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Review Paper

The Conceptual Framework for Creating an Industrial Smart and Tourism Favoured Cluster for Sustainable Development of the Ukranian Region

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ABSTRACT

In the article authors investigated the conceptual framework for creating an industrial smart and tourism favoured cluster for the sustainable development of the Ukranian region. The best world experience of clustering is investigated in the article, and the benchmark smart-cluster, its characteristics and indicators are defined. Using the Bakanov-Sheremet method of distance from the standard, the authors determined the coefficients of deviation of the most promising Ukrainian clusters from the reference one and outlined the clusters for introducing industrial tourism in their structure. For visual perception, the research methodology is presented in the form of a logical sequence of stages indicating the research methods used. As a result, the authors developed a conceptual framework for creating an industrial smart cluster for sustainable development of the region and the development of industrial tourism proposed and an algorithm for evaluating alternatives to industrial tourism tools based on factors of significance. The results confirmed the hypotheses put forward in the study.

HIGHLIGHTS

- The Bakanov-Sheremet distance method from the standard can be used to determine the deviation of the most promising clusters from the reference one.
- The unification of the industrial smart and tourism cluster will create an additional synergistic effect for the sustainable development of the region.

Keywords: Industrial tourism, smart cluster, sustainable development

Clusters are a relatively new form of economic organization. The increased interest of scientists was formed after the publication of the works of Michael Porter and which is given a leading role of clusters in shaping the competitiveness of states and regions. Despite the economic feasibility of clustering the economy, clusters have not yet become widespread in many countries, in contrast to highly developed countries. As of October 2021, there are 64 industrial parks in Ukraine (Fig. 1), and in Kazakhstan– up to 10, but there is not a single industrial park or cluster

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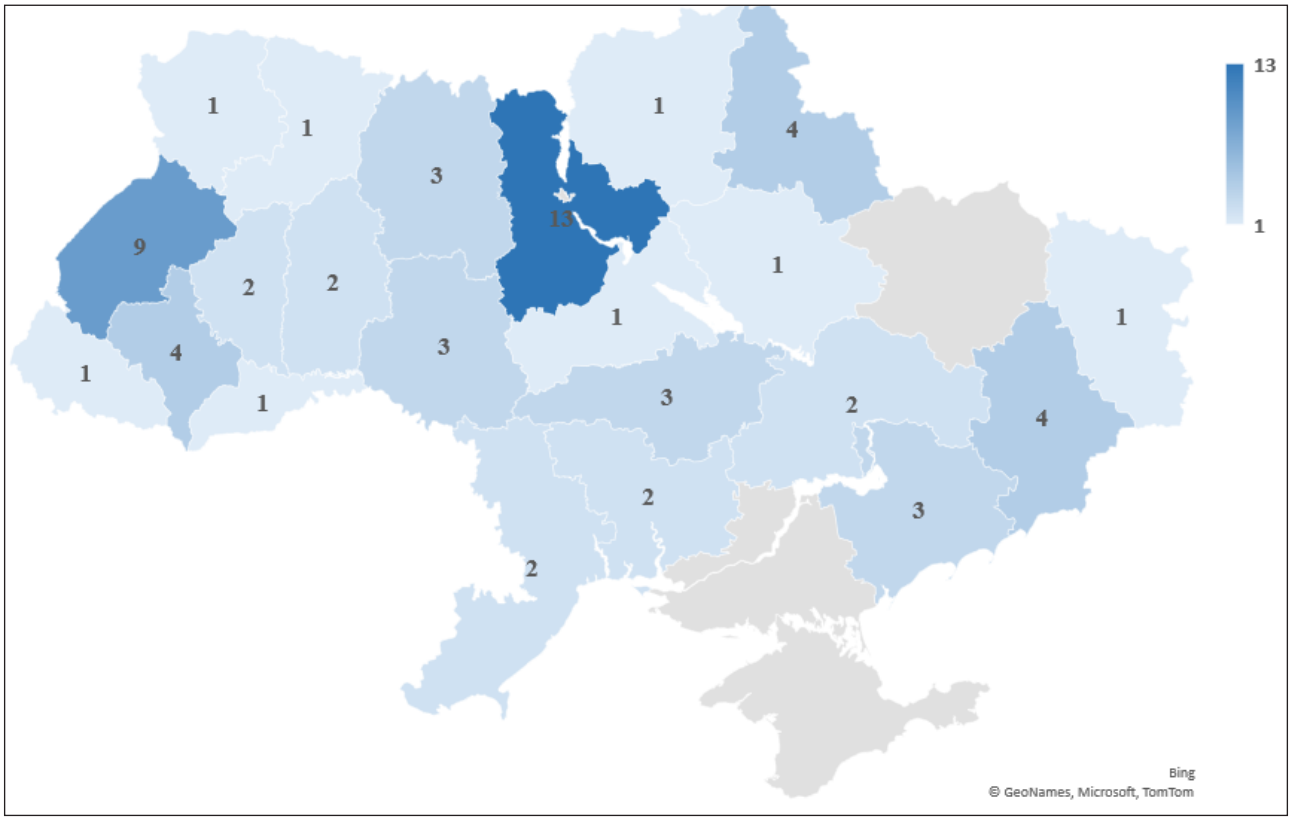

Fig. 1: The territorial distribution of industrial parks in Ukraine (compiled by the authors according to the data of the Ministry of Economics of Ukraine, 2021)

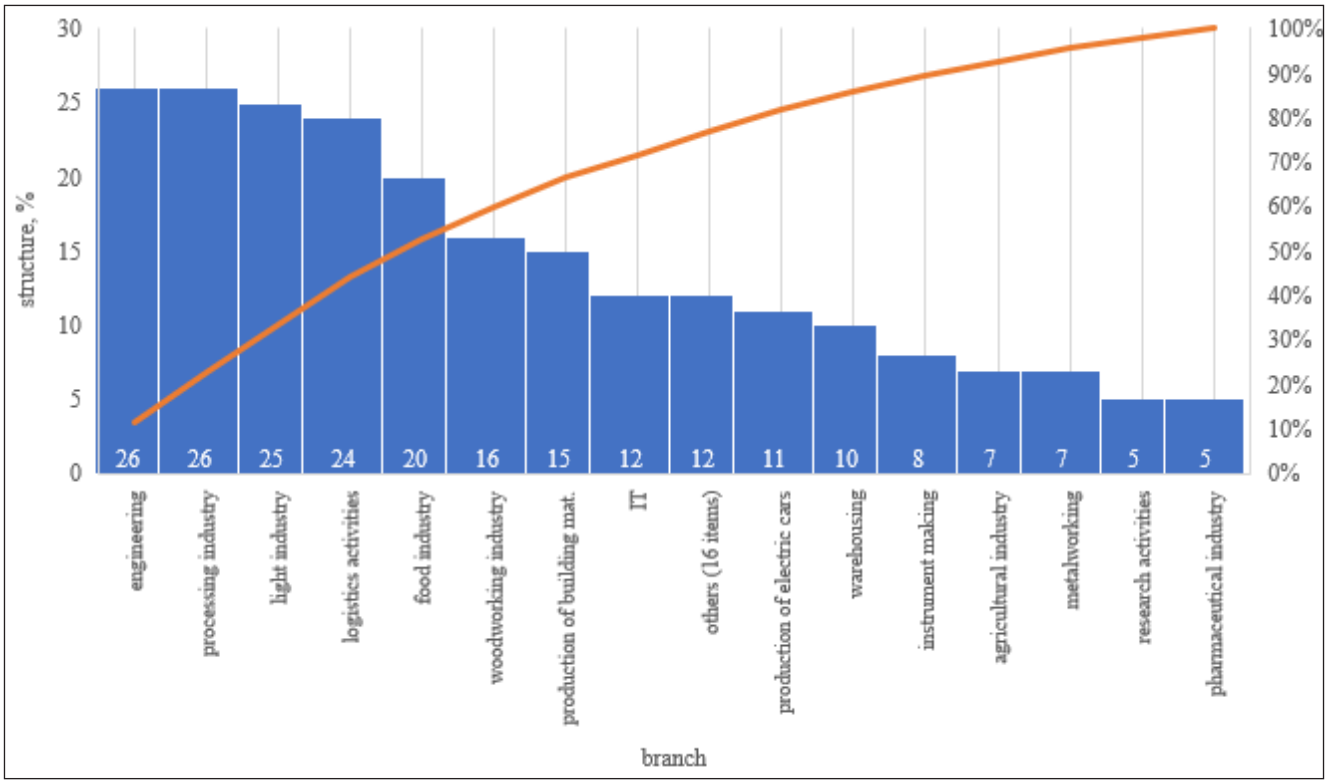

Fig. 2: Branch distribution of industrial parks (compiled by the authors according to the data of the Ministry of Economics of Ukraine, 2021)

