

## **SUSTAINABLE DEVELOPMENT POTENTIAL OF AN OLD INDUSTRIAL REGION: THE CASE OF UKRAINE**

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**Abstract:** The significance of this study is in the interpretation proposed by the authors of the definition of 'sustainable development potential of an old industrial region'. The authors have identified and systematised the main components of the sustainable development potential of an old industrial region according to the main classification attributes such as finance, ecology, food security, sociocultural state, infrastructure, marketing of the region, and industrial production potential. The article has a theoretical character and is based on system-structural methods, comparative analysis, graphic method and logical generalization synthesis, induction and deduction, and dialectical and SWOT analysis. The features of the sustainable development of an old industrial region are the concentration of cities around large industrial agglomerations, environmental pollution, and the use of Industry 3.0 and Industry 2.0 obsolete technologies in industrial production. It has been proven that the complex problem of modernization in old industrial regions of Ukraine by transitioning to Industry 4.0 technologies requires necessary decisions to be taken at the level of state and local authorities, as well as the level of industrial owners.

**Keywords:** decentralization, industrial production, Industry 4.0, modernization

**JEL classification:** O18, O31, Q01, Q56, R11

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## Introduction

An old industrial region is an area that was industrialised in the past but is now in decline or has already fallen into decline. This was due to the lack of capacity or unwillingness of the owners of industrial enterprises to invest in the modernisation of production facilities; significant lagging of the applied production technologies behind the modern innovations of technological progress; lack of adaptability to the steady market changes of industrial products, etc. However, ensuring the innovative development of old industrial regions is an urgent task for countries where the contribution of industry to the GDP is significant. Based on the sustainable development paradigm, the old industrial region needs innovative solutions in the economic, environmental and social spheres, which would provide prerequisites for the modernisation of economic relations, territories, environmental protection, infrastructure, industrial production, etc. Therefore, the problem of researching the main determinants of sustainable development in an old industrial region is relevant.

The research is based on the main scientific works which developed solutions to the problems of development of old industrial regions. Thus, the monograph by O. Novikova et al. (2012) identifies the basis for sustainable development of Ukraine and its industrial regions in the context of social and human development. Some ways to solve the problem of corruption in the innovation clusters of China's old industry regions are suggested by C. Gebhardt (2017). The paper by A. Yevdokymova et al. (2017) identifies the main social, economic, environmental, institutional, and legal foundations and prerequisites for sustainable development in Ukraine, describes the international and national regulatory framework, as well as the necessary conditions for the transition of Ukrainian society to the implementation of sustainable development at all levels of public life. O. Snihova (2018) found that it is advisable to use the German experience in the structural reorganisation of old industrial regions in Ukraine based on the implementation of the "postindustrial synthesis model", and justified the need to establish this model in the old industrial regions of Ukraine. O. Amosha et al. (2018) proposed the application of the smart specialisation concept in old coal mining regions to implement a strategy for their future sustainable development and developed recommendations on how to ensure that the institutional environment in such regions of Ukraine is consistent with the proposed concept. L. Li et al. (2020) proposed the concept of regional economic resilience to analyse the economic transformation of old industrial bases in Liaoning Province, China. O. Kudrina et al. (2020) noted the importance of a systemic innovation policy to introduce the development and adoption of a new system of priority directions for science and innovation, focused on achieving the Sustainable Development Goals by detailing the technologies or dimensions of sustainable development. A useful study is that of R. Hassink & M. Kiese (2021), who analysed the successful case of Ruhr, an old industrial region in Germany, which has overcome the problems of restructuring and deindustrialisation through a smart specialisation strategy. I. Petrova (2021) analysed the institutional provision of international-public-private partnerships to achieve the goals of sustainable development of old-industry regions; proposed the establishment of a Centre for International-Public-Private Partnership

as an independent expert body to prepare, organise, and support international-public-private partnership projects as well as support public administration and business bodies. Yu. Kharazishvili & V. Lyashenko (2021) quantified the influence of innovation factors on economic development dynamics and determined their endogenous contribution to economic growth in general and old industry regions in particular.

The research is also based on the problems studied in the previous works of the authors (Biloshkurskyi, 2013; Biloshkurska, 2015). However, the problem of systematization and classification of the main determinants of sustainable development of old industrial regions is poorly studied and requires further development.

The aim of the article is to systematise the components of the sustainable development potential of an old industrial region and ways to modernise it.

## Methods

To achieve the aim of the article, a combination of general scientific and special methods of scientific cognition was used, which made it possible to achieve the unity of scientific research. The investigation of theoretical and applied aspects of forming the components of the potential for sustainable development of an old industrial region was carried out using the following methods:

- logical generalization, synthesis, induction and deduction in clarifying the conceptual apparatus;
- dialectical and system-structural methods in the analysis of approaches to understanding the economic nature of the sustainable development potential of the old industrial region and its components;
- comparative analysis to clarify the approaches to the formation of the condition of transition of the old industry to Industry 4.0 technologies;
- graphic method to visualize the structure of sustainable development potential of an old industrial region;
- SWOT analysis to identify the strengths, opportunities, weaknesses, and threats to the modernization of old-industry regions based on Industry 4.0 in Ukraine.

## Results and Discussion

The sustainable development paradigm implies a dynamic process of evolutionary positive change to balance economic, social and environmental modernisation. It should form the basis for shaping approaches to solving the problems of the old industrial region. This is especially relevant in Ukraine when the decentralisation reform of power is coming to an end, when the economic reforms are being transferred to the regions and their role in the implementation of the economic, social, and environmental policy of the state is being strengthened. Therefore, the basis for the sustainable development of an old industrial region is its potential.

The sustainable development potential of an old industrial region is a rather complex and multidimensional concept with the following characteristics:

- the volume and types of resources of the region that are used or can be used;
- the capacity to meet societal needs;

- the capacity to function effectively within a sustainable development framework;
- the ability to identify and tap untapped sources of development in order to ensure the effective functioning of the territory (Shevtsova et al., 2020).

To effectively ensure the sustainable development of an old industrial region, the main components of its potential are identified according to such classification attributes as finance, ecology, food security, sociocultural state, infrastructure, marketing of the region, and industrial production potential (Figure 1).

Decentralisation of power authority is a key area of state policy for regional development (Zhalilo et al., 2019), as well as the basis for the modernisation of old industrial regions in the context of their sustainable development. Financial decentralisation is the basis for the financial component of the sustainable development potential of an old industrial region, which strengthens financial autonomy and allows for greater implementation of targeted development programmes and strategies by depositing more tax revenues in local budgets. Credit and insurance institutions play an important role in the financial component of the sustainable development potential of an old industrial region, providing uninterrupted financing for industrial operations and minimising the risks in industrial production. An external aspect of the financial component of the sustainable development potential of an old industrial region, which objectively exists and affects positively in the growth phase and negatively in the decline phase, is the cyclicity of the economy.

The main aspects of the environmental component of the sustainable development potential of an old industrial region are natural and climatic conditions, environmental protection activities, the level of technogenic pollution, the volume of pollutants emitted into the environment, and waste management. It is the environmental component that determines how safe the environment is for the inhabitants of the old industrial region.

Aspects of the food component of the sustainable development potential of an old industrial region, on which the physical livelihood of the population directly depends, are the state of the agro-industrial complex, the development of the food products trade network, the activities of agribusiness processing enterprises, and the activities of vertically integrated complexes.

Aspects of the sociocultural component of the sustainable development potential of an old industrial region include employment and unemployment, interethnic and interreligious relations, the development of the social sphere and the network of educational, scientific, cultural and artistic institutions, the qualifications of the labour force, and the activities of public and charitable organisations. The harmony of demographic processes in the old industrial region depends on the balance of all these aspects.

**Components of the sustainable development potential of an old industrial region:**

**Financial component:**

- financial decentralisation;
- financial autonomy;
- targeted development programmes and strategies;
- activities of credit and insurance institutions;
- macroeconomic (un)stability.

**Environmental component:**

- natural and climatic conditions;
- environmental protection;
- anthropogenic pollution;
- emissions of pollutants;
- waste management.

**Food component:**

- the state of the agro-industrial complex;
- state of the trade network;
- activities of processing enterprises;
- activities of vertically integrated complexes.

**Socio-cultural component:**

- employment of the population;
- interethnic and interreligious relations;
- development of the social sphere;
- network of educational and scientific institutions;
- qualification of labour force;
- cultural and artistic institutions;
- activities of public and charitable organizations.

**Infrastructural component:**

- market infrastructure;
- condition of roads, railways, airfields, ports;
- availability of communication facilities, internet, telecommunications.

**Marketing component:**

- branding of the region;
- recognition of the region in social networks and media;
- availability of tourist magnets.

**Industrial production component:**

- availability of production facilities;
- availability of mineral resources in the region;
- regional dependence on natural monopolies.

**Figure 1. Components of the Sustainable Development Potential of an old industrial region**

Source: Own study Formed by the authors based on (Du Plessis, & Bam, 2018, p. 16)

The development of market infrastructure, the condition of roads, railways, airfields, ports, availability of communication facilities, internet, and telecommunications create the basis for the infrastructural component of the sustainable development potential of an old industrial region.

Aspects of the marketing component of the sustainable development potential of an old industrial region, on which its image and the perception by external national and foreign stakeholders depends, include branding success and visibility on social networks and mass media, as well as the presence of tourist magnets.

The aspects of the industrial production component of the sustainable development potential of an old industrial region play an important role in its formation. These aspects include the availability of the production capacity of basic industrial enterprises and their availability of mineral resources. A tangible aspect of the sustainable development of an old industrial region is its dependence on natural monopolies (water supply, energy supply, etc.). Furthermore, the industrial production component of sustainable development in the old industrial region needs measures to modernise industrial production and move it towards Industry 4.0, which is a critical area.

Also, when examining the main components of the sustainable development potential of an old industrial region, the following characteristics should be taken into account.

- the concentration of cities (districts within cities, settlements) around large industrial enterprises and agglomerations, which is a logistical advantage, but becomes a social catastrophe if businesses leave the region;
- a critical state of environmental pollution, and as a consequence, a high morbidity and mortality rate;
- industrial production is based on Industry 3.0 (less often Industry 2.0) technologies, which are morally and physically obsolete, energy- and resource-intensive, and usually threatening the environment (Stock et al., 2018).

When considering possible directions for modernising the activities of industrial sites located in old industrial regions, Industry 4.0 projects should be taken into account. The innovative products of Industry 4.0, like Industry 3.0, are needed in industrial production, and in old-industry regions, in particular. However, their implementation requires funding and investment. However, Industry 3.0 products are already widely used in Ukraine and have significantly increased the level of industrial innovation (Biloshkurska et al., 2019; Omelyanenko et al., 2019). Industry 4.0 products are overwhelmingly high-value, cutting-edge technological developments that are capable of delivering exponential growth for businesses in the medium term.

In order to determine the prospects of introducing Industry 4.0 products in old industrial regions of Ukraine, it is recommended to perform a SWOT analysis (Table 1).

Based on the data in Table 1, it should be noted that the Ukrainian economy has sufficient potential to adopt Industry 4.0 innovations. However, all possible stakeholders need to be involved in the implementation of key measures, especially public authorities. At the same time, it is necessary to develop an adequate state policy to move Ukraine's industry to Industry 4.0, including preferential taxation, cluster development, and the comprehensive attraction of both domestic and foreign investors.

