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Promotion of economic zones and business support in industrial clusters: Information, investment and human capital approaches

Abstract. The study aimed to analyse the specifics of promoting economic zones and providing business support in industrial clusters. To achieve this goal, a sample of the following objects was created: Frankfurt-Höchst Industrial Park (Germany), North Huntsville Industrial Park (USA), the Industrial Cluster and Knowledge Cluster programmes (Japan) and Shenzhen-Hong Kong-Guangzhou (China). The selected clusters were analysed in terms of information exchange strategies, investment attraction and quality human capital. According to the comparative analysis, the key features of effective cluster promotion are the creation of an extensive information network for interdisciplinary cooperation and information exchange, the attraction of investment in human capital development and investment diversification. A synthetic analysis using SWOT analysis, PEST analysis and Porter's Five Forces model identified the main obstacles to the

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effective promotion of economic zones and clusters: shortage of human resources or their poor quality; lack of demand for the products and/or services offered in the region where the cluster operates; insufficient understanding of the context of the cluster's operation, leading to ineffective strategic decisions. Based on the analysis, the following recommendations were made for the effective promotion of economic zones and clusters in terms of investment, information and human resources policy: transition to intensive investment and human capital development practices; diversification of investments, especially in low-income regions with higher priority state budget expenditure items; preliminary contextual analysis to identify public demand for cluster functioning

■ **Keywords:** contextual analysis; development of cooperation; diversification of financing; sustainable development; capital raising

■ INTRODUCTION

In times of economic uncertainty, promoting economic zones and securing business in industrial clusters are key strategies for sustainable development. The idea of creating economic zones originated in the UK in the 1980s and was soon implemented in other countries, including the US, Japan, China and the EU. The emergence and development of such zones are driven by the idea that creating special conditions for doing business helps to create new jobs and economic growth, especially in regions where market forces are weak or not at all.

Numerous studies were devoted to the study of the concepts of economic zones and industrial clusters, including an article by M. Kim & T. Chapin (2022), which argued that the policy of creating an economic zone is a policy of economic and social development aimed at providing special incentives to targeted areas to increase investment and economic growth. M. Crawford (2024) emphasised that the existence of economic zones stimulates business growth and job creation in economically disadvantaged communities where market forces usually do not operate. The author highlighted that there are more than 3,000 economic zones in the United States, some of which, such as in Kansas, are the size of an entire state. The concept of an economic zone is inextricably linked to the concept of an industrial cluster, which H. Kim *et al.* (2023) defined as a group of geographically contiguous, interconnected companies and institutions in a particular area. That is, industrial clusters can be defined as elements of economic zones.

Economic zones are becoming more common due to the benefits they offer, including reduced unemployment (Saeed *et al.*, 2024). According to R. Hasan *et al.* (2024), the creation of favourable conditions for small and medium-sized enterprises, including the provision of tax incentives, contributes to their sustainable growth and development, which is expressed, among other things, in the creation of new jobs. For instance, the idea was confirmed in a study by M. Crawford (2024), according to which the Southwest Enterprise Zone of Baltimore County in Maryland, established in 1996, had 62 thriving companies and 920 new jobs as of 2024. D. Neumark (2020) believed that job creation reduces unemployment and poverty, thereby contributing to the restoration of social justice. Thus, the existence of economic zones is a prerequisite not only for the economy but also for the social well-being of a particular region.

Due to government support, economic zones are becoming innovation zones, offering effective solutions to

pressing problems in key areas (Ustymenko, 2024). According to J. Xie & Y. Wang (2024), enterprises in economic zones use innovative approaches to efficiently allocate and use limited resources economically. An example is the introduction of innovative solutions to reduce the carbon footprint of enterprises. According to Q. Sheng *et al.* (2024), the initiatives of individual enterprises can make a significant contribution to solving environmental problems at the regional or national level. Based on the cited studies, it is possible to argue that the existence of economic zones is associated with numerous benefits at different levels of the state.

The functioning of such zones, however, also implies overcoming certain difficulties, which, according to F. Alfazzi (2023), include limited availability of financial and other resources, reduced competitiveness and insufficient regulatory framework. According to S.A. Frick & A. Rodriguez-Pose (2023), the attraction of innovation in the development of economic zones is also a challenge, especially in economically unstable regions of Africa, Asia and Latin America. Thus, planning for the creation and development of economic zones implies an in-depth analysis of possible obstacles and the development of strategies to overcome them. The study aimed to analyse the peculiarities of economic zone promotion and business provision in industrial clusters.

■ MATERIALS AND METHODS

The materials for this study were industry reports on the following economic zones: Frankfurt-Höchst Industrial Park, Germany (Heck *et al.*, 2024); North Huntsville Industrial Park, Alabama, USA (CRE Consulting Corps, 2023); Industrial Cluster and Knowledge Clusters Programme, Japan; Shenzhen-Hong Kong-Guangzhou Industrial Cluster, China (Li, 2024). Reports from the United Nations (Global Innovation Index..., 2024), among others, were considered. Industry reports published in the last five years, i.e., which are relatively recent and relevant, were selected for the study. The main research tool used was the case study method, which was aimed at presenting a detailed analysis of selected economic zones and industrial clusters in Germany, Japan, China and the United States. The chosen case study method implied the use of statistical analysis to assess the performance of the selected clusters. To analyse each of the selected cases, a three-component model was applied, as shown in Figure 1.

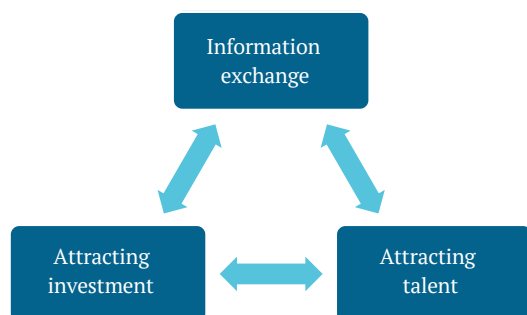


Figure 1. Model for analysing selected cases

Source: compiled by the authors

Based on the presented model, the analysis of the functioning of economic zones and industrial clusters implies an assessment of the efficiency of planning and development of resources such as information, investment and human resources. Information exchange is understood as the use of certain tools to assess the impact of internal and external factors on the creation and operation of an economic zone or industrial cluster: SWOT analysis, PEST analysis and Porter's five forces analysis. Investment attraction means analysing initiatives aimed at attracting investors, allocating resources and using them efficiently to support the sustainable development of the economic zone or cluster. The human resources element involves a detailed analysis of efforts to attract specialists whose knowledge and skills are the driving force behind the successful functioning of the economic zone or industrial cluster. As an additional method, a comparative analysis was used to identify universal methods of promoting economic zones and industrial clusters, regardless of their geographical location. The analysis also aimed to identify the most common difficulties in the development and expansion of economic zones and industrial clusters. The identified challenges were analysed in terms of costs and benefits to justify the feasibility of strategies aimed at improving economic zones and industrial clusters.

■ RESULTS

Features of the organisation of economic zones and industrial clusters in Germany, the USA, Japan and China

Several economic zones and industrial clusters in the EU, USA, China and Japan were analysed. One of the economic zones analysed is the Frankfurt-Höchst Industrial Park, Germany. This park is a licensed, fully developed site for research, development and production of chemical, pharmaceutical, biotechnology and related products (About Industriepark Höchst, n.d.). As of 2024, the park covered an area of 460 hectares, housing 90 companies with a total of 22,000 people. An important feature of Frankfurt-Höchst Park is the efficient use of information, made possible by the expert services offered by the players in interacting with government agencies to ensure that they can quickly obtain a licence to carry out certain activities, such as biotechnology research. The exchange and implementation of information also includes interaction with on-site experts who help companies manage technological systems and installations throughout their life cycle, as well as develop cost-effective solutions to help implement maintenance

strategies. The Frankfurt-Höchst Industrial Park is therefore designed to facilitate cooperation between companies and local experts, as well as interdisciplinary collaboration between companies.

In addition to the exchange of information, the functioning of the Frankfurt-Höchst Industrial Park depends on attracting investments and their subsequent efficient distribution (Heck *et al.*, 2024). Since 2000, more than EUR 8.5 billion has been invested in the development of the park, making Frankfurt-Höchst one of the largest projects in the EU (About Industriepark Höchst, n.d.). An example is the investment by the German company INERATEC in 2022 of EUR 30 million in a research project on the efficient use of hydrogen. The project has attracted interest at the state level; and the first hydrogen filling station built thanks to the investment was visited by German Chancellor Olaf Scholz. Based on the information provided, it is possible to state that since the park's inception, most investments have come from German companies.

