

ISCKMC 2020
International Scientific Congress «KNOWLEDGE, MAN AND CIVILIZATION»**INTEGRATED APPROACH FOR ASSESSING THE LEVEL OF
STAKEHOLDER INTERACTION ON CONSTRUCTION
ENTERPRISES**

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Abstract

In current conditions, there are mixed trends in the functioning of construction enterprises. It is proved, that one of the solutions is the formation and implementation of areas of growth in the effectiveness of interaction between stakeholders of construction enterprises by creating a quantitative basis using an appropriate approach to assessment. The study aims to develop an integrated approach to assessing the level of interaction between stakeholders of construction enterprises. To achieve this goal, the following tasks are solved: identification of stakeholders interacting in the construction sector; formation of tools for assessing the level of interaction of stakeholders in the construction sector; the development of models to assess the level of interaction of stakeholders in the construction sector; the development of ways to improve the construction enterprises functioning, considering the directions and characteristics of the stakeholder interaction. As a result of the study, an integrated approach to assessing the level of interaction between stakeholders of construction enterprises by using the absolute method, method of expert assessments and method of hierarchies based on a set of interrelated actions was developed, which allowed determining the local, systemic and integral factors for forming a quantitative basis for making managerial decisions to increase the effectiveness of interaction between interested persons in the construction sector. Measures to increase the efficiency of the functioning of construction enterprises are proposed.

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Keywords: Stakeholders, construction enterprises, level of stakeholder interaction, integrated approach



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1. Introduction

In current conditions, there are mixed trends in the functioning of construction enterprises. In particular, over the past decades, there has been an increase in sales volumes, performance, but the number of employees is decreasing. This indicates a reduction in human capital, which is essential and ensures the development of enterprises. In such conditions, one of the solutions is the formation and implementation of areas of growth in the effectiveness of interaction between stakeholders of construction enterprises by creating a quantitative basis using an appropriate approach to assessment.

2. Problem Statement

The materials for the study are theoretical and practical provisions for the formation and interaction with stakeholders, which are presented in works of Clarkson (1995), Mamonov (2011), Mitchell et al. (1997), Savage et al. (1991), Parmar et al. (2010) and others.

Directions and features of the functioning of the construction sector considering the level of interaction between stakeholders are studied by Prunenکو et al. (2017), Gritskov and Mamonov (2017), Demianenko (2009), Ermolaev (2013), Serobyán (2015), Tarasevich (2009) and others. However, the issues of ensuring the growth of the effectiveness of interaction between interested parties based on the formed quantitative basis remain unresolved. Appropriate methods are used to conduct the study:

1. generalization (to identify stakeholders, which affect the level of interaction in the construction sector);
2. systematization (for regulatory support used in the construction sector and for stakeholder interaction);
3. analytical methods (to establish the main trends in changing the basic indicators of the construction sector functioning);
4. an integrated approach to assessing the level of stakeholders interaction in construction enterprises;
5. hierarchy analysis method (for determining weighting factors, which determine the influence of stakeholder factors on the integral indicator of the interaction level between stakeholders of construction enterprises).

The study aims to develop an integrated approach to assessing the level of interaction between stakeholders of construction enterprises.

To achieve this goal, the following tasks are solved:

- Identification of stakeholders interacting in the construction sector;
- Formation of tools for assessing the level of interaction of stakeholders in the construction sector;
- The development of models to assess the level of interaction of stakeholders in the construction sector;
- The development of ways to improve the construction enterprises functioning, considering the directions and characteristics of the stakeholder interaction.

3. Research Questions

To achieve this goal, the following research questions are solved:

- Identification of stakeholders interacting in the construction sector;
- Formation of tools for assessing the level of interaction of stakeholders in the construction sector;
- The development of models to assess the level of interaction of stakeholders in the construction sector;
- The development of ways to improve the construction enterprises functioning, considering the directions and characteristics of the stakeholder interaction.

4. Purpose of the Study

The study aims to develop an integrated approach to assessing the level of interaction between stakeholders of construction enterprises.

5. Research Methods

Appropriate methods are used to conduct the study:

1. generalization (to identify stakeholders, which affect the level of interaction in the construction sector);
2. systematization (for regulatory support used in the construction sector and for stakeholder interaction);
3. analytical methods (to establish the main trends in changing the basic indicators of the construction sector functioning);
4. an integrated approach to assessing the level of stakeholders interaction in construction enterprises;
5. hierarchy analysis method (for determining weighting factors, which determine the influence of stakeholder factors on the integral indicator of the interaction level between stakeholders of construction enterprises).

