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Indicators characterizing integration between investment construction companies and special economic zones in the course of implementation of an investment and construction project

The article addresses the generation of indicators characterizing the process of integration of investment and construction enterprises (ICE) and special economic zones (SEZ) in the course of implementation of investment and construction projects (ICP). The objective is to examine the external and internal environments of the subjects of interaction, given that these environments have factors of the meso-environment and the micro-environment. The key approach, used to synthesize the indicators, includes the analysis of information flows that take into account the prospects for the implementation of an ICP in a SEZ, and the efficiency assessment of the involvement of an ICE enterprise in the construction of a building, based on the analysis of financial and economic activities of the object under study (an ICE enterprise), the calculation of the rate of return and the cost effectiveness of investments, demonstrating the likelihood of integration of SEZ and ICE enterprises. The integrated monitoring of the information environment of impacts, produced by the entities of various origin, allows developing indicators of qualitative and quantitative characteristics of the subject of research with account taken of the external and internal effects that contribute to integration, or externalities and internalities. Having identified the nature of the influence, produced by external and internal effects, one can predict the scope of benefits and costs for interacting parties and demonstrate the strengths and weaknesses of potential integration of ICE enterprises and SEZ in the course of implementation of an investment and construction project. The monitoring results are presented as matrices of absolute and relative indicators that need to be brought to unified dimensions. The authors of the article suggest using a new system of indicators to attain strategic development goals set in the documents governing the improvement of the construction industry by solving the problem of the spotty siting of SEZs to implement sophisticated and unique ICPs.

Keywords: *special economic zones, investment construction enterprises, investment and construction project, integration, externalities, internalities*

INTRODUCTION

Currently, the prospects for using SEZs as an instrument of the cluster approach to certain types of construction work are specified in strategic policy documents^{1, 2}. The lack of well-coordinated plans of urban and spatial development of subjects of the Russian Federation has ended in the spotty siting of integrated development areas having the real estate infrastructure required for the implementation of sophisticated and unique industrial projects. One of the top-priority solutions is to take support measures and boost the demand for land use planning tools among the business community to consolidate the private and public capital towards improving the industrial and infrastructure-focused construction sector, identify the prospects for integration between ICE enterprises, as carriers of production factors, and SEZs as fundraising tools^{1, 2} [1]. However the lack of an unbiased assessment of the interaction potential, prognosticated benefits and costs of consolidated efforts, advantages of investment and construction activities in SEZs trigger the demand for relevant indicators [2]. External and internal environments, that translate into factors of meso- and micro-environments, serve

as the basis for the synthesis of indicators. It is generally accepted that indicators characterize quantitative or qualitative constituents of the phenomenon under study. Within the framework of the study, quantitative indicators convey the sale volume (or an ICP) [3, 4], calculated in monetary units or labour costs per unit of time. The data, needed to develop quantitative indicators, are extracted from accounting and management reporting documents, statistical data provided by authorized state statistics bodies, and information available in open sources. The mission of qualitative indicators is to demonstrate and evaluate the effectiveness of an enterprise in conditions of limited resources, and it is expressed in relative values. If applied to the purpose of the study, qualitative indicators are the values that are used to calculate the return on investments and an increase in the total value of the corporate capital as a result of integration.

The purpose of the article is to present the devised set of indicators and areas of their application within the framework of interaction between ICE enterprises and SEZs in the course of implementation of an ICP [3, 5]. The main tools, used to analyze and theorize the subject of research, include theories of infographic modeling [6–8], the P.K. Anokhin theory

¹ Strategy for the development of the construction industry, housing and utilities in the Russian Federation through 2030 with a forecast for the period up to 2035. URL: <https://www.minstroyrf.gov.ru/upload/iblock/672/V-Strategiya-na-sayt-i-GASU.pdf> (date of access: 22.05.2022).

² Strategy for the innovative development of the construction industry of the Russian Federation through 2030. URL: https://stroim.su.ru/uploads/user_files/files/str_2030.pdf (date of access: 24.05.2022).

of functional systems [7], the theory of externalities, and the theory of growth poles developed by Francois Perroux [9]. The results of the research methodology are presented in the form of matrices containing relative and absolute indicators.