Recognising the importance of human capital, the Frankfurt-Höchst Industrial Park has introduced initiatives to attract and retain well-trained and highly motivated professionals. The park is also home to Provadis, a company that helps companies develop innovative internship programmes to attract and train qualified employees. Provadis helps companies operating in Frankfurt-Höchst to create an individual professional track for each employee, which begins at college or university, where they search for candidates with a high level of professional training and good leadership skills. The companies of the Frankfurt-Höchst Industrial Park are thus committed to investing in human capital, viewing it as the driving force behind their progress.

The Huntsville, Alabama industrial-industrial zone is one of the most notable clusters in the United States. This cluster is known nationally and internationally for its achievements in the aerospace industry, which helped it earn the title of "Rocket City" (CRE Consulting Corps, 2023). Compared to Frankfurt-Höchst, North Huntsville Industrial Park is relatively small, as its total area does not exceed 27 hectares. This industrial cluster has nevertheless overcome the space limitation by shifting the focus to interdisciplinary interaction between leading companies in the aerospace and defence industry. This thought is supported by the fact that 47 Fortune 500 companies are in Huntsville.

Thus, North Huntsville Industrial Park is an example of the fact that for an industrial cluster to be successful, it is not so much the size of the cluster that matters, but the ability to effectively manage available resources, including information. Interdisciplinary collaboration between research centres, engineering companies and innovative start-ups to create high-tech aerospace products takes place within the cluster. Examples of such cooperation are such well-known US companies as SJ&L, IIC Blake or Stewart Electric. The effective exchange of information and knowledge is also facilitated by the operation of two Meta data centres in the industrial park. According to the report of the city administration, Meta plans to further expand its presence on the territory of the industrial park, which will contribute to the creation of an extensive information network of the cluster.

Raising and rationally allocating funds is a priority for North Huntsville Industrial Park, which seeks to attract national and international investors to develop infrastructure projects. An example of this is the cooperation with Meta, which came to the park in 2021 and attracted USD 3 billion in investment and created 75 new jobs.

A significant portion of the investments received is redirected to the development of the cluster's educational system. An example is the USD 1.9 million investment that Meta has made in Huntsville and Madison counties to partner with local schools and non-profit organisations to help disadvantaged youth, promote STEM education and support equity and empowerment initiatives. Similar to Frankfurt-Höchst, North Huntsville Industrial Park's management strives to create conditions in which vocational school graduates are interested in long-term cooperation with companies in the industrial cluster. The effectiveness of this strategy is determined by the fact that it provides companies with access to a pool of candidates with the required knowledge, skills and qualities, and reduces the risk of an outflow of qualified and motivated personnel. The Industrial Cluster Programme of the Ministry of Economy, Trade and Industry of Japan was launched in 2001 to establish interaction between economic entities within a regional agglomeration. The initiative was born out of the need to improve the link between scientific research and industry, particularly the woodworking industry, to increase the latter's efficiency. The project proved to be quite successful, as, by the end of the first five years of its existence, it had 19 industrial clusters comprising 6,100 companies and 250 universities (Ku wajimi, 2022).

Unlike the previously discussed initiatives, the Industrial Cluster is a set of programmes aimed at creating and developing industrial clusters throughout the country. A new round of the programme was launched in 2007 with the adoption of a law on the formation and development of regional clusters to promote the autonomous development of regional economies (Ku wajimi, 2022). The law required each candidate region to formulate specific "basic plan" for industrial agglomeration in consultation with local business groups and submit it to the central government for review and approval. In other words, it can be argued that the functioning of industrial clusters in Japan implies a more complex hierarchical structure than the functioning of such clusters in Germany, the USA and several other countries. The similarity is that once approved, the submitted plan receives government support in the form of various tax incentives. The Industrial Cluster programme of the Japanese Ministry of Economy, Trade and Industry assumes that the government is the main source of funding for initiatives. The main task of attracting and retaining human capital in industrial clusters is to rationalise common forms of labour productivity, which is implemented, among other things, through the Knowledge Clusters programme.

The Knowledge Clusters programme was developed by the Ministry of Education, Culture, Sports, Science and Technology of Japan in parallel with the Industrial Cluster programme (Matsumae *et al.*, 2020). Knowledge clusters were created based on universities and research institutions, and their main goal was to increase cooperation with industry by generating ideas for the latter. The

programme was funded in 18 regions of the country, giving rise to numerous knowledge clusters, including the largest ones such as the Sapporo Carrozzzeria IT cluster, the Hiroshima Biocluster, and the Nagoya Nano-Technology cluster. The almost simultaneous emergence of the Industrial Cluster and Knowledge Clusters initiatives implied their further interaction. An example of such interaction is the cooperation between the Hamamatsu Knowledge Cluster and individual industrial clusters in other Japanese cities. The knowledge cluster helped to launch the development of medical imaging and surgical guidance technologies. These technologies were then incorporated into the plans of industrial clusters to create a local industry using these technologies. An important feature of Japan's knowledge clusters is their openness to international cooperation, the main objective of which is to exchange knowledge and experience and train specialists following generally accepted quality standards. An example of such cooperation is the creation of the EU-Japan Industrial Cooperation Centre, which has trained thousands of industrial cluster employees. The centre has also developed a mapping tool that provides detailed information on clusters in different parts of the country and beyond, thus facilitating the establishment of links between them.

In addition to the countries already analysed, it is worth mentioning China, which hosts the world's largest industrial clusters by size. As of 2024, Shenzhen-Hong Kong-Guangzhou ranked 2nd in the top 15 largest science and technology clusters in the world. The idea for this cluster dates to the 1970s but only took its modern shape in 2011 with the construction of most of the Shenzhen-Hong Kong-Guangzhou high-speed railway, also known as the Guangshengang Express. The industrial cluster selected for analysis includes three key ports, each with unique characteristics, including in terms of its contribution to the national economy. Guangzhou, for instance, is the largest port for foreign trade in South China, with new international routes opening as Nansha Port is built and developed. Shenzhen Port is predominantly focused on international container traffic, with delivery speeds 5-10 days slower than from Guangzhou Port. As the ports of Shenzhen and Guangzhou evolved, the specialisation of the Port of Hong Kong underwent some changes it became more frequently used as an international transshipment port and less frequently for cargo delivery. The cost of sending cargo from the Port of Hong Kong is on average USD 300 higher than from the ports of Shenzhen or Guangzhou; therefore, this port is more often used to ship goods that cannot be shipped from mainland ports. The use of Shenzhen, Hong Kong and Guangzhou ports for international transport has had a significant impact on the development of the industrial cluster, including the improvement of its technical characteristics. As of 2024, the Shenzhen-Hong Kong-Guangzhou industrial cluster had one of the highest concentrations in digital connectivity at 26.1%. The development of digital connectivity, in turn, enables the development of an extensive information network underpinning the strategic planning of industrial clusters. International cooperation in digital connectivity has also ensured China's leading position (Global Innovation Index..., 2024). A comparative analysis of the selected zones and clusters is presented in Table 1.

Table 1. Analysis of economic zones and industrial clusters in Germany, USA, China and Japan

Zone/cluster	Country	Information exchange	Human capital	Attracting investment
Frankfurt-Höchst	Germany	Interaction of companies with the park's experts and with each other	Collaboration with Provadis to create an individual professional track for each employee	Since 2000, approximately EUR 8.5 billion has been invested in the park, mainly by national investors
North Huntsville Industrial Park	USA	Interdisciplinary cooperation between research centres, engineering companies, and innovative start-ups to create an open information space	Investing in employee training starting from high school (Meta); creating the preconditions for long-term cooperation with cluster companies	Attracting national and international investments for the development of infrastructure, educational and other projects
Industrial Cluster Programme "Industrial Cluster"	Japan	Interaction between industries and higher education institutions to bring theory and practice into line	The attraction of personnel is conditioned by the specifics of a particular industrial cluster; as a rule, it involves interdisciplinary cooperation to gain access to the necessary knowledge and skills. Training and retraining of specialists are carried out through cooperation with universities and other educational institutions	The government is the main source of investment in industrial clusters. The amount of funds invested depends on the size of the cluster and the strategic importance of its activities for the state
"Knowledge Clusters"	Japan	Establishment of knowledge centres at universities and research institutions; cooperation between knowledge centres and industrial centres	Interdisciplinary and international cooperation for training and retraining of specialists following generally accepted quality standards	The main source of investment is the state. The use of mapping tools helps to establish cooperation at both the national and international levels to obtain additional funding
Shenzhen-Hong Kong-Guangzhou	China	With a high concentration in digital communications, Shenzhen-Hong Kong-Guangzhou has favourable conditions for the accumulation and exchange of data that can be used, among other things, for the further development of the industrial cluster	The cluster has created conditions for international cooperation, including in human capital attraction	Investments in the development of the industrial cluster come from both state funds and international sources. The emergence of the latter is due to the cluster's potential as one of the leaders in international transport

Source: compiled by the authors based on About Industriepark Höchst (n.d.), N. Kuwajimi (2022)

Based on the table above, it is possible to conclude that industrial clusters as an element of an economic zone can differ significantly in size and number of constituent enterprises. In the sample analysed, the smallest cluster is North Huntsville Industrial Park, USA, and the largest is Shenzhen-Hong Kong-Guangzhou, China. Industrial clusters may also differ in the amount of investment received and its predominant source; for example, Japanese clusters predominantly invested from regional and state budgets, while German and American clusters demonstrate sustainable development, including through diversification of investment sources. Despite these differences, the analysed industrial clusters

use universal approaches to information exchange, human capital development and investment attraction. A detailed analysis of management practices provides an understanding of the challenges of developing economic zones and industrial clusters and allows for planning strategies to overcome them.

Development of economic zones and industrial clusters

The development of economic zones and industrial clusters involves a detailed contextual analysis using various tools, including SWOT analysis. The results of the analysis are presented in Table 2.

Table 2. SWOT analysis of the functioning of economic zones and industrial clusters

Strengths	Weaknesses
Improved productivity	Increasing competition
Creation of new jobs	Uneven distribution of resources
Cooperation and innovation	Environment pollution
Access to specialised resources	
Opportunities	Threats
Regional and international cooperation	Economic downturn
Demand for social justice	Changes in legislation
Government and international support	Blocking cluster activities at the regional level

Source: compiled by the authors

The demonstrated table demonstrates that the development of economic zones and industrial clusters is directly related to labour productivity and is modelled by the variable of exchange of tangible and intangible resources. The existence of clusters is a driving force for the development of a particular region or country, as it leads to the creation of new jobs. An example that illustrates this point is the functioning of the Northeast Enterprise Zone in Portland, USA, which has led to the creation of 4,000 new jobs (Bergantino *et al.*, 2025). The emergence of new jobs not only contributes to solving several economic, social and other problems of the region but also helps to accumulate specialised resources, access to which is a driving force behind innovation processes.

Despite the obvious advantages, there are several weaknesses to consider, such as increasing competition, which grows in proportion to the number of businesses that offer the same or similar goods and services to their customers

within a short distance of each other (Trusova *et al.*, 2020b). In some national contexts, such as Japan, competition is won by large enterprises that gain almost total control over the local economy. This results in an uneven distribution of resources, making it difficult for new businesses to enter the market. Another important factor is the fact that as economic clusters grow, they also increase their emissions of harmful substances that pollute the atmosphere; for example, the construction and operation of the Guangsheng-gang Express involved the disruption of certain ecosystems and air pollution by carbon dioxide emissions. As such, in addition to the obvious benefits, the development of economic zones and industrial clusters poses several challenges for stakeholders, the solution of which requires a detailed contextual analysis. The functioning of the selected clusters was analysed using the PEST analysis method, which was used to analyse political, economic, social and technological factors. The results of the analysis are presented in Table 3.

Table 3. External factors of economic zones and industrial clusters (PEST analysis)

Factor	Comment
Political	Government support for industrial clusters in the form of tax breaks, additional funding, etc
Economic	Industrial clusters determine the sustainable development of small and medium-sized enterprises and can become a source of economic prosperity for the region
Social	There is a growing demand in society for equal distribution of resources and social justice
Technological	The development of digital communications contributes to the development of industrial clusters, including their involvement in international cooperation

Source: compiled by the authors

The table demonstrates that planning for the development of industrial zones and clusters addresses several universal external factors, the manifestation of which, however, strongly depends on the national context. An example is government support for the creation and development of zones and clusters, which depends on the financial profile of a particular state. The cases cited above show that a high level of government support is observed in Germany, the United States and Japan, i.e., countries with high gross domestic product and average per capita income. In developing countries, such as China, the level of government support may be significantly lower due to the existence of higher priority spending, such as on healthcare or housing for socially vulnerable groups. With limited government support, companies in industrial clusters are forced to look for additional sources of funding, including foreign ones (Sadikhov, 2024). With sufficient support, industrial clusters become a driving force for the economic well-being of the region, as is evident in the case of Shenzhen-Hong Kong-Guangzhou. As of 2022, Shenzhen alone had a gross domestic product of USD 500 billion, largely driven by the work of electronics giants such as Huawei and Tencent. The work of such companies not only transforms certain industrial clusters into electronic ones but also contributes to solving acute social issues such as unemployment and social injustice. In other words, the analysis shows that when planning the management of industrial clusters, favourable external factors outweigh unfavourable ones in terms of their number and degree of influence.

Opportunities can be maximised by assessing the external factors affecting the competitiveness of industrial clusters through Porter's five forces: buyers, suppliers, substitutes, competitors and incumbent competitors.

A distinctive feature of industrial clusters is the virtually unlimited range of buyers due to the variety of goods and services offered. As the cluster grows, the number of buyers increases, also due to the diversification of the assortment. In turn, the risk of substitute products is minimised, as industrial clusters offer a wide range of goods and services oriented to the needs of a particular region (Trusova *et al.*, 2020a). Despite these advantages, industrial clusters may face challenges such as the limited number of suppliers that make up the cluster. In terms of Porter's theory, fewer suppliers increase the cost of a good/service while lowering its quality. This limitation is partly overcome through competition between industrial clusters seeking to expand and conquer new market niches. However, the emergence of new clusters can be challenging in Japan, China and several other countries dominated by giant clusters that have monopolised the market.

Based on the analysis, recommendations were developed for the effective creation of economic zones and the development of industrial clusters, regardless of their geographical location. The first recommendation relates to the need for a detailed analysis of human capital, which is the driving force behind the growth and development of cluster companies. At the stage of analysis, it is necessary to assess whether the capital available in a particular region is sufficient and whether potential employees have the knowledge and skills to support the effective functioning of the industrial cluster. Several cluster members seek to attract staff as an important competitive advantage through external recruitment, including from other regions. However, external recruitment may show better results, as it has been proven to be effective, for example, in the context of

the Frankfurt-Höchst industrial park, where specialists develop strategies to increase the productivity of enterprises without increasing the number of employees.

The second recommendation is to conduct a contextual analysis of the sources of funding for industrial clusters. The strategic development of economic zones and clusters is usually based on funds received from the state and/or international investors. The planning process, however, should consider that the amount of investment received, its sources and other significant factors largely depend on the realities of the region or country in which the cluster will operate. The amount and intensity of government support is directly proportional to the income level of a particular region or country.

In addition to the recommendations presented, it is also proposed to conduct a preliminary analysis of the demand for industrial clusters in certain regions. A detailed understanding of this demand can be obtained by applying analytical tools such as PEST analysis or Porter's five forces analysis. Based on the study, it is possible to argue that the demand for clusters is strongest in regions with low market forces and high levels of social inequality. In other words, the cases reviewed provided an understanding of the specifics of the creation and operation of economic zones and industrial clusters in different countries and regions of the world. The analysis of internal and external factors that predetermine the emergence and development of industrial clusters formed the basis for the recommendations.

■ DISCUSSION

It is possible to identify correspondences between the conclusions drawn and the results obtained during earlier studies, including the role of economic zones and industrial clusters in solving the socio-economic problems of the region. D. McKernan & O. McDermott (2024) determined that in European countries, the existence of industrial clusters has a positive impact on employment and average wages. After conducting a contextual analysis, the experts found that 39% of European jobs and 55% of European wages are concentrated in industrial clusters. Y. Zhang & K. Chen (2024) studied the Chinese experience, analysing the impact of clusters on sustainability in the context of the reform of state-owned enterprises. Based on a comparative analysis of Chinese prefectures with industrial clusters and prefectures without such clusters, the researchers concluded that the former increased the number of self-employed, thereby reducing unemployment. Y. Zhang & K. Chen was able to trace the link between the functioning of industrial clusters, bold strategic planning and the solution of acute social problems, including unemployment and inequality. N. Kolisnichenko (2024) concluded that the implementation of cluster policy implies the use of various instruments that influence the implementation of strategically important national and regional projects and thus contribute to national recovery from the crisis.