**Table 1. SWOT analysis of modernisation of old industrial regions based on Industry 4.0 in Ukraine**

<b>STRENGTHS</b>	<b>WEAKNESSES</b>
Developed IT industry; more than 100 companies are innovators of Industry 4.0; coordinating council under the Ministry of Economy; Digital Agenda Ukraine; developed chain “integrators – developers – engineering companies”; success of decentralisation reform; participation of scientists from higher education institutions and NASU in Industry 4.0; potential of certain segments of mechanical engineering.	Low government operational effectiveness, lack of industrial and innovation strategy as the basis for Industry 4.0; weak regulatory influence on industrialists; very low government support for Industry 4.0 innovators; low level of involvement of IT sector, NASU, engineering, and industrial engineering in Industry 4.0; weak government ability to effectively collaborate and interact with expert communities; lack of regional and Industry 4.0 ecosystems; lack of strategies for digital transformation.
<b>OPPORTUNITIES</b>	<b>THREATS</b>
The IT share of Ukraine’s GDP is 10%; Industry 4.0 potential of foreign countries; EU research funding programs available to Ukraine (for example, Horizon Europe and Euratom); integration into global markets, outsourcing and exports; growing automation needs of large customers; need to upgrade fixed assets and automate production processes; rapid permeability of Industry 4.0 technologies; labour market potential.	Further degradation of industry innovation ecosystems; growing imbalance in the economy with a declining share of manufacturing; deepening lagging behind developed countries in most strategic aspects of 4.0; accelerated brain drain of engineers to IT and abroad; growing distrust of business and experts in government programmes due to slow reforms; high impact of political, military, and social instability risks on the investment climate.

Source: Formed from data given in (OSCE Coordinator in Ukraine (n. d.), p. 30), based on (Du Plessis & Bam, 2018, p. 20)

## Conclusions

Therefore, as a result of the research, the main components of the sustainable development potential of an old industrial region have been identified and systematized according to classification features such as finance, ecology, food security, sociocultural condition, infrastructure, region marketing, and industrial production potential.

The features of sustainable development in the old industrial region have been highlighted, in particular the concentration of cities (urban areas, settlements) around large industrial plants and agglomerations, the critical state of environmental pollution, and the use of Industry 3.0 (less frequently Industry 2.0) technologies in industrial production.

It has been shown that the problem of modernisation of old industrial regions of Ukraine, which is acute in most countries of the world, involves a transition to Industry 4.0 technologies, now decisive in ensuring the competitiveness of industrial production. The problem is complex and its solution requires informed decision-making at the level of state authorities, local authorities, and industrial owners.

During the study of the sustainable development potential of an old industrial region, the authors had the following main limitations: the methodology of assessing the sustainable development potential at all levels (global, national or regional) is not sufficiently developed; most statistical information on the modernization status of industrial enterprises is not freely available; there are no successful cases of modernization of old industrial regions in Ukraine. In this context, the prospects for the authors' further research will be the development of an integrated methodology for assessing the level of the sustainable development potential of an old industrial region: the case of Ukraine.

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## POTENCJAŁ ZRÓWNOWAŻONEGO ROZWOJU STAREGO REGIONU PRZEMYSŁOWEGO: PRZYPADEK UKRAINY

**Streszczenie:** Znaczenie tego opracowania polega na zaproponowanej przez autorów interpretacji definicji „potencjału zrównoważonego rozwoju starego regionu przemysłowego”. Autorzy zidentyfikowali i usystematyzowali główne komponenty potencjału zrównoważonego rozwoju starego regionu przemysłowego według głównych atrybutów klasyfikacji, takich jak finanse, ekologia, bezpieczeństwo żywnościowe, stan społeczno-kulturowy, infrastruktura, marketing regionu oraz potencjał przemysłowo-produkcyjny. Artykuł ma charakter teoretyczny i opiera się na metodach systemowo-strukturalnych, analizie porównawczej, metodzie graficznej oraz logicznym uogólnieniu, syntezie, indukcji i dedukcji, analizie dialektycznej i analizie SWOT. Wskazano cechy zrównoważonego rozwoju starego regionu przemysłowego, takie jak koncentracja miast wokół dużych aglomeracji przemysłowych, zanieczyszczenie środowiska, stosowanie w produkcji przemysłowej przestarzałych technologii Przemysłu 3.0 i Przemysłu 2.0. Udowodniono, że złożony problem modernizacji starych regionów przemysłowych Ukrainy poprzez przejście na technologie Przemysłu 4.0 wymaga podjęcia niezbędnych decyzji na poziomie władz państwowych i lokalnych, a także właścicieli zakładów przemysłowych.

**Słowa kluczowe:** decentralizacja, produkcja przemysłowa, Przemysł 4.0, modernizacja

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