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Veröffentlichungsversion / Published Version

Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Baklanov, P. Y. (2022). Sustainable development of coastal regions: geographical and geopolitical factors and limitations. *Baltic Region*, 14(1), 4-16. <https://doi.org/10.5922/2079-8555-2022-1-1>

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SUSTAINABLE DEVELOPMENT OF COASTAL REGIONS: GEOGRAPHICAL AND GEOPOLITICAL FACTORS AND LIMITATIONS

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Received 20.06.2021
doi: 10.5922/2079-8555-2022-1-1
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Having formed at the end of the 20th century, the concept of spatial development retains its relevance today. Yet, it is associated with a range of problems with its practical implementation and theoretical vindication, especially at a regional level. Attaining sustainable regional development, understood as a steady progress balanced across the economy, social industries and environmental protection, has been deemed impossible without identifying and considering regional development factors, such as geographical and economic-geographical position, environmental conditions and their geographical diversity, natural resource and their location, spatial features of the economy and the settlement structure. Coastal regions are affected by sundry other factors, such as the presence of a seacoast, viewed as a special resource, access to maritime transport and the availability of marine resources, including renewable ones, which are essential for sustainable development. The geopolitical situation of a region and the components of this situation are considered as geopolitical factors. Other limitations include extreme natural processes and events (large waves, tsunamis, typhoons etc.) The article aims to show that an integral geographical system or a combination thereof covering a region should be considered as the most appropriate object for assessment, planning and management of sustainable development, which is based on regional nature management including water and land resources. It is proposed that sustainable development criteria include economic, social and environmental metrics of regional development. Strategic marine and spatial planning and the monitoring of regional environmental management and development are identified as principal tools for attaining and maintaining sustainable development.

Keywords:

water and land region, integrated geosystem, coastal zone, sustainable development, geographical factors, natural resources, geopolitical situation, strategic planning, monitoring

To cite this article: Baklanov, P. Ya. 2022, Sustainable development of coastal regions: geographical and geopolitical factors and limitations, *Balt. Reg.*, Vol. 14, no. 1, p. 4–16. doi: 10.5922/2079-8555-2022-1-1.

Introduction

The substantial development paradigm was propounded in the early 1990s, and it rapidly gained currency across the world. Many countries, including Russia, have adopted legal acts and programme documents to stimulate development based on sustainability principles. Yet, the research component of the problem has received little attention, particularly at a regional level. The principles, mechanisms and indicators of sustainable development require a theoretical underpinning. This also holds for its goals and ways to manage and achieve them. The practical implementation of sustainable development lacks a research rationale as well. It is widely accepted today that sustainable development presupposes steady qualitative and quantitative socio-economic increments, qualitative ecological improvements at a national and regional level and balanced development of territories [1–17]. Despite the applicability of this approach to the sustainable development of regions, there is significant local variance in initial problems, limitations, geographical and other factors and ways to attain sustainable development, observed in continental, coastal and transboundary areas [4; 6; 7; 9–13; 16–18]. Various factors are of equal importance for regions: social (necessary for upholding living standards and maintaining a sufficient size and optimum structure of the population); economic (resources for effective economic growth); innovative (required for a qualitative upgrade of technology, goods and services); environmental (preservation of natural resources and the environment). The geographical factors exhibit spatial variability. Amongst them are the geographical and economic geographical situation, the location and availability of natural resources, environmental conditions, economic and settlement structures. All these factors impinge on the efficiency of the social, economic and environmental components of sustainable development. And in coastal regions, they are even more complex and far less investigated.

This article aims to demonstrate the need for describing an integrated geographical system or a region-wide combination of such systems, which is the most adequate object for assessing, planning, managing, achieving and maintaining sustainable development. At the same time, the ultimate basis for regional sustainable development is regional environmental management, including the mobilisation of water and land resource combinations and the creation of spatial environmental management structures. The latter requires considering the interaction of geographical factors within such an integrated system, these factors having specific features in coastal regions. Geopolitical factors, such as the geopolitical situation and transboundary status, dramatically affect the long-term development of coastal zones. Their effect is more pronounced in the case of coastal regions than inland territories. This difference is also addressed in the article.

