overcome environmental decline caused by human activities. The population growth of the XXth century needs today the instruments of stabilisation as far as it concerns excessive resource usage. The biodiversity loss due to air and water pollution affects the agricultural economy and production systems. The problem of industrial and domestic waste is discussed at the level of international institutions as far as human beings live in a world where all the elements are interconnected and influence each other.

However, these actions are still insufficient to implement necessary sustainable changes in the long-term perspective. The problem of balance in sustainable actions and solutions, in resource and instruments distribution, and in time- and money-related approaches deserves adequate attention from the global community.

This article aims to open the discussion on the category balance in sustainable development and presents the perspectives of ecological and economic systems regarding sustainability. Therefore, the article, first, analyzes the phenomenon of urbanisation and the risks for the realization of sustainable ideas through the context of megapolises. Secondly, the article concentrates on the migration phenomenon and represents the ways that foster or block the realization of sustainable solutions. Thirdly, the article explains the risks in the area of consumption with its changing trends, attitudes and system of values within the growing attention to the sustainability discussion.

2 Methods

As it was declared in the Brundtland Report [1], the world population growth and rapid economic development caused critical structural global changes. The population growth resulted in heavy resource consumption and waste production; obvious consequences of these processes are environmental and domestic pollution, biodiversity reduction, and environmental degradation. Furthermore, the depletion of natural resources and food shortages in some territories lead to the deterioration of the physical and mental health of people, worse life qualities and social tension. Such global problems as climate change, the greenhouse effect, ozone depletion, air and water pollution, and loss of biodiversity concern local communities, businesses and individuals. Environmental stress in all ecological and economic systems signifies global environmental unsustainability.

Almost uncontrolled economic growth, technological innovations, in some cases endangering the environment, global corporations expansion and protection of their interests by governments, overconsumption and creative marketing tools resulted in changes at the global and local levels. Such drivers to social, environmental and economic unsustainability encourage different scholars to define necessary reforms or sustainable alternatives, to suggest long-term environmental strategies, and to stimulate economic and ecological integration with qualitative (institutional level) and quantitative (economic level) changes. To deal with sustainable challenges and environmental decline, it is necessary to talk about global systems or ecosystems with interconnected elements that influence each other.

An ecosystem is understood as an entity of various living organisms; they constantly interact with each other and their environment. As a result of these interactions, an ecosystem receives a stable structure. In the economic system, there is an organized structure of productive forces that transform materials and energy into consumer products and production waste. So, ecological and economic systems as an economy of any region or territory are interconnected as far as they share and interchange some resources. Furthermore, this area of interconnections should be regulated and controlled to prevent some kind of imbalance.

Some scholars suggest that ecosystems as complex networks can be differentiated through three categories [2; 3]. Firstly, natural parts such as oceans, wetlands, and forests; secondly, domesticated or man-subsidised as agricultural land, aquaculture or woodland.
Thirdly, fabricated or fuel-powered in cities, industrial areas and airports. Natural systems can reproduce themselves; domesticated and fabricated need some external support for this process. It is crucial to denote that only the third type is highly dependent on life-supporting systems such as natural resources. Therefore, if natural resources are harmed or restricted, the successful operation of fabricated systems is in danger, too. In other words, the negative environmental impact of human activities destroys the life-supporting systems themselves causing environmental stress.

Other scholars emphasize the necessity of applying the systems approach to sustainability [4; 5; 6]. This approach can define the areas to influence as, for instance, biological systems (diversity, resilience, renewable resources), economic systems (fulfilment of basic demands, goods and services quality improvement), and social systems (equity, social justice, efficient institutions). In this way, sustainable development can be defined as an intersection of all these areas with precise goals and missions. Moreover, it is necessary to include territorial, legal, socio-cultural and technological characteristics of every case to implement successful practices of sustainable development management.