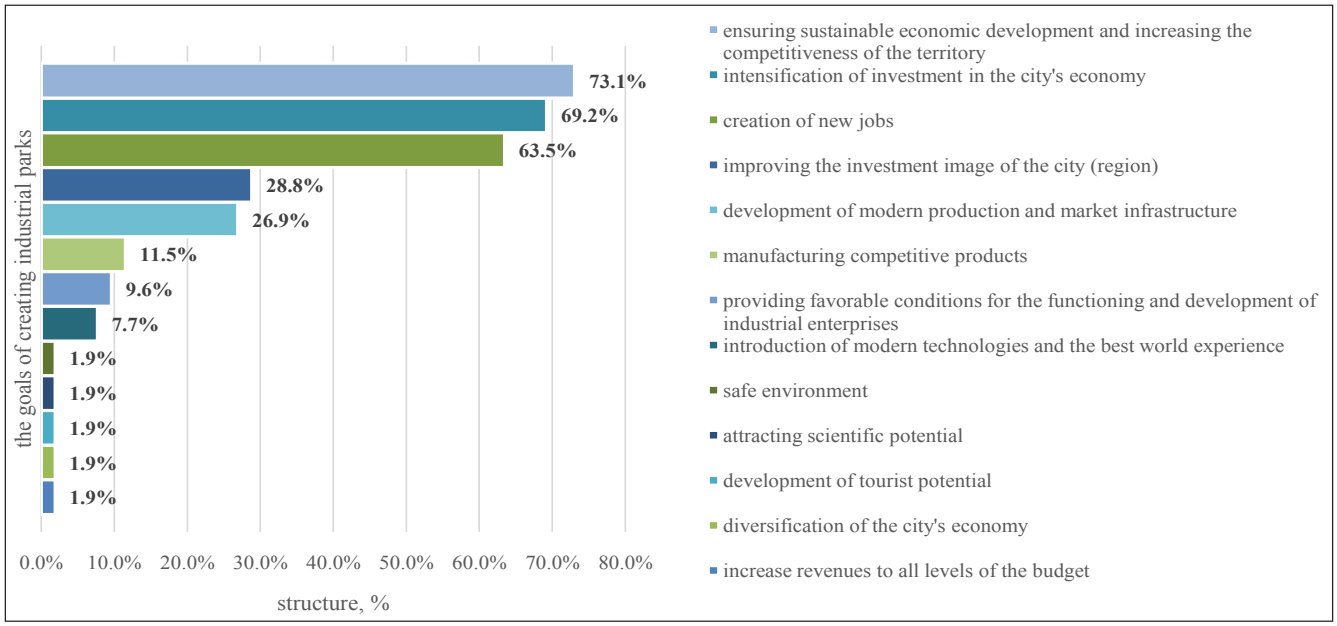

Fig. 3: The goals of creating industrial parks (compiled by the authors according to the data of the Ministry of Economics of Ukraine, 2021)

that would be in total; to some extent, it functions in the way that such leading clusters work.

In 2012, Ukraine adopted the law "On Industrial Parks", in September 2021, it adopted amendments to it. Their principal activity is engineering, processing industry and light industry (Fig. 2).

Statistical and analytical research showed that Ukrainian industrial parks do not ensure sustainable development of the region. However, ensuring sustainable economic growth and increasing the territory's competitiveness was one of the goals of creating more than 70% of industrial clusters (Fig. 3).

However, only four high-quality infrastructure facilities that already have residents with actually operating plants are fully operational. These are:

- Bila Tserkva Industrial Park (Kyiv region);
- Vinnytsia Industrial Park (Vinnytsia region);
- Solomonovo Industrial Park (Zakarpattia region);
- Korosten Industrial Park (Zhytomyr Region).

The reasons are many, and the main one is the lack of total funding. According to the (Ministry of Economy of Ukraine, 2021), during 2016-2019, the State Fund for Regional Development financed only four projects related to creating an infrastructure of industrial parks, for a total of 7.2 million hryvnias.

Often the problem is the lack of understanding of local communities of the IP tool and, consequently, their indifference to this issue. For example, there are cases when the whole territory allocated by the local authorities for the park turned out to be an inconvenient peat bog, or it has disputed property, or the networks are too far away, or the owners of the adjacent plots do not agree to lay networks, etc.

The idea of creating a park remains on paper: sluggish progress in development is often due to the lack of management companies that would be responsible for industrial parks - their creation is also not encouraged. Usually, there are problems in each case because the culture of development of industrial parks in Ukraine is absent.

We believe that the successful implementation of a regionally integrated approach is possible only if the clusters of narrower (specialized) approaches have a clear, practical focus. This is confirmed by recent works of foreign scientists (Donahue *et al.* 2018; Govindasamy, *et al.* 2018; Jyani *et al.* 2018; Smith *et al.* 2020). One of them is the expansion of the cluster due to industrial tourism (Kornus *et al.* 2019; Nunes *et al.* 2019).

The work aims to study the activities of successful industrial clusters and develop conceptual foundations for creating a smart industrial cluster for the region's sustainable development and industrial tourism development.

We put forward the following hypotheses to be tested:

1. **Hypothesis 1:** Industrial clusters with a literate organization are a powerful tool for the region's sustainable development.
2. **Hypothesis 2:** Introducing industrial tourism into the industrial cluster will create an additional synergistic effect for the region's sustainable development.

MATERIALS AND METHODS

The methodological basis of the study is the theory of economic clusters, as well as individual elements of the concepts of territorial production complexes and regional inter-sectoral complexes that were developed before it. The study used various theoretical methods and techniques of scientific, and geographical research, particularly the analysis, synthesis, systematization and others. To confirm the hypotheses, consider the research methodology, which begins with empirical, theoretical study and ends with the practicality of use (Fig. 4).

TTo determine the final rating, the standard method of (Bakanov & Sheremet, 2002) or the method of distance from the standard (Bashynska *et al.* 2022), the essence of which is to find the coefficients of deviation from the standard, their subsequent generalization and weighting on the coefficient of significanceo determine the final rating, the standard method of Bakanov & Sheremet or the method of distance from the standard, the essence of which is to find the coefficients of deviation from the standard, their subsequent generalization and weighting on the coefficient of significance.