6. Findings

For the functioning of the construction industry and ensuring the interaction between stakeholders, the following legal and regulatory provisions are applied: Laws of Ukraine (“On regulation of urban planning activity”, “On building standards”, “On energy saving”, “On architectural activity”, “On improvement of settlements”, “On liability for offenses in the sphere of urban planning”, "On the prevention of the impact of the global financial crisis on the development of the construction industry and housing", "On financial and credit mechanisms and property management in housing and real estate", "On technical regulations and conformity assessment", "On licensing of economic activities", «On amendments to some legislative acts of Ukraine on improvement of urban planning activities», «On

access to construction, transport, electricity objects for the development of telecommunication networks», "On environmental impact assessment", "On energy efficiency of buildings", "On electricity market"); resolutions of the Cabinet of Ministers of Ukraine ("On state expertise on energy saving", "On approval of the Procedure for checking the observance of the requirements of regulatory documents and standards for calculating the cost of construction of objects constructed with attraction of budget funds, as well as funds of state and municipal enterprises, institutions and organizations, loans granted under state guarantees", "On approval of the general conditions for the conclusion and implementation of work contracts in capital construction", "On approval of the rules for confirming the suitability of new construction products for use", "On approval of the technical regulation for construction products, buildings and structures", "On copyright and technical supervision during the construction of an architectural object", "On approval of the procedure for application of building norms developed on the basis of national technological traditions, and building norms harmonized with normative regulations European Union documents», "On the approval of the Procedure for the examination of urban planning documentation", "On the approval of the Procedure for the implementation of state architectural and construction control", "On the urban planning cadastre", "On the approval of the Procedure for approval of construction projects and their examination and the recognition of some decisions of the Cabinet of Ministers of Ukraine as invalid", "On Approval of the Procedure of state architectural and construction supervision", "Some issues of activity of the state architectural and construction control bodies", "On Approval of the criterion for assessing the risk of conducting economic activity in the sphere of urban development and determining the periodicity of planned state supervision measures (control) by the bodies of state architectural and construction control", "On approval of the list of construction works that do not require documents that give the right to their execution, and after which the object is not subject to acceptance for operation"); Orders (Ministry of regional development, construction and housing and communal services of Ukraine dated December 30, 2014 No. 381 "On Approval of the Instruction on conducting a verification of compliance with the requirements of normative documents and standards for calculating the cost of construction of objects constructed with attraction of budget funds, as well as state and utility funds, institutions and organizations, loans granted under state guarantees», dated April 24, 2015 No. 79 "On approval of the Procedure for the commissioning and technical inspection of individual (estate) residential buildings, garden, country houses, household buildings and structures, public buildings and agricultural buildings and structures of complexity category I and II built without permission to carry out construction work", dated December 30, 2014 No. 1417 "On approval of the form and description of the official certificate of an official of the state architectural and construction control (supervision) body", dated July 1, 2015 No. 150 "On approval of the form and description of the official certificate of the official of the state architectural and construction control (supervision) body", dated 20.10.2016 No. 281 "On Approval of the Procedure for calculating the amount of estimated salary to be considered in determining the cost of construction of objects", from 06.11.2017 No. 289 "On approval of the list of construction objects for which urban planning conditions and restrictions are not provided", registered at the Ministry of Justice of Ukraine on 27.11.2017 No. 1437/31305), etc.).

The level of stakeholder interaction in the construction sector is influenced by factors characterizing its functioning and development. As a result of the study, a slowdown in the growth rate of

the construction products index was determined (Table 1, (State Statistics Service of Ukraine, 2020), which indicates a decrease in the capabilities of construction enterprises regarding their development.