In these circumstances, systems thinking becomes a significant skill on the way to reconsidering sustainable and unsustainable practices. All cultural, social, and economic processes as global systems are understood as a set of interconnected elements that form a certain integrity, and unity; besides, the interaction of any system with the environment additionally represents its integrity. Moreover, each system is determined by some structure (elements and relationships between them) and behaviour (change of the system over time). Systems thinking as a part of interdisciplinary approaches to global problems allows us to define global trends that disrupt the natural balance of natural and social systems and observe and investigate various social, economic and ecological systems of different scales and characteristics.

However, the problem of many approaches to sustainable development is the lack of attention to the category of balance. Some hypotheses are socially or environmentally unsustainable; others demonstrate the conflicting nature of approaches due to several social, spatial or temporal inequalities regarding resource usage. It is clear that environmental issues are too complex for a single solution; they produce scientific uncertainty and require correct managerial instruments on the way to sustainability.

Sustainable policies can become effective instruments to maintain and enhance the ecological and economic systems, for instance, for sustainable land use planning, re-vegetation of marginal lands, control of air and water pollution, application of renewable energy sources and methods of waste recycling [7; 8]. It can also improve environmental laws and stimulate environmental education at different levels. Nevertheless, policy-makers cannot define a common solution for population decrease and sustainable resource management.

Generally, the categories of balance and responsibility for thinking and acting can function as moral principles on the way to sustainable development [9]. The aim to harmonize social, economic and environmental pillars of sustainability concerns the balancing practices that include the cooperation of businesses, government, science and local communities. Socially responsible behavior and thinking create an atmosphere of public trust, and sharing common values; it also improves the results of sustainable management and regulation of the social and ecological economic systems.

3 Results

The main goal of this paper is to consider the examples of interaction between ecological and economic systems regarding their role in sustainable development. The phenomenon of ecological and economic interaction represents key sustainable challenges to satisfy the needs
of the present generation without harming ecosystems for future generations [10]. To determine the potential of ecological and economic systems to fulfil the needs of present generations, it is necessary to deal with risk management and various indicators that clarify the present condition of different systems.

The idea of finding the proper balance in sustainable development concerns various factors. Some researchers emphasize different business models as greening strategies to choose [11; 12]. Other researchers focus on particular cases of urban sustainability: they investigate the balance between sustainable challenges (social, economic, cultural and environmental) and urban conservation strategies [13]; between urban sustainable development, human welfare and resident happiness [14]; between different indicators of sustainability applied to various urban and rural areas [15].

Furthermore, modern ecological and economic systems today are changing too quickly, therefore, it becomes more and more complicated to manage them and develop new strategies to apply. Such changes constantly create problems with balance at the institutional, functional or territorial levels. Talking about ecological and economic systems, it is possible to define two types, global and regional (local). Under the framework of sustainability, there is a need to switch from economic systems to ecological-economic systems as far as the environment, human beings and economics exist in strong relationships.

Therefore, it is necessary to talk about the management of the ecological and economic systems that should include a set of administrative, economic, socio-political, psychological, and ethical methods and tools for dealing with social, economic and environmental challenges. In these conditions, it is crucial to include in the analysis the character of environmental products and services, the characteristics of reproductive processes in environmental management, and the specifics of market relations in the environmental sphere.

3.1 Risks of urbanisation

One of the main sources of environmental degradation and damage is the process of urbanisation. On the one hand, cities as ecological and economic systems are connected to technological development, labour market specialisation, industrial growth, digitalisation and better life quality; on the other hand, it results in overpopulation, overconsumption and social disconnection. Modern cities produce additional ecological pressure on the environment [16]; by demanding various resources from nature, citizens produce a lot of waste that destroys the ability of nature to reproduce itself. Unplanned urban processes and irrational resource usage are the characteristics of modern urban agglomerations. As a result, the balance between the environment, economy and society is endangered which concerns the global state of the urbanisation process [17].

As the switch from traditional to modern society with market relations as a basis, urbanisation redefines the relationship between human beings and nature. Due to the concentration of various industries and manufacturing in megapolises, the air quality in some areas is lower than recommended for health issues; besides, automobilisation adds certain air pollution, too [18]. In the same way, water resources near big cities are often polluted due to extended industrial and domestic usage as well as uncontrolled or even illegal industrial waste [19]. It leads to water resources scarcity in megapolises.