State of research, materials and methods

There is ample literature on sustainable development in different countries and regions. Although the general principles and goals of sustainable development, as well as applicable approaches, have received considerable scholarly attention [1–19], some of the studies also stress the importance of a geographical approach and the contribution of geographical sciences [4–7; 9–12; 16; 17; 19]. The central methodological principle of sustainable development — in both national and regional terms — is achieving a balance between economic, social and environmental aspects [4; 6; 7; 10; 11; 17]. Yet, the non-linear cyclic character of regional development complicates striking this balance [17; 20]. And it is essential to provide a rationale for different measures, or indices, of sustainable development [5–7; 15; 17; 21; 22]. Researchers have also looked at the character of sustainable development in urban areas distinguished by a dense population and a vigorous economic life [7; 9; 11; 17; 23] and rural areas, where natural resources occupy a decisive role [7; 9; 11; 16; 24]. Another major area of research is the exploration of sustainable development in closed communities of coastal zones [25]. There is a consensus that strategic planning, particularly multi-level spatial planning [7; 17; 27], is the key to achieving and maintaining sustainable development at a national or regional level [26]. Marine planning is of vital importance for coastal regions [28–30]. Regional development modelling, which, among other things, may use the balance sheet approach, has also been described as a pressing need [10, 31]. Despite this, a rationale has not been framed for treating integrated geographical systems as a comprehensive object for the analysis, assessment and calculation of sustainable development scenarios. In the case of coastal regions, such geosystems should include land-sea components. The sustainable development of coastal regions is more susceptible to geopolitical factors than that of inland territories, and this effect remains poorly understood [32].

This article uses the relevant literature and regional development programs, employing the methods of geographical zoning, comparative and geosystem analysis and the geographical forecast approach.

Results and discussion

Studies into the problems of regional sustainable development [4; 7; 9; 11; 13; 14; 15–17; 20 etc.], including those carried out by the author of this contribution [6, 10], demonstrate that attaining sustainable development that is balanced in terms of the economy and the needs of the social sphere and the environment requires that the following conditions be met at the stage of devising long-range programmes.

1. It is necessary to analyse the natural, resource, environmental and socio-economic structures of an integrated geographical system, i. e. to consider the geosystem containing the region of interest in its entirety.

2. There is a need for long-term data on the geosystem, including those for the retrospective and horizon periods.

3. It is also essential to model the structure and dynamics of an integrated geosystem and calculate a balanced scenario for its sustainable development. Then, a model of the sustainable development of a region can be created as a harmonious image of a region's future.

4. Implementing a regional sustainable development model should be a seamless combination of strategic planning and current operations management. At the same time, the object for analysis, modelling, calculations, planning and management should be an integrated geosystem, or a combination of such systems, embracing the whole area of interest, which can be, for example, a Russian region.

5. The analysis, calculations, modelling, planning and management are impossible without vast information, systematised and territory-specific. It could be presented in the form of a regional geographic information system. There is also a need for constant updates obtained by monitoring changes in the geosystem structure and calculating various scenarios.

6. Finally, a sine qua non of sustainable development is a regional monitoring system focused on regional environmental management [33].

The concrete (and interrelated) objects of the monitoring are geographical factors and their development in time. The factors such as geographical position, economic-geographical situation and environmental conditions are relatively stable, changing little over time; yet their effects on regional development are conditional upon other, less stable factors.

The exploitable natural resources of a land or water area are more volatile, affected by natural and anthropogenic processes. The latter include resources extraction and management, as well as industrial impacts. Although generally inert, spatial economic and settlement structures can change substantially as they function and develop.

In coastal regions, all these geographical factors possess specific characteristics influencing the achievement and maintenance of sustainable development (Table 1).

Table 1

**Characteristics of enabling and constraining geographical factors
in the sustainable development of coastal regions**

Geographical factor	Characteristics observed in coastal regions
Region's geographical and economic-geographical position	Unlimited access to the open sea; a vast shoreline and coast as specific natural resources; contact structure and functions in the land-sea zone
Natural conditions and their spatial variability	Marine influence, including extreme natural events and the impact of the monsoon marine climate on coastal areas
Exploitable natural resources, their location and variations	Access to various marine resources, including renewables; possibilities for merging marine and coastal resources
Established spatial economic and settlement structures	The pivotal role of coastal socio-economic centres; possibilities for developing marine industries, including maritime transport and marine recreation

Coastal regions have characteristic contact structures and functions in environmental protection, natural resource management and socio-economic activities. Consequently, land-sea structures emerge in those areas [10; 13; 17; 33]. Therefore, the most comprehensive objects for analysis, modelling, planning and management are sea-land regions comprising coastal areas and 200-nautical-mile exclusive zones. The common geographical space of such a region is considered an integrated geosystem consisting of closely interrelated and interacting land geosystems, land-sea geosystems and marine geosystems.

Table 2 shows factors enabling and constraining the achievement of sustainable development in coastal regions (Table 2).