METHODS

According to the P.K. Anokhin theory of functional systems and the theory of infographic modeling [6, 7], based on the analysis of various information flows and a need for the comprehensive monitoring of external and internal environments and a set of indicators, future indicators should be distributed between the foci of monitoring to convey formation and application processes within the framework of an ICE enterprise willing to conduct investment and construction activities in a SEZ.

At the first stage of the study, the proposed system of indicators was structured in compliance with its purpose. Indicators were distributed among the foci of the integrated monitoring of the collaborative environment and presented in Fig. 1.

The collaborative environment, that encompasses investment construction enterprises and a SEZ, is monitored to identify the benefits of an ICP project, including the commercial and social

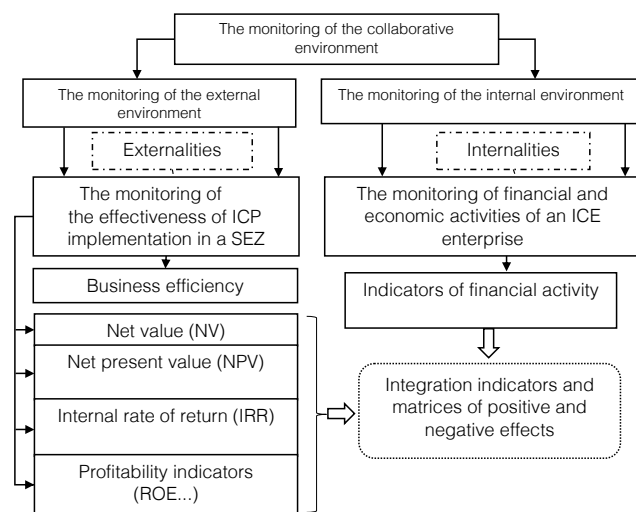


Fig. 1. The foci of the integrated monitoring of a collaborative environment

efficiency, demonstrated by external and internal effects that contribute to the integration or disintegration of interaction subjects. A matrix of absolute and relative indicators is formed on the basis of the monitoring results, that represent a combination of financial performance of an ICE enterprise willing to get involved in the implementation of an ICP.

The next stage of the study is focused on the generation of a management subsystem aimed at the integration of ICE enterprises with SEZ for the purpose of implementation of an ICP. Fig. 2 shows the route of input and output information from meso- and micro-environments, surrounding the subjects of interaction, and the decision-making by the person, who is responsible for integration and applies the proposed system of indicators [10, 11].

The management subsystem demonstrates the route of data towards the person responsible for interaction and integration.

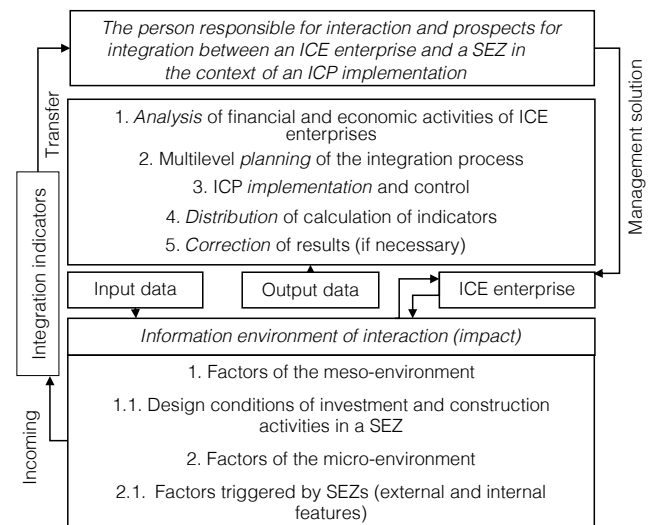


Fig. 2. A management subsystem for the integration between ICE and SEZ enterprises in the course of implementation of an ICP

An important characteristic of the subsystem is its ability to trace the relationship of the decision-making process in terms of the application of integration indicators and their potential change, since the information environment is rather dynamic than inert, and it has a response effect on the process of integration.

An essential stage of research is the identification of the properties of a set of integration indicators. Table 1 has a summarized description of the properties to be considered in the course of synthesizing indicators to make them relevant to the goals of scientific research.