1. The initial data are given in the form of a matrix a_{ij}, where the rows contain the numbers of indicators (i = 1,2,3,… n), and in the columns - the cluster numbers (j = 1,2,3,… t).
2. Each indicator is the maximum value and is entered in the column of the conditional reference cluster (m + 1).
3. The initial indicators of the matrix a_{ij} are standardized as the ratio to the corresponding

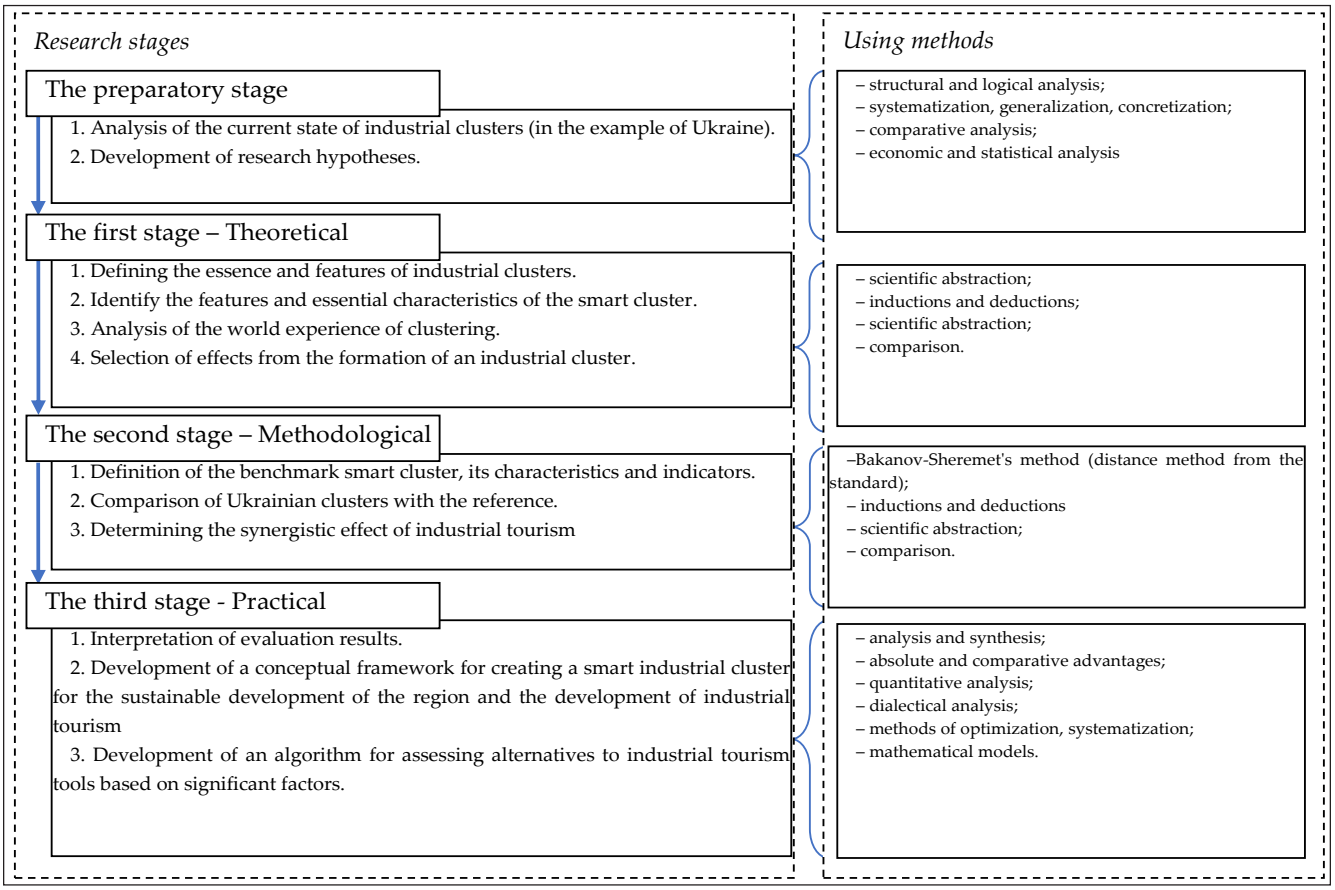

Fig. 4: The logical structure of the study (compiled by the authors)

indicator of the reference cluster by the formula:

$$x_{ij} = a_{ij} / max\ a_{ij} \quad \ldots(1)$$

Where, x_{ij} - standardized indicators of the state of the jthcluster.

4. The value of the rating of each cluster of the regional complex:

$$R_j = \sqrt{(1 - x1j)^2 + (1-x_{2j})^2 + \ldots + (1-x_{nj})^2} \quad \ldots(2)$$

Where, R_j is the rating of the jth cluster. The highest rating has a cluster with a minimum value of R_j;

X_{1j}, X_{2j},..., X_{nj} are standardized indicators of the jth cluster.

THEORETICAL AND METHODOLOGICAL BASIS

The essence and features of industrial clusters

There are various typologies of clusters. Porter (1998) distinguishes 3 types of clusters based on economic development:

(a) Local industries: provide goods and services to the local market, limit competition with others and circulate money in the region;

(b) Depending on the resources of the industry: employment exists where the necessary resources are available and competes with both national and international competitors;

(c) Traded industries: sales of goods and services to other countries and regions. The concentration of employment varies by region and attracts cash flow based on resource advantages and a stable basis.

Porter (1998) notes that clusters may include government and other institutions, such as universities, standard-setting institutions, think tanks, vocational training organizations, and trade associations, which provide specialized training, education, information, research, and technical support to the cluster.