Table 2

**Factors constraining and enabling the sustainable development
of coastal regions**

Problems and limitations	Benefits and advantages
Negative impacts of extreme marine events (high waves, tsunamis, storms typhoons, etc.)	Availability of various marine resources (biological, recreational, energy), including renewables
The need for coastal reclamation and costly shore protection works; large budgets for deep-water port construction	Cheap maritime transport; access to domestic and international markets bordering on the water area
Hard-to-break sea ice and low temperatures in the Arctic regions	Shorter legs of the Northern Sea Route, which are easier to access from land

Sea-land zones and geosystems, as well as networks of coastal settlements, have a decisive role in sustainable development. On the one hand, they induce the exploration and use of marine resources; on the other, they provide a link between the marine and land geosystems and their structures, including those pertaining to the marine economy [10; 13; 33; 34].

Therefore, I propose distinguishing several spatial levels: zones and districts utilising marine resources and marine economy opportunities to a varying degree (Table 3). The key criterion here is the distance from the seacoast.

Table 3

Parameters for coastal area zoning

Spatial zoning levels	Generalised zone width (distance from the coast)	Factors affecting sustainable development
Coastal zone	The area within 50 km from the sea with coastal centres and settlements	Shoreline features and coastal marine resources; natural resources within the 200-mile zone; the socio-economic capacity of coastal settlements as a foothold for the exploration of marine resources and development of maritime transport
Belt of base-level coastal districts	The area within 100 km from the sea (within the boundaries of coastal municipal districts)	The identification and description of water-land natural resource systems and management structures; integrated geosystems; socio-economic capacity of settlements lying farther from the coast
Belt of meso-districts within federal territorial units of Russia	The area within 300 km of the sea (within the boundaries of coastal regions)	The socio-economic capacity of coastal zones (regions); exploitable natural resources and changes in their availability; capacity for infrastructure development; division (including physiographical) of the region and adjacent water areas; natural resources, environment and geography, socio-economic conditions in base-level districts; analysis of economic priorities of base-level districts and settlements

Regional natural resources management and its spatial structures play an essential role in the sustainable development of coastal regions [33]. The fundamental principle here should be the preservation of sufficient natural resources in both coastal and marine geosystems over as long a period as possible. Thus, the

primary objective of monitoring regional natural resources management should be tracking changes in the availability of natural resources of terrestrial and marine geosystems, exploited to enhance regional socio-economic development.

In earlier works, I demonstrated that coastal and marine natural resources are not isolated but linked by multifarious ties and relationships forming sea-land natural resource combinations and systems [13; 33]. Changes in the availability of one natural resource (for instance, its extraction) within an integrated geosystem affect other related resources, sometimes through interresource connections and mechanisms of the geosystems.

To assess accurately and control the balanced dynamics of the natural resources of a sea-land region in their entirety, it is crucial to cover all possible coastal and water-and-land combinations, interresource connections taken into account. It seems that the close interresource connections existing in integrated geosystems are the objective reason why private ownership of selected natural resources and zones of their occurrence (including marine resources) is incompatible with sustainable development. Therefore, coastal and sea-land natural resource systems should be the principal focus of analysis, planning, and exploration, as well as the object of property relations.

The prime social goal is to reduce income inequality and disparities in the quality of life at a national and regional level. In the context of sustainable development of coastal regions, communal ownership seems to be the most effective, benefitting the extensive exploration of natural resources. This conclusion applies to coastal and marine resources and their various combinations.

Geopolitical factors also have a profound impact on achieving and maintaining sustainable development. The most influential of them is the geopolitical situation [32]. Table 4 shows elements of the geopolitical situation and their features in coastal regions.

Table 4

**Elements of the geopolitical situation and their features
in coastal regions**

Elements of the geopolitical situation	Features characteristic of coastal regions
Neighbourhood with foreign regions	Neighbourhood through water areas; territories may share both land and sea boundaries
Differences and similarities in the geopolitical capacity of neighbouring states	Important components of geopolitical strength are natural resources and possibilities for transport and transit services within the 200-nautical-mile zone (including the untapped potential).