Another huge problem in megapolises is domestic waste and the possibilities of recycling. The problem of waste utilisation is even more complicated as far as many modern materials are not easy to recycle or even impossible to recycle or reuse (e.g., composite plastics). Therefore, this waste decomposes at the landfill or gets burned which leads to further water, soil and air pollution [20].
Noise pollution is one of not obvious sustainability challenges but it has a very serious influence on the physical and mental health of citizens [21]. The presence and localisation of private autos, public transportation, train stations or airports close to cities create the noise pollution map that establishes the indicators of comfort and discomfort in a city. In the same way, city light pollution, or excessive use of artificial outdoor light at night, disrupts the natural wildlife patterns and human sleep cycles [22].

One question that concerns both sustainability and urbanisation is the problem of adaptability and sustainability of office and trade buildings [23; 24]. With the process of urbanisation and migration of people from small places to big cities, there was a need to build various office and trade buildings. The development of e-markets within the digitalisation of many services led to the independency of physical company offices from any territory. In other words, big and small companies do not need anymore an obligatory office space; they can exist in the digital world. The same story happens with consumer markets and shopping centres; as far as shopping today goes more and more often online, there is less need for countless shopping malls everywhere. Furthermore, the COVID-19 pandemic with social distance restrictions and home offices influenced the perception of spaces; so, many workers after the quarantine did not want to return to offices. Therefore, there is a problem of abandoned or unused spaces (from offices or shopping centres) in megapolises that becomes a problem of unsustainable resource usage.

These are just a few examples of imbalance of the components of ecological and economic systems in the context of urbanisation. The summary of these ideas is presented in Table 1 below.

<table>
<thead>
<tr>
<th>Balance dangers in cities</th>
<th>Potential for balance policies in cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Air pollution</td>
<td>At the public level, to regulate emissions of toxic air pollutants; at the individual level, to change your daily routine practices as driving a car, limit backyards fire in the city, plant and care for trees</td>
</tr>
<tr>
<td>2 Water pollution</td>
<td>At the public level, to apply water quality management, build appropriate infrastructure, improve sanitation, sewage treatment, industrial and agricultural wastewater treatment, erosion control; at the individual level, to use fewer chemicals for cleaning, avoid using pesticides and herbicides, dispose waste properly</td>
</tr>
<tr>
<td>3 Waste disposal</td>
<td>To apply the principles of recycle, refuse, reduce, reuse, repair, re-gift and recover at the individual and public levels</td>
</tr>
<tr>
<td>4 Noise pollution</td>
<td>To define the noise levels in different areas and the spheres of responsibilities; to educate citizens about the danger of improper levels of noise and respect to others</td>
</tr>
<tr>
<td>5 City light pollution</td>
<td>To define the city light levels in different areas and the spheres of responsibilities; to use technologies as dimmers, motion sensors, timers for the outdoor lighting; to educate citizens about the danger of improper levels of city lights and respect to others</td>
</tr>
<tr>
<td>6 Unsustainable use of office and trade buildings</td>
<td>To apply creative approach for urban redevelopment and revival, attract local businesses by creating attractive business offers</td>
</tr>
</tbody>
</table>
3.2 Risks of migration

The question of people’s migration deserves special attention in the context of sustainability and the balance of ecological-economic systems. Among different types of migration, it is possible to broadly define voluntary (e.g., labour, educational, lifestyle) and forced (e.g., emigration, refugees) types. Both types of migration affect environmental, economic and social conditions of the territories from where and where people migrate. This is another example of unbalanced ecological and economic systems.

Generally speaking, if one territory becomes overpopulated (a case of a megapolis), it produces higher demands on the environment to fulfil the basic needs of locals including migrants. In the same way, the abandoned territory while having enough natural resources may not have enough inhabitants to take care of it. Rural-urban mobility of labour migrants affects not only big cities but also those abandoned, left places [25]. The imbalance of demands on the environment in rural and urban areas leads to further environmental decline that multiplies various social, economic and ecological challenges. Stronger environmental pressure, climate change or pollution leads to some ecological transformation and migration of pieces that change the local ecosystem [26].