Table 1. Changes in the Growth Rate of Construction Products Index in 2011 - 2018,%

Month	Month (period) to the corresponding month (period) of the previous year							
	2018	2017	2016	2015	2014	2013	2012	2011
January	105.0	146.5	96.5	67.6	103.4	83.7	118.6	117.9
February	102.3	114.2	113.6	73.9	99.7	92.3	105.4	117.1
January-February	103.6	127.6	105.8	70.9	101.4	88.1	111.5	117.5
March	103.0	122.3	112.1	69.5	106.0	79.3	104.7	120.6
January-March	103.3	125.4	108.3	70.3	103.2	84.4	108.5	118.8
April	102.7	117.0	125.5	68.0	87.8	87.6	111.8	128.0
January-April	103.1	122.9	113.0	69.7	98.4	85.4	109.5	121.4
May	109.0	136.1	112.6	78.0	87.6	74.3	116.1	125.6
January-May	104.6	126.0	112.9	71.5	95.9	82.5	111.2	122.4
June	115.0	141.1	113.5	83.9	78.8	82.2	98.4	130.8
January-June	107.0	129.2	113.0	73.8	92.2	82.4	108.1	124.3
July	116.7	129.1	121.0	81.8	74.7	96.7	85.6	113.0
January-July	108.8	129.1	114.4	75.0	88.9	84.8	103.6	121.9
August	105.9	133.1	120.8	91.8	67.6	93.5	87.5	119.6
January-August	108.3	129.8	115.4	77.2	85.4	86.1	100.8	121.5
September	107.4	120.8	128.1	92.0	73.1	86.6	91.3	115.4
January-September	108.2	128.3	117.3	79.1	83.6	86.1	99.3	120.5
October	112.3	121.9	115.3	96.6	72.1	88.5	85.2	128.4
January-October	108.7	127.5	117.0	81.1	82.1	86.4	97.3	121.5
November	109.1	120.0	118.5	96.4	77.4	97.5	76.5	127.0
January-November	108.7	126.5	117.2	82.7	81.6	87.6	94.6	122.2
December	107.1	125.2	118.5	125.7	67.1	99.4	80.6	108.2
January-December	108.5	126.3	117.4	87.7	79.6	89.0	92.7	120.0

The dynamics of the construction products index by type are presented in Table 2, (State Statistics Service of Ukraine, 2020). Based on the study, it was determined that between 2010 and 2018, there is an increase in the volume of construction products in general and by type:

- residential buildings – by 4.27 times;
- non-residential buildings – by 2.93 times;
- engineering structures – by 3.2 times.

Table 2. Dynamics of the Construction Products Index by Type, % to the previous year

Years	Construction, total	Buildings	Including		Engineering structures
			residential	non-residential	
2011	120.0	114.9	101.7	122.1	124.4
2012	92.7	93.9	93.5	94.1	91.7
2013	89.0	96.6	111.3	90.0	82.8
2014	79.6	79.6	103.5	66.3	79.7
2015	87.7	91.9	98.9	85.8	83.7
2016	117.4	120.7	117.8	123.7	114.0
2017	126.3	121.4	116.3	126.1	131.7
2018	108.5	103.4	100.9	105.7	113.6

The dynamics of the construction products index by type indicates a slowdown in growth trends in residential and non-residential buildings, engineering structures. The dynamics of the volume of construction products by type are presented in Table 3 (State Statistics Service of Ukraine, 2020).

Table 3. Dynamics of Output of Construction Products by Type

Years	Construction, total	Buildings	Including		Engineering structures
			residential	non-residential	
2010	42918.1	19659.1	6876.5	12782.6	23259.0
2011	61671.7	26745.4	8137.1	18608.3	34926.3
2012	62937.2	28104.8	8523.0	19581.8	34832.4
2013	58586.2	28257.3	9953.1	18304.2	30328.9
2014	51108.7	24856.5	11292.4	13564.1	26252.2
2015	57515.0	28907.5	13908.8	14998.7	28607.5
2016	73726.9	38106.4	18012.8	20093.6	35620.5
2017	105682.8	52809.6	23730.0	29079.6	52873.2
2018	141213.1	66791.6	29344.8	37446.8	74421.5
Index (2018/2010)	3.29	3.4	4.27	2.93	3.2

The volume of housing commissioned by its types is presented in Table 4, (State Statistics Service of Ukraine, 2020).

In 2010–2017, there was an increase in the volume of housing commissioned by 20 % due to an increase in the total area with two or more apartments and hostels. However, the total area of residential buildings, with one apartment, decreased by 30 %.

Table 4. The Volume of Housing Commissioned by its Type, thousand m² of the total area

Years	Total	Including Residential Buildings		
		With One Apartment	With Two Or More Apartments	Hostels
2010	8603.9	5713.0	2868.8	22.1
2011	8685.3	4714.1	3938.0	33.2
2012	9769.6	6465.1	3260.9	43.6
2013	9949.4	5864.1	4023.7	61.6
2014	9741.3	4553.4	5161.1	26.8
2015	11044.4	5580.0	5435.2	29.2
2016	9366.8	4089.2	5249.6	28.0
2017	10206.0	4231.4	5934.9	39.7
Index (2017/ 2010)	1.2	0.7	2.1	1.8

The total area and number of apartments in the residential buildings are presented in Table 5, (State Statistics Service of Ukraine, 2020).