The end of table 4

Membership in an international transboundary region	Inclusion of coastal regions in transboundary sea basins; the need to establish geopolitical relationships regarding joint management of marine resources with countries having access to the sea
Neighbouring states' geopolitical interests and issues in the region	Actual or potential geopolitical interests and issues, usually relating to the management of marine natural resources, transport/transit services and disputed borders

According to combinations of geographical and geopolitical factors in sustainable development, Russian coastal regions can be classified as follows:

- 1) coastal regions with access to landlocked seas (Caspian regions);
- 2) coastal regions that are part of transboundary basins of southern seas (the Black and Mediterranean);
- 3) north-western coastal regions comprising transboundary basins of the Baltic, Barents and White Seas;
- 4) coastal regions with access to the Arctic seas: the Kara, Laptev, East Siberian and Chukchi;
- 5) regions of the Russian Far East included in the transboundary basins of the Chukchi, Bering, Okhotsk Seas and the Sea of Japan. These regions benefit from the natural resources and the transport/transit capacity of the North Pacific and access to the Pacific markets; these regions comprise Pacific Russia [13; 29].

The principal tool to attain and maintain sustainable development in coastal regions should be strategic planning covering land and water areas. It is essential to use the already existing approaches and methods of hierarchical spatial planning and adopt new marine spatial planning approaches [28–30]. Particularly, coastal-marine space segments should be treated as the primary object of marine spatial planning [29]. Overall, strategic planning should build on a preparatory description and analysis of various regional development options, from which the most effective should be selected.

It is worth noting that the strategic planning of balanced sustainable development is incompatible with private ownership of large economic objects since private businesses seek to maximise profits. Sometimes capital generated in one district, using its infrastructure, natural, social and R&D resources, is invested in other districts and even countries. Such movement of capital, which is beyond the reach of regional strategic planning, is detrimental to the economic dimension of sustainable development.

I propose to employ indicators of regional economic, social and environmental progress as integrated measures of sustainable development [6; 10]. Qualitative economic and social indicators show qualitative and quantitative increments in regional economies and social industries, whilst the quality of the environment is

a measure of environmental improvement and changes in renewable and non-renewable resources. Such criteria should be applied when considering options for regional strategic planning, including spatial and marine, and choosing the most effective one.

A full account of geographical and geopolitical factors in regional development requires several steps. Those described below were formulated for Pacific Russia but apply to other regions as well.

1. Scenario projections and calculations for long-term development programs and regional strategic planning and management should consider Pacific Russia as a coastal-marine region including the 200-nautical-mile zone and its exploitable natural resources. Long-term regional development documents should take advantage of modern geographical information systems whilst identifying and analysing combinations of geographical and geopolitical factors for selected spatial zones.

2. Long-term development documents consider the region as one of strategic national importance since it is where Russia fronts on to the US, China and Japan — countries of considerable geopolitical power [32].

3. It is advisable to use a range of tools to speed up advanced and sustainable socio-economic and innovative development.

4. There is an urgent need for reliable massive investment in infrastructure, coastal and marine resource processing and the social industry. It may be useful to establish a private-public partnership standard: at least 50 per cent of investment in priority projects and activities on land and water has to be made by the state. This rule seems particularly important for marine resources and the economy.

5. Greater incentives are needed to prevent population decline in the region.

6. Each transboundary region requires international programmes for sustainable development and long-term international agreements on the coordination of efforts towards sustainable development and natural resources management.

7. Another crucial step is monitoring regional natural resources management and sustainable development to ensure social, economic and environmental progress and make an international statement of Russia's high living standards and amicable intentions.

Conclusions

Coastal-marine regions — combinations of integrated land, sea-land and marine geosystems — should be the principal object for assessments, analysis, strategic planning and sustainable development management in coastal regions.

There is a pressing need for simulating regional dynamics to calculate scenarios and choose a model that best ensures sustainable development. Calculations and analysis should be carried out at various hierarchical spatial development levels within selected zones and settlements.

Strategic planning requires vast information on neighbouring regions and geosystems. And it is equally essential to employ geoinformation and digital technology. In coastal areas constituting a transboundary region, for instance, a transboundary-river or marine basin, it is necessary to keep track of different types of information across the transboundary region. This need is explained by the close ties forged during the functioning and development of individual parts of transboundary regions and geosystems [10; 13; 18].

It is recommended that regional monitoring of sustainable development be performed within a digital geographic information framework. Another pressing need is to model scenarios for regional integrated geosystems. Of crucial importance is monitoring regional environmental management, analysing and harnessing geographical and geopolitical factors.

Global climate change poses new challenges to the sustainable development of coastal regions: melting permafrost, coastal flooding, etc. Yet there are beneficial effects too, such as better conditions for navigation. Therefore, the role of geographical factors in the sustainable development of coastal regions is growing.

Overall, the paradigm of national and regional sustainable development, which originated in the 20th century, remains attractive to this day. Its practical implementation, however, is impossible without the political and economic systems of many countries undergoing a substantial transformation.

The research was supported by the Russian Foundation for Basic Research, project No. 18-05-80006.

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