Therefore, indicators of integration of ICE enterprises and

Table 1. Properties of indicators of integration between an ICE and SEZ enterprises in the course of implementation of an ICP

Property	Summarized description
Balance	The combination of financial and non-financial characteristics used to develop a set of indicators
Comparability	The availability of a benchmark that ensures the validity and objectivity of indicators
Retrospection	Account must be taken of time as an aspect of dynamic change in the project parameters and the environment of influences
Aggregation	Consolidation of individual indicators into a single indicator containing summarized information
Multi-stage nature	Usability of indicators at various stages of integration of ICE enterprises and a SEZ

a SEZ in the course of implementation of an ICP can be synthesized with account for the application of the research methodology and identification of areas in the environment to be subjected to integrated monitoring with account taken of the data coming from various information sources.

► RESULTS

Indicators of integration between ICE enterprises and a SEZ within the framework of implementation of an ICP correspond to the two types of monitoring: the monitoring of the internal environment, represented by the indicators of the analysis of financial and economic activities of an ICE enterprise willing to operate in a SEZ, and the monitoring of the external environment, characterized by the indicators describing the implementation of an ICP in a SEZ and the extent of involvement of an enterprise in a project [12, 2]. Table 2 has a list of relative and absolute indicators of financial and economic activities of an ICE enterprise.

Table 2. Indicators of financial and economic activities of an ICE enterprise in the process of integration with a SEZ

Absolute indicators		Relative indicators	
Revenue	R_{SEZ}	Coefficient of autonomy	C_a
Gross profit	P_{gr}	Coefficient of financial dependence	C_{fd}
Cost of sales	CS	Capital productivity	CP
Inventory and costs	IC	Return on assets	R_a
The total value of sources of reserves and costs	TVR	Coefficient of current liquidity	C_l
Sufficiency of the working capital of an enterprise	SOWC	Coefficient of solvency	$C_{s,r}$
Tax deductions	T	Coefficient of capitalization	C_c

The proposed set of indicators demonstrates the financial stability of an enterprise, the structure of its capital, and the loan to equity ratio. These indicators demonstrate the solvency of an enterprise, its ability to honour the debt obligations, which is of key importance for integration prospects.

The next group of indicators encompasses effectiveness indicators of ICE enterprises and their involvement in ICPs [12–15], calculated using the formulas of simple and compound interest with account taken of the time factor, or the calculation of cash flows [16], presented in Table 3.

These interrelated indicators determine the nature of influence of external and internal effects of integration expressed through matrices of absolute and relative indicators presented in (1) and (2).

$$A = \begin{bmatrix} \dots & Y_1 & Y_2 & \dots & Y_m \\ X_1 & a_{11} & a_{12} & a_{13} & a_{1n} \\ X_2 & a_{21} & a_{22} & a_{23} & a_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ X_n & a_{n1} & a_{n2} & \dots & a_{nm} \end{bmatrix}, \quad (1)$$

$$B = \begin{bmatrix} \dots & Y_1 & Y_2 & \dots & Y_m \\ X_1 & a_{11} & a_{12} & a_{13} & a_{1n} \\ X_2 & a_{21} & a_{22} & a_{23} & a_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ X_n & a_{n1} & a_{n2} & \dots & a_{nm} \end{bmatrix}. \quad (2)$$

Table 3. Efficiency indicators of the ICP implementation in SEZs and the involvement of ICE enterprises

Absolute indicators		Relative indicators	
Net value	NV	Profitability index	PI
Net present value	NPV	Internal rate of return	IRR
Duration of preparatory work in case of implementation of an ICP in a SEZ	$T_{d,p}$	The ratio of the time of preparatory work to the time of construction and installation work in a SEZ	C_c
The time needed to obtain documentation and permits from authorized government agencies	$T_{d,p,g}$	—	

The task of the matrix is to predict possible benefits and costs of integration by generating patterns of interaction on the basis of intersections between the two above-mentioned groups of indicators.

Patterns are prospects for interaction, identified using the values of monitoring indicators of X_i , the 1st subject of interaction (the ICE enterprise), and Y_i , the second subject (the SEZ), and an in-depth study of the characteristics of patterns. The matrix conveys a certain dependence between the actions taken by ICE enterprises operating in SEZs.

Similarly, the matrix of relative integration indicators of ICE enterprises and a SEZ is shown in (3).