Gordon and McCann (2013) classified clusters based on the type of interaction of cluster enterprises. They distinguish three types:

(a) Clusters of pure agglomeration: favourable location of enterprises in the cluster in terms of, for example, labour (in fact, there are no interactions);

(b) Clusters of industrial complexes: favourable location of enterprises in the cluster in terms of, for example, reducing the cost of interaction (there are some interactions, such as the interaction of buyer and supplier);

(c) Models of social networks: favourable location of enterprises in the cluster in terms of, for example, improved interactions, such as innovation (there are many interactions to enhance the quality of services and products)

Marcusen (2011) distinguished the clusters according to internal and external interaction into four categories:

(a) Small local enterprises: small enterprises, longterm contracts between buyers and sellers in the cluster, minimal interaction outside the cluster;

(b) Fan (cluster) cluster: few key companies that act as a hub with suppliers around them, like the spokes of the wheel; significant intra-district trade embodied in long-term commitments;

(c) Areas of satellite platforms: large enterprises located outside, making investment decisions with minimal trade within the region, no commitment to local suppliers;

(d) Districts anchored in the state: the state organization is the crucial anchor of the tenant in the district.

Finally, Panichia (1998) identified six categories of clusters based on different features:

(a) (Semi) canonical industrial areas: family businesses with a small number of employees;

(b) Diversified urban industrial areas;

(c) Satellite platforms or agglomerations with hubs and spokes: a limited number of small enterprises working as subcontractors for large enterprises.

(d) Concentrated or integrated agglomerations or industrial areas: integration of some networks of the technological sector, leading to the opening of new markets;

(e) Areas of joint location: joint location of enterprises engaged in similar activities;

(f) Scientific or technological agglomerations.

The importance and high value of enterprises' geographical agglomeration in the global economy era are apparent. The industry cluster is beneficial to both the economy and individual enterprises. However, there is no smart security cluster yet. Smart clustering is unique, created in response to modern challenges, but contains features characteristic of the above clusters.

The features and critical characteristics of the smart cluster.

We believe that a smart cluster ("smart specialization") should be based on the following basic principles:

(a) Territorial cohesion. The main advantage of clustering on a territorial basis is the proximity of the subjects. This saves significant time and resources (when solving complex, urgent issues), financial (savings on logistics, rent, cost-sharing, etc.), etc. If the cluster needs some unique non-territorially connected with the cluster, it is solved either by moving work or establishing cooperation remotely or by opening a branch/franchisee, etc.

(b) Availability of smart services on the territory ("smart" cooperation between territories, their inter-connectedness), its development and infrastructure. There are also two possible scenarios: either choosing such an area or creating (Silicon Valley). Both options have advantages and disadvantages, the leading choice is either we save first (without re-creating) or then for many years (on taxes, on a more targeted organization, etc.). From this arises the third option, trial creation in the existing territory and then scaling to create the ideal model (Shpak *et al.* 2019);

(c) The complexity of the implementation of smartization in three interrelated areas: expanding the space of smart services, the formation of centres of competence of the digital economy at the world level, positioning the cluster as a centre of global communications on "smart";

(d) Continuity of development of the digital ecosystem of the cluster based on fair competition within the framework of agreed technical conditions, requirements and information security;

(e) Integration of the cluster into the Ukrainian and global digital and legal space. The cluster must, first of all, cooperate with the pioneers of the Fourth Industrial Revolution and leaders in the fields of technology, personnel, etc.;

(f) Constant cooperation and communication along the lines of "business-government-science", and not only at the time of the creation of the cluster;

(g) Inclusiveness for all possible participants (Malynovska *et al.* 2022).

Here are the key characteristics of a smart cluster:

- The business provides an information basis for identifying opportunities and setting priorities, and the state creates favourable conditions for the development of partnerships between participants;
- Decisions on investing in certain projects are made regardless of the source of their origin; preference is given to areas in which innovative solutions effectively complement existing production assets;
- Any sector or region can become a platform for promising transformation projects; as a result of modernization, the boundaries between traditional and new activities are blurred;
- Smart cluster is progressive by definition, as it involves a constant search for new directions and opportunities;
- "Smart specialization" provides many options for diversification;
- Continuous monitoring of implementation and evaluation of smartization results according to pre-developed criteria are of great importance as a basis for improvement;
- The creation process should be highly flexible to ensure timely redistribution of state resources in favour of the most viable projects (Fukuda & Tanaka 2002; Bondar *et al.* 2021).

We see the smart cluster as a regional policy model that stimulates economic growth based

on smartization through effective coordination of public resources to develop entrepreneurship and increase the competitiveness of industries and enterprises. The combination of new industrial and innovation policy tools, based on the principles of initiative, transparency and flexibility, contributes to develop promising activities. The strategy of creating a smart cluster cannot be called neutral because it implies the prioritization in favour of specific technologies, enterprises and regions, thus setting the vector of priority measures of smart policy. Areas of activity that have the potential for structural transformation with smartization are subject to development through the concentration of resources.

RESULTS

To perform the rating, all 52 clusters of Ukraine in different regions were surveyed according to official data during 2021 (Ministry of Economy of Ukraine, 2021). The analysis showed that many clusters are created "on paper" or are in active search of the first participants, and such clusters were excluded from the ranking. It is worth noting that the COVID-19 pandemic has made significant adjustments to the development of clusters: most of those who were in the process of creating, finding a management company, or the first investors postponed their activities for a year.