One of the reasons why industrial clusters can become instruments of recovery and sustainable development is their effectiveness as centres of innovation (Karimli *et al.*, 2024). In this paper, examples of clusters, including the Frankfurt-Höchst Industrial Park, where interdisciplinary cooperation facilitates the emergence of innovative solutions that increase the efficiency and competitiveness of

their member companies were presented. The idea was confirmed in a study by J.L. Hervás-Oliver *et al.* (2024), which analysed the factors of successful functioning of individual industrial clusters. According to the experts, innovation processes in clusters are possible due to the existence of various multi-level systems and the cooperation of local organisations and stakeholders to collaborate on meaningful projects, such as sustainable development. S. Xu *et al.* (2024) investigated data from 285 Chinese cities and found that compared to individual enterprises, enterprises in industrial clusters are more innovation-oriented and therefore more successful in the medium and long term. A similar view was found in the report of L. Borunsky *et al.* (2020), according to which 65% of labour productivity growth in clusters is due to innovative solutions. According to D. McKernan & O. McDermott (2024), innovation processes in industrial clusters are also facilitated by the functioning of start-ups within them, which tend to have a fresh perspective on business processes and seek to differentiate strategies. Thus, there is a correspondence between the cited studies emphasising the role of innovation in the development of industrial clusters and the presented work, which sees information sharing as key to innovation processes. Innovation, in turn, is a prerequisite for effective cooperation and competitiveness of the enterprises that make up an industrial cluster.

The increased competitiveness of enterprises in industrial clusters discussed in this paper has been confirmed in earlier studies. H. Hoja *et al.* (2022) analysed data from 230 enterprises operating in the footwear and leather goods industry and concluded that belonging to industrial clusters significantly increased their competitiveness. The direct link between the functioning of clusters and the competitiveness of their member enterprises was confirmed by M. Dance *et al.* (2024) who analysed the printing industry. The researchers concluded that the relationship between clustering and competitiveness is modelled by access to resources necessary for efficient business operations. The consistency between the results obtained by M. Dance *et al.* (2024) and the findings in the presented study, according to which the operation of closely located businesses facilitates the exchange of resources that increases labour productivity, is noteworthy. An example from the presented study is the mutually beneficial use of resources and infrastructure of the ports that are part of the Shenzhen-Hong Kong-Guangzhou industrial cluster, in China.

The analysis also concluded that the efficiency of enterprises depends not only on the fact of functioning in the economic zone but also on the set of factors affecting the competitiveness of the cluster. The idea was confirmed in earlier studies, including one by D.C. Chifor *et al.* (2024), which presented a ranking of factors that increase and decrease the competitiveness of clusters. The latter group of factors included selected territorial, sectoral, organisational and political factors. According to an analysis by H. Guan *et al.* (2020), which addressed the peculiarities of the functioning of the economic zone in the Pearl River Delta (China), the competitiveness of clusters decreases when they switch to extensive development strategies, which provide for a constant search for new resources instead of rational use of existing resources. A similar

idea was presented in the analysis of selected economic clusters, including Frankfurt-Höchst Industrial Park in Germany and North Huntsville Industrial Park in the USA, whose priority strategies are the creation of an individual professional track, external recruitment and long-term co-operation instead of permanent recruitment of third-party candidates. According to J.L. Aguilar Colmenero & J. Portela Garcia-Miguel (2024), the effectiveness of industrial clusters is also significantly influenced by contextual factors, including their geographical location. This correlates with the findings of this paper, which is based on a comparative analysis of economic zones and industrial clusters in Germany, the United States, Japan and China.

The existence of multiple contextual factors necessitates the use of various analytical tools in the planning of economic zones and industrial clusters. This paper proposed the use of tools such as SWOT analysis, PEST analysis and Porter's five forces analysis to understand the factors that drive the effectiveness of industrial clusters. Support for the proposed recommendation was found in earlier works including M. Komorowski (2020) proposing a multi-component analysis of the factors for the creation and development of economic zones and industrial clusters. In addition to the tools used in this study, other analytical approaches whose effectiveness has been empirically proven include synthetic qualitative-quantitative contextual analysis; Solow, Romer and Cobb-Douglas economic models (Onikienko, 2024); spatial clustering of applications with density-based noise (Cui *et al.*, 2024); and value chain analysis (Pratiwi *et al.*, 2024). The use of these and other tools contributes to the sustainable development of industrial clusters, the effectiveness of which has been confirmed in earlier studies, including Y. Teng *et al.* (2024). According to experts, such planning contributes to the sustainable development of economic zones and individual clusters. The conclusions drawn in this study were confirmed in previous studies. Correspondences were found regarding the role of clusters in solving urgent problems of the region and its sustainable development, the relationship between clustering and innovation, as well as factors influencing the development and competitiveness of clusters. Tools for contextual analysis and further planning of cluster activities were proposed.