On the one hand, by making one territory attractive in social, cultural, educational or labour contexts it is possible to cover the basic needs of the area and solve the problems with unemployment, social security or urban decay. On the other hand, increased worldwide mass tourism before and after the COVID-19 pandemic negatively affected local ecosystems, too [27]; it resulted not only in ecological problems (air and water pollution, energy consumption, waste production) but the increase in social intolerance and aggression against tourists [28].

Furthermore, climate change and natural hazards in some regions stimulate compelled human mobility and migration: with the changes in weather, climate conditions, sea level or coastal area local people have to deal with forced displacement [29; 30]. It is significant to mention the question of access to water, food, and energy resources as basic needs in different areas [31]; with the change in population rate, this access can be limited due to the imbalance. In the same way, the cases of forced migration negatively affect the new areas producing environmental overload and ecological pressure [32]. It can always be a concerned as in-country or international migration [33]; the need for regulations at the levels of local municipalities, and regional and national levels stays on the priority list on the way to sustainability.

However, in some cases (such as labour-based or tourism) migration can positively affect the areas [34]. Thus, cultural events, for example, art or gastronomic festivals, can revitalize rural areas, bring income to the local economy and attract further investments to the territory [35].

Table 2 below presents the summary of the above-mentioned ideas.

<table>
<thead>
<tr>
<th>Balance dangers in migration processes</th>
<th>Potential for balance policies in migration processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Labour migration</td>
<td>At the public level, to analyze degrading areas and create for them attractive conditions for labor migrants</td>
</tr>
<tr>
<td>2 Education migration</td>
<td>At the public level, to define the attractive conditions for students to stay after studies or, in contrary, to leave</td>
</tr>
<tr>
<td>3 Lifestyle migration</td>
<td>At the public level, to define the conditions for enter the place (e.g., visa, income, type of activities), to determine local rules and regulations; benefits for local communities</td>
</tr>
<tr>
<td>4 Climate change</td>
<td>To conduct regular studies of endangered areas in order to heal</td>
</tr>
</tbody>
</table>
migration potential problems if possible and prevent unexpected migration

Forced migration
To collaborate with international organizations to help people in difficult life situations

3.3 Risks of consumer patterns

On the one hand, the rise of sustainability discussion at the global and local levels stimulated the change in some consumer patterns; consumers today know more about conscious consumption, ethical production and consumer responsibilities [36]. Moreover, companies aim to attract consumers by implementing sustainable strategies and technologies in the processes of goods production, distribution and marketing. Global rating of the business’s success and consumer loyalty today depend on the companies’ actions towards sustainable development.

Some scholars talk about sufficiency that can bring substantial changes in consumption needed from the sustainable challenges [37]. Some strategies as absolute reductions (reducing the amount of consumption), modal shifts (shifting from one consumer mode to less resource intensive), product longevity (extending product lifespans), and sharing practices (clothes, tools, food) can be applied for the daily routine and result in major sustainable changes in consumer patterns. Such strategies require sustainable leaders, institutional power and adequate policies to apply to each concrete case. However, there might be certain barriers as consumer attitudes and behaviour, culture, the economic system, the political system, and the physical environment that hamper sustainable changes.

Another idea of responsible consumption and a conscious approach to ecological systems defines new consumer values and behavioural models [38]. It affects consumer lifestyle (e.g., informed purchasing decisions, buying local, choosing sustainable brands), shopping habits (e.g., second-hand clothes instead of buying new clothes, reusable shopping bags instead of plastic bags) and, as a result, the profits of different companies [39]. However, there is always a risk that a new ecological market with its trends will become not a sustainable solution but just a fashion fad that leads to overconsumption.

With the development of online markets, the risks of overconsumption increased: the variety of sales, stimulating bonuses, free delivery and other attractive offers activate consumers to purchase more. It results not only in the amount of unnecessary items per household but in energy consumption, air pollution through national or international delivery and waste production itself. At the same time, different online platforms for sharing practices or renting clothes or tools more and more often pop up in different countries. It confirms the suggestion that consumers, in some cases still very slow, but change their standardized unsustainable consumer patterns to more sustainable and responsible.