However, the applicability of these matrices is not limited to determining the possible effects of integration. In case of uncertainty, the matrix will have the form shown in (3).

$$C = \begin{bmatrix} \dots & E_1 & E_2 & \dots & E_m \\ D_1 & c_{11} & c_{12} & c_{13} & c_{1n} \\ D_1 & c_{21} & c_{22} & c_{23} & c_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ D_n & c_{n1} & c_{n2} & \dots & c_{nm} \end{bmatrix}. \quad (3)$$

In case of uncertainty, the integration matrix is a means to assess various options for the development of interaction, when events, generated by the environment, such as E_i , are unknown or random. Subject D_i performs one of the procedures.

DISCUSSION

Given the research results, the authors believe that the development of indicators, needed to integrate ICE enterprises with SEZs, must be based on the study of the external and internal environments of the subjects of interaction. The key approach, that provides for the synthesis of relevant indicators, is the analysis of information flows and identification of possible effects of interaction between the economic entities of different origin. Selected areas of integrated monitoring, related to the analysis of financial and economic activities of an ICE enterprise and the assessment of its effectiveness during the implementation of an ICP in a SEZ, are used to identify important aspects of interaction, which are further expressed in matrices of absolute and relative indicators.

The proposed decision-making subsystem of interaction and subsequent integration of ICE enterprises and SEZ opens up broad prospects for studying and improving the decision-making process.

CONCLUSION

The authors of the article believe that the value of the study lies in the applicability of its results and methodology to various areas towards improving the performance of ICE enterprises. The matrices of absolute and relative indicators of integration predict patterns of interaction, which in the future will allow identifying a certain reliance on the actions taken by ICE enterprises and SEZs to clarify the problem of disproportion in the siting of the territories of integrated development that are necessary for the implementation of technically complex and unique construction projects.

An important result of the study is the visual representation of the management decision-making subsystem designated for collaborative interaction. It illustrates the route of output and input information coming from meso- and micro-environments. The ability to examine the relationship between the indicators of integration and decision-making by the person responsible for interaction allows for a more comprehensive study of the aspects of a dynamic environment that has a multi-level structure of factors of influence.

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Показатели интеграции предприятий инвестиционно-строительной сферы и особых экономических зон при реализации инвестиционно-строительного проекта

Статья посвящена изучению и формированию показателей, характеризующих процесс интеграции предприятий инвестиционно-строительной сферы (ИСС) и особых экономических зон (ОЭЗ) при реализации инвестиционно-строительных проектов (ИСП). Решение этой задачи заключается в исследовании внешней и внутренней среды, окружающей субъекты взаимодействия, представленной факторами мезосреды и микросреды. Ключевым подходом, используемым для синтеза показателей, является анализ информационных потоков, учитывающих перспективы реализации ИСП на территории ОЭЗ и оценку эффективности участия предприятия ИСС в возведении объекта строительства, основанного на анализе финансово-хозяйственной деятельности изучаемого объекта (предприятия ИСС) и расчете доходности и рентабельности инвестиционных вложений, отражающих вероятность осуществления процесса интеграции ОЭЗ и предприятий ИСС. Применяемый комплексный мониторинг информационной среды воздействия различных природо-возникновения позволяет разработать показатели, которые от-

ражают качественные и количественные характеристики предмета исследования, связанного с выявлением внешних и внутренних эффектов, способствующих интеграции — экстерналий и интерналий. Определение характера влияния внешних и внутренних эффектов дает возможность спрогнозировать величину выгод и издержек для сторон взаимодействия, демонстрируя сильные и слабые стороны возможной интеграции предприятий ИСС и ОЭЗ при реализации ИСП. Результаты мониторинга представляются в виде матриц абсолютных и относительных показателей, которые необходимо привести к единой размерности. Авторы статьи предлагают применять разработанную систему показателей для осуществления целей стратегического развития, изложенных в программных документах по совершенствованию строительной отрасли, связанной с решением проблемы диспропорции размещения ОЭЗ, которые необходимы для реализации технически сложных и уникальных ИСП.

Ключевые слова: особые экономические зоны, предприятия инвестиционно-строительной сферы, инвестиционно-строительный проект, интеграция, экстерналии, интерналии

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