The results of the rating assessment of clusters, definition and comparison with benchmark comparisons are presented in Table 1.

Because Ukrainian clusters are not "indicative" and the defined reference cluster will not be the same in European countries, we have added a "reference leading cluster", which is defined as the average

Table 1: Final rating assessment of industrial clusters of Ukraine for October 2021 p. (*Source:* com-piled by the authors according to the Ministry of Economy of Ukraine, 2021)

Cluster name	Region	Profitability of activity, %	Return on assets, %	Labour efficiency, %	Rating, points $R_j = \sqrt{(1-x_{1j})^2 + (1-x_{2j})^2 + \ldots + (1-x_{nj})^2}$	Place	Availability of industrial tourism in the region (+ 5-15%	Proximity to a tourist destination (5-10%)	Rating, points	Corrected place
Bila Tserkva	Kyiv region	31,75	46,33	38,26	66,25	2	1,10	1,05	76,52	2
Vinnytsia Industrial Park	Vinnytsia region	31,82	37,58	45,35	65,23	3	1,00	1,00	65,23	5
Vinnytsia cluster of refrigeration engineering	Vinnytsia region	36,25	46,53	36,68	67,74	1	1,00	1,00	67,74	4
Solomon's	Transcarpathian region	32,9	36,95	35,06	58,91	6	1,00	1,10	64,80	6
Korosten	Zhytomyr region	30,41	35,26	37,66	58,16	7	1,00	1,00	58,16	8
Svema	Sumy region	24,18	47,41	29,87	59,37	5	1,00	1,00	59,37	7
Ternopil	Ternopil	9,3	11,6	18,47	22,06	11	1,00	1,00	22,06	11
Slavuta	Khmelnytsky region	12,69	55,6	3,58	55,90	9	1,00	1,00	55,90	10
PATRIOT	Sumy	18,35	27,07	40,63	50,51	10	1,00	1,10	55,56	9
Pavlograd	Dnipro	30,02	33,24	37,3	56,56	8	1,15	1,10	71,55	3
iPARK	Odessa region	38,04	35,33	40,3	63,99	4	1,15	1,10	80,95	1
Benchmark cluster	—	38,04	55,6	45,35	79,50	—	1,15	1,10	100,57	—
Reference cluster (average value of leading European clusters)	Denmark; Belarus; Great Britain, Germany; Poland	95,74	95,28	67,84	149,44	—	1,15	1,10	189,04	—

value of the leading European clusters. To assess the prospects for developing industrial tourism in the cluster, we have added two main characteristics (availability of industrial tourism in the region and proximity to a tourist destination), which can increase the cluster's attractiveness by a maximum of 25%.

The analysis showed a large gap in terms of performance, the benchmark cluster indicators were obtained from three different clusters, while only one of them entered the TOP-3 effective clusters. If we consider the prerequisites for obtaining a synergistic effect through tourism, then this cluster has lost its position.

The analysis showed a large gap in terms of performance, the benchmark cluster indicators were obtained from three different clusters, while only one of them entered the TOP-3 effective clusters. If we take into account the prerequisites for obtaining a synergistic effect through tourism, then this cluster has lost its position. In terms of the aggregate indicator, clusters are almost half as efficient as the benchmark cluster. The best Ukrainian clusters are still far from the leading European ones, but this gap is not critical or unattainable, provided that the clusters can obtain a synergistic smart effect, in particular, by using tourism. Unfortunately, the analysis showed that not all existing clusters could master the tourist destination because historical and territorial prerequisites are of great importance. However, three (iPARK, Odesa region; Bila Tserkva. Kyiv region, and Pavlograd, Dnipro city) have all the prerequisites to increase the region's sustainable development.