Table 3 below summarizes the above-mentioned ideas.

<table>
<thead>
<tr>
<th>Balance dangers in consumer processes</th>
<th>Potential for balance policies in consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overconsumption</td>
<td>Define consumer goals; reconsider habitual consumer practices; opt for sharing and second-hand goods if possible; opt for sustainable brands and local producers</td>
</tr>
<tr>
<td>Waste production from unnecessary items</td>
<td>Make a shopping list; prefer long-lasting products of a good quality and higher price; apply recycling, reusing, re-purposing instruments</td>
</tr>
<tr>
<td>Online consumption</td>
<td>Define payment limits; make a shopping list; prefer buying</td>
</tr>
</tbody>
</table>
4 Discussion

The discussion on finding balance seems to be long-lasting due to the variety of concepts, definitions, instruments and approaches. On the one hand, it is possible to assume that any treatment towards finding balance in the ecological and economic systems is already enough to contribute to sustainable development. On the other hand, it is very doubtful to apply general ideas and solutions for each specific case that requires decent timely, intellectual, financial and other resources.

The problem of urbanisation can bring some benefits to the territory as technological advancement, investment in urban development, new labour markets, and urban planning projects. Throughout history, many people wanted to move to a bigger city for better life chances and better quality of life. However, during the COVID-19 pandemic, the new trend of ruralisation (as a migration process from a big city back to a province or a village) attracted attention; it is necessary to declare that this trend was in use by those who already had enough resources, primarily of finances, to change the lifestyle, the character of income and further activities of a megapolis inhabitant.

The problem of migration in the same way can deliver some profits to the territory as well as to the migrants and locals. The bigger problem is the fact that in the modern world of uncertainty, post-pandemic effects, and various political, social and economic conflicts it becomes more and more difficult to predict scenarios of voluntary or forced migration. It primarily affects ecological and economic systems by its instability and unpredicted results.

The problem of overconsumption refers mainly to the developed countries with high consumption classes. These consumers have the choice to follow the traditional pattern of overconsumption (uncontrolled and irrational consumer patterns) or to switch to more trendy conscious consumer stereotypes that sometimes are of a higher price. The possibility of educating wealthy consumers in the sustainable paradigm can define new consumer trends for other mass consumers.

5 Conclusion

This article aimed to analyze the concept of sustainable development regarding the balance in ecological and economic systems. The growing attention to the sustainable discussion does not leave the chance to avoid producing various social, economic and ecological contributions from governmental institutions, businesses, science and technologies as well as local authorities.

First, the article considers the problem of urbanisation from the perspective of risks to the urban and rural areas as ecological and economic systems. Second, the article analyses voluntary and forced migration as the phenomenon that changes territorial, economic, ecological and social contexts for locals and migrants. Third, the article explores modern consumer patterns and attitudes in the context of growing sustainable discussion, overconsumption and conscious practices.

Special attention in this article is given to the category of balance and its contrary part, imbalance, as stimulating, regulating and challenging ideas on the way to realisation practices of sustainable development. The influence of balance and imbalance of resources on
ecological and economic systems determine the possibilities of today's generations to fulfil their demands not compromising the resources for future generations.

References

2. B. Cook, Research in Urbanism Series 7, 177–202 (2021)
9. E. Bikmetov et al, E3S Web of Conferences 420(4), 06031 (2023)
24. R.B. Bouncken, A. Lapidus, Y. Qui, Sustainable Technology and Entrepreneurship 1(2), 100011 (2022)
27. J. Jover, I. Díaz-Parra, Tourism Geographies 24(1), 9–32 (2022)
30. B. Mallick, J. Schanze, Sustainability 12(11), 4718(2020)
32. J. Fleetwood, Sustainability 12(12), 5027 (2020)
35. M. Qu, J. Cheer, Routledge 18–37 (2022)
37. M. Sandberg, Journal of Cleaner Production 293, 126097 (2021)