Table 5. The total area and number of apartments commissioned in residential buildings

Indicators	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total									
Commissioning of the total area, thousand m ²	8604	8685	9770	9949	9741	11044	9367	10206	8689
including									
in urban areas	5738	6366	6778	6685	6645	7465	6503	7274	5652
in rural areas	2866	2319	2992	3264	3096	3579	2864	2932	3037
The number of apartments built, thousand	71	77	83	93	105	120	113	126	103

	including									
in urban areas	52	61	63	67	77	89	85	99	76	
in rural areas	19	16	20	26	28	31	28	27	27	
Per 1000 population										
Commissioning of the total area, m ²	198	201	227	232	227	259	220	241	206	
including										
in urban areas	193	215	229	226	225	254	222	249	194	
in rural areas	209	170	221	243	232	269	217	223	233	
Number of apartments built	1.6	1.8	1.9	2.2	2.5	2.8	2.6	3.0	2.4	
including										
in urban areas	1.8	2.1	2.1	2.3	2.6	3.0	2.9	3.4	2.6	
in rural areas	1.4	1.2	1.5	1.9	2.1	2.4	2.1	2.1	2.1	

The total area and number of apartments commissioned in residential buildings indicate the excess of their commissioning in urban areas compared with the rural areas. The number of buildings and engineering structures of construction in progress as of January 1, 2004 - 2014 is presented in Table 6, (State Statistics Service of Ukraine, 2020).

Table 6. The number of buildings and engineering structures of construction in progress as of January 1, 2004–2014, units

Years	Total number of buildings and engineering structures in progress	Including	
		Buildings	Engineering structures
2004	27383	19435	7948
2005	25912	18010	7902
2006	24482	16835	7650
2007	22701	15574	7127
2008	21516	14688	6828
2009	19989	13682	6307
2010	18977	13018	5959
2011	18261	12519	5742
2012	16654	11347	5307
2013	16109	10943	5166
2014	16380	11371	5009

From 2004 to 2014, there has been a decrease in the number of buildings and engineering structures of construction in progress as of January 1. This indicates that construction companies are trying to reduce the level of construction in progress and ensure the growth of the readiness of construction sites. The level of commissioning of social facilities in January-September 2017 is presented in Table 7, (State Statistics Service of Ukraine, 2020).

Table 7. Level of Commissioning of Social Facilities in January-September 2017

Indicators	Commissioned	% to the corresponding period of the previous year
Residential buildings, thousand m ² of the total area	6889.3	121.4
General educational institutions, student places	5607	474.4
Pre-school education institutions, places	3279	119.8
Hospitals, beds	586	156.3
Outpatient clinics, shift visits	3072	98.7

The study defined growth as % of the corresponding period of the previous year:

- the total area of residential buildings – in 1.21 times;
- student places in general educational institutions – in 4.7 times;
- places in preschool educational institutions – in 1.2 times;
- beds in hospitals – in 1.6 times.

However, the number of visits per shift in outpatient clinics is reduced by 1.3%. To assess the level of interaction between stakeholders of construction enterprises, it is proposed to use an integrated approach based on the use of the following stages:

- 1 Characterization of the state and tendencies of the functioning of the construction sector.
- 2 Definition of indicators of the construction sector functioning (S_{b1j}).
- 3 Formation of stakeholders providing interaction with construction enterprises and determining relevant indicators (S_{b2j}):
 - customers of construction products (S_{b21});
 - contractors (S_{b22});
 - designers (S_{b23});
 - central bodies of state power (S_{b24});
 - local governments (S_{b25});
 - suppliers of inventory with which construction enterprises interact (S_{b26});
 - competitors (S_{b27});
 - other enterprises (S_{b28}).
- 4 Definition of indicators characterizing the functioning and development of construction enterprises (S_{b3j}).
- 5 Construction of a model for evaluating the integral indicator of the level of interaction between stakeholders of construction enterprises (S_b). In general, the model of estimation of the integral indicator as follows:

$$\{S_{b1j}, S_{b2j}, S_{b3j}\} \subset S_b, \quad (1)$$

The economic-mathematical model of integral indicator estimation of stakeholders interaction level of construction enterprises is offered:

$$S_b = k_{v1}xS_{b1j} + k_{v2}xS_{b2j} + k_{v3}xS_{b3j}, \quad (2)$$

where k_{v1}, k_{v2}, k_{v3} – are the weight coefficients that determine the influence of stakeholder factors on the integral indicator of stakeholder interaction level in construction enterprises, rel. units; j – is the number of systemic stakeholder factors.