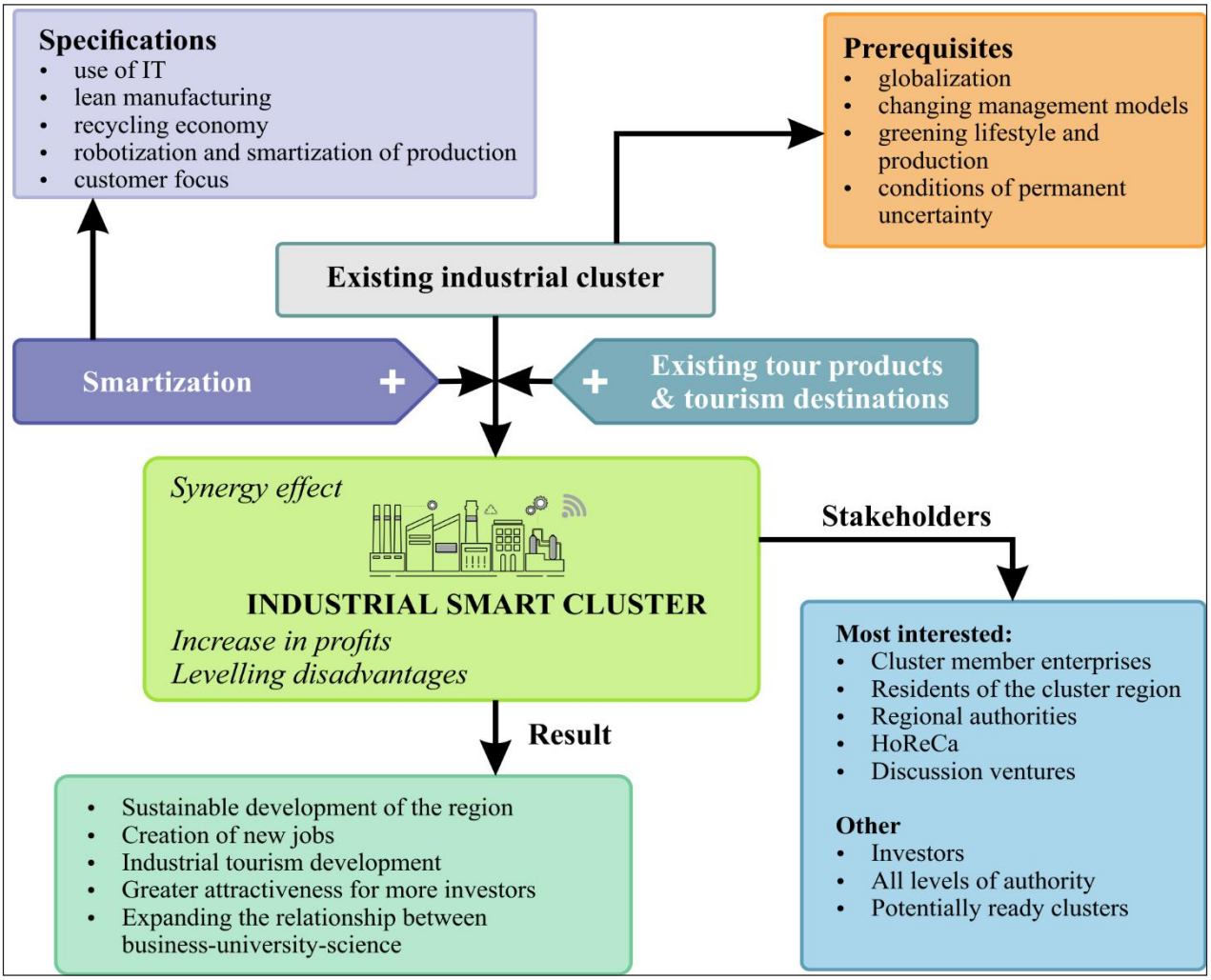

Fig. 5: The conceptual framework for creating an industrial smart cluster for sustainable development of the region and the development of industrial tourism (***Source:*** developed by the authors)

DISCUSSION

The studied theoretical-methodological basis and analysis of the existing cluster of practice allow us to develop a conceptual framework for creating an industrial smart cluster for the region's sustainable development and industrial tourism development (Fig. 5).

These conceptual foundations reflect the specifics of creating an industrial smart cluster for specific purposes: sustainable development of the region and the development of industrial tourism, which will allow for levelling the disadvantages of the industry, such as:

- High barriers to entry;
- Dependence on raw materials;
- The need for significant additional investment;
- Long payback period;
- The need for a physical location, and so on.

It should be noted that it will be more effective to develop industrial tourism already in the existing industrial cluster, which first of all needs to be smartized because industrial tourism requires minimal facilities. We recommend developing industrial tourism gradually, constantly analyzing the results, the successful experience of other clusters or industrial tourism objects, and the development of technologies.

New technologies and tools appear every day, many of which become effective for solving tactical and strategic tasks of the cluster.

However, it is also necessary to approach their choice wisely. For such a choice, we propose an algorithm for making management decisions regarding the choice of the appropriate tool (Fig. 6).

This algorithm is universal for most cluster specializations.

In the 1st stage, it is necessary to identify the economic type of the cluster and conduct marketing research and technical audit to identify its needs for the purposes of smartization and performance measurement.