■ CONCLUSIONS

The study analysed the peculiarities of organising and promoting economic zones and providing business support in industrial clusters in Germany, the USA, Japan and China. Based on previous studies, the study concluded that the emergence of economic zones and clusters facilitates business activities and solving urgent socio-economic problems in regions with no market forces. The idea of creating economic zones, which emerged in the UK in the 1970s, has not lost its popularity in other countries, as the functioning of industrial clusters ensures the

creation of new jobs, promotes the emergence and promotion of innovative ideas and underpins the sustainable development of the region.

A comparative analysis of the Frankfurt-Höchst Industrial Park in Germany, North Huntsville Industrial Park in the USA, the Industrial Cluster and Knowledge Clusters programmes in Japan and the Shenzhen-Hong Kong-Guangzhou cluster in China concluded that despite the existing differences in size, focus and several other parameters, the development of industrial clusters relies on a set of universal principles. The key principles of successful functioning of industrial clusters include the following: interdisciplinary cooperation and constant exchange of information as a source of innovation processes and a foundation for the competitive functioning of the enterprises included in the cluster; intensive development of human capital through training and retraining of personnel with knowledge, skills and motivation for long-term cooperation; openness to co-operation and continuous attraction of investment, especially in middle- and low-income countries whose enterprises cannot rely on sufficient state support.

Using the methods of SWOT analysis, PEST analysis and Porter's five forces, the key challenges in promoting economic zones and developing industrial clusters were identified. The challenges analysed included a lack of human capital or poor quality of such capital in the area where the industrial cluster is located, low demand for the cluster in a particular geographic area, and insufficient understanding of the external factors that determine the development of a cluster in a particular region. In the context of the identified difficulties, the following recommendations for the development of economic zones and individual industrial clusters were proposed: a detailed assessment of human capital in a particular region using qualitative and quantitative analysis tools; abandonment of extensive use of human resources in favour of intensive development; contextual analysis of funding sources and search for alternative investments, especially in low-income regions; and contextual analysis of public sphere.

In future studies, it is recommended to expand the sample by studying the functioning of clusters in Africa, the Middle East, Latin America and Australia. Such a sample will provide an in-depth understanding of the contextual factors that determine the emergence and promotion of economic zones and the management of industrial clusters. It is also recommended to analyse the experience of developing economic zones and industrial clusters in the face of political, economic and environmental uncertainty to formulate sustainable development strategies.

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None.

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Просування економічних зон і забезпечення бізнесу в промислових кластерах: підходи, орієнтовані на інформацію, інвестиції та людський капітал

■ **Анотація.** Метою представленої роботи було проаналізувати особливості просування економічних зон і забезпечення бізнесу в промислових кластерах. Для досягнення мети було створено вибірку з таких об'єктів: індустріальний парк Frankfurt-Höchst (Німеччина), North Huntsville Industrial Park (США), програми «Індустріальний кластер» і «Кластери знань» (Японія) та Шеньчжень-Гонконг-Гуанчжоу (Китай). Обрані кластери були проаналізовані з точки зору стратегій обміну інформацією, залучення інвестицій та якісного людського капіталу. Згідно з результатами порівняльного аналізу, ключовими особливостями ефективного просування кластерів є створення розгалуженої інформаційної мережі для міждисциплінарного співробітництва та обміну інформацією, залучення інвестування в розвиток людського капіталу та диверсифікація інвестицій. Синтетичний аналіз із застосуванням інструментів SWOT-аналізу, PEST-аналізу та моделі п'яти сил Портера допоміг виокремити основні перешкоди до ефективного просування економічних зон і кластерів: брак кадрових резервів або їхня низька якість; відсутність попиту на пропоновану продукцію та/або послуги в регіоні функціонування кластера; недостатнє розуміння контексту функціонування кластера, що призводить до неефективних стратегічних рішень. Виходячи з проведеного аналізу, було запропоновано такі рекомендації щодо ефективного просування економічних зон і кластерів із погляду інвестицій, а також інформаційної та кадрової політики: перехід на інтенсивні практики інвестування та розвитку людського капіталу; диверсифікація інвестування, особливо в регіонах із низьким рівнем доходу та наявністю пріоритетніших статей видатків державного бюджету; попередній контекстуальний аналіз для виявлення суспільного запиту на функціонування кластеру

■ **Ключові слова:** контекстуальний аналіз; розвиток співробітництва; диверсифікація фінансування; сталий розвиток; залучення капіталу