- 6 Definition of systemic stakeholder factors of construction enterprises:

$$S_{b1j} = \sqrt[n]{\prod_{i=1}^n S_{b1ji}}, \quad (3)$$

$$S_{b2j} = \sqrt[n]{\prod_{i=1}^n S_{b2ji}}, \quad (4)$$

$$S_{b3j} = \sqrt[n]{\prod_{i=1}^n S_{b3ji}}, \quad (5)$$

where n – is the number of local factors forming systemic stakeholder indicators, rel. units; S_{b1ji} – are the local factors characterizing the functioning of the construction sector rel. units; S_{b2ji} – are the local

factors that ensure interaction with construction enterprises, rel. units; S_{b3ji} - local factors characterizing the functioning and development of construction enterprises, rel. units; i – is the local factor number.

- 7 Assessment of local factors, which are determined by absolute and relative indicators. To determine the relative indicators, the method of expert assessments is used, and the scale presented in Table 8 is used.
- 8 Estimation of weight coefficients by the method of hierarchies.
- 9 Determination of the integral indicator of the stakeholder interaction level on construction enterprises (S_b).

Table 8. The scale of local stakeholder indicator values, rel. units (developed by the author)

Ind. value	Level	Characteristic
0	The absence of stakeholder interaction	no influence of stakeholders on the functioning of the construction industry, there is no information and analytical support for the functioning and development of construction enterprises, the absence of interaction with construction product customers, contractors, designers, central government, local self-government bodies, suppliers of inventory with which construction companies, competitors, and other enterprises interact.
1	low level of interaction	low level of influence of stakeholders on the functioning of the construction sector, low level of information and analytical support on the functioning and development of construction enterprises, low level of interaction with stakeholders of construction enterprises.
2	relatively low level of interaction	relatively low level of influence of stakeholders on the functioning of the construction sector, relatively low level of information and analytical support on the functioning and development of construction enterprises, relatively low level of interaction with customers of construction products, contractors, designers, central state authorities, local self-government, suppliers of commodities interact construction companies, competitors, other enterprises.
3	insignificant level of interaction	insignificant level of influence of stakeholders on the functioning of the construction sector, insignificant level of information and analytical support on the functioning and development of construction enterprises, insignificant level of interaction with stakeholders of construction enterprises.
4 - 6	moderate level of interaction	a moderate level of influence of stakeholders on the functioning of the construction sector, a moderate level of information and analytical support for the functioning and development of construction enterprises, a moderate level of interaction with customers of construction products, contractors, designers, central government, local self-government, suppliers of commodities interact construction companies, competitors, other enterprises.
7	a significant level of interaction	a significant level of influence of stakeholders on the functioning of the construction sector, a significant level of information and analytical support for the functioning and development of construction enterprises, a significant level of interaction with stakeholders of construction enterprises.
8	relatively high level of interaction	relatively high level of influence of stakeholders on the functioning of the construction sector, relatively high level of information and analytical support for the functioning and development of construction enterprises, relatively high level of interaction with customers of construction products, contractors, designers, central government, local authorities, suppliers of inventory interact construction enterprises, competitors, other enterprises.
9	high level of interaction	high level of influence of stakeholders on the functioning of the construction sector, high level of information and analytical support on the functioning and development of construction enterprises, high level of interaction with stakeholders of construction enterprises.

10	the absolute level of interaction	permanent influence of stakeholders on the functioning of the construction sector, formation of information and analytical support for the functioning and development of construction enterprises, there is a constant increase in the effectiveness of interaction of stakeholders of construction enterprises.
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7. Conclusion

As a result of the study, an integrated approach to assessing the level of interaction between stakeholders of construction enterprises by using the absolute method, method of expert assessments and method of hierarchies based on a set of interrelated actions was developed, which allowed determining the local, systemic and integral factors for forming a quantitative basis for making managerial decisions to increase the effectiveness of interaction between interested persons in the construction sector.

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