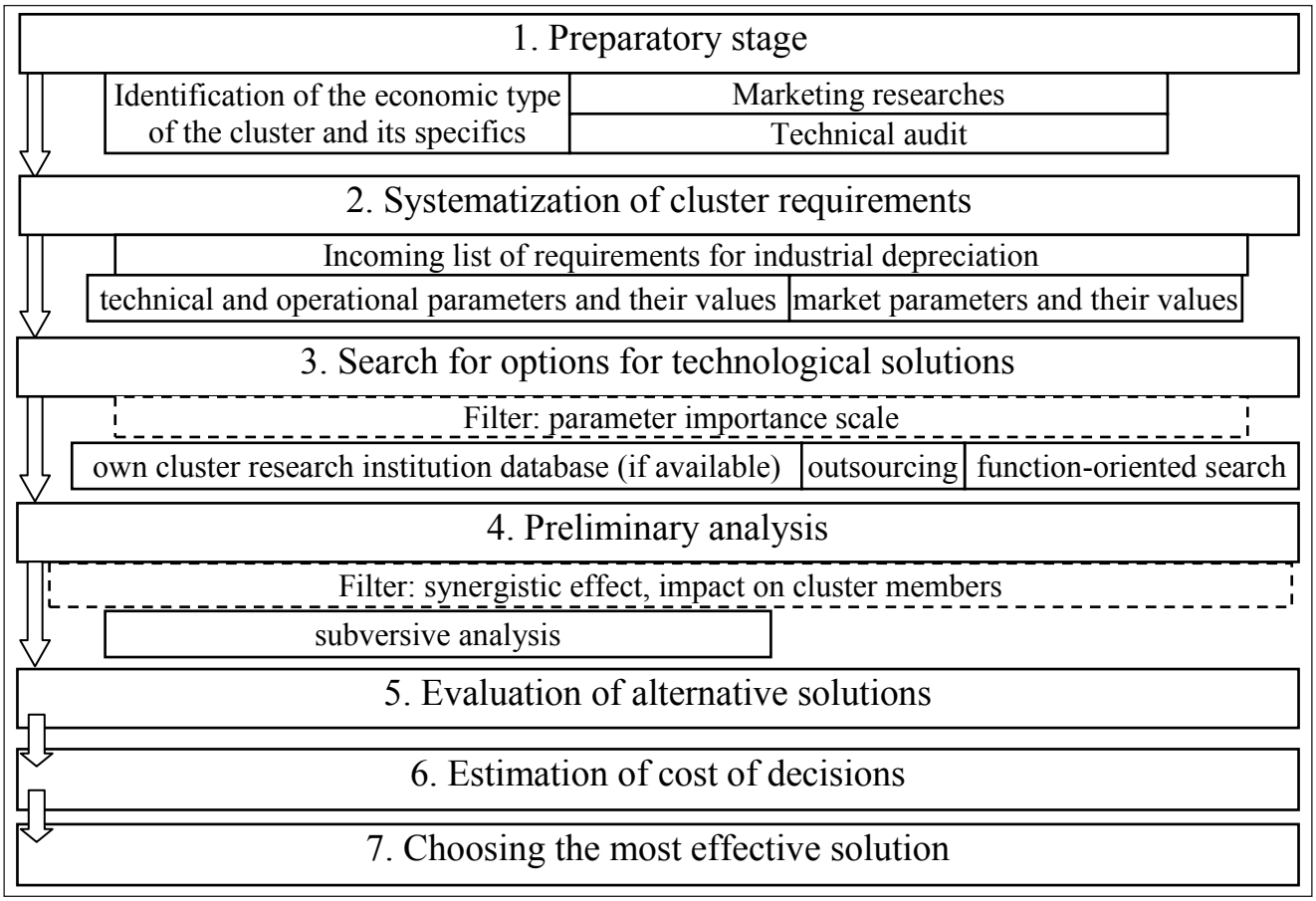

Fig. 6: Algorithm for selecting tools for industrial tourism (***Source:*** Own development)

Marketing research is needed to analyze the needs of the cluster by the level of smartization reinforcement. Technical audit in the organization of needs research allows to conduct a comprehensive engineering and technical assessment of the cluster's potential, systematize information about its specific needs, and make a final decision on smartization (which ones, what are the expected results, etc.).

In the 2nd stage, the results of the performed comprehensive audit are presented in the form of an incoming list of cluster requirements. As a result, the scientific organization forms two blocks of characteristics: technical and operational parameters and their values and market parameters and their values. Significance factors must also be determined for these requirements.

In the 3rd stage, the search for options for tools, particularly industrial tourism, is a combination of options to achieve the cluster's goals. The depth of the study at this stage directly depends on the specifics of the cluster.

Next, it is also necessary to rate the requirements of the cluster. It is most convenient to establish significant factors (tools) following the requirements by initially assessing the importance of each of the parameters. This procedure should be carried out based on the results of an expert survey of key members of the cluster when the value of the items is given, which are then converted by the formula into factors of significance. The translation of points into coefficients of relevance is as follows: for each of the defined parameters, the cluster evaluates the importance of the parameter from 1 to 5 points, based on the following scale (Table 2).

Table 2: The scale of importance of tools for the cluster

Number of points	Terms of use
1	The tool is not relevant to the cluster.
2	This tool is more important to the cluster than not.
3	The tool is essential for the cluster.
4	The tool is vital for the cluster.
5	The tool is of fundamental importance to the cluster.

To form a relevant solution can be used own database of the scientific institution of the cluster, outsourcing or function-oriented search.

In the 4th stage, the research institution analyzes the possible synergetic effect and influence on the cluster participants. Then a subversive analysis is performed. This stage aims to identify alternative technical solutions that also affect the market parameters of the cluster. Also, at this stage is the identification of "bottlenecks" of possible technologies and solutions. At the same time, unique solutions may require patent research.

In the 5th stage, alternative solutions are evaluated considering technical and operational and market requirements and their coefficients of significance - determining the value of the integrated indicator of the degree of satisfaction of the cluster's solution needs.

In the 6th stage, the cost of the solution for the cluster is determined, and the efficiency and payback are assessed.

In the 7th stage, the choice of the most effective decision is carried out. To do this, the alternative values and the cost of this solution for the cluster are correlated. If you know the limit of funds owned by the cluster, it is offered the best option within the specified cost limits; if this information is not available, the option with the maximum efficiency factor is offered.

We tried to develop the most versatile algorithm that, with minimal adaptation, can be used for other needs of the cluster, not only for the development of tourism. We have carried out detailed testing of this algorithm, but its presence will be reflected in our further studies.

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