Contents lists available at Science-Gate

International Journal of Advanced and Applied Sciences

Journal homepage: http://www.science-gate.com/IJAAS.html

Integral approach of assessment of interaction level of stakeholders of construction enterprises

Oleksandra Marusheva [1,*], Vitalina Konenko [2], Serhii Haidenko [2], Olha Voronina [2], Oksana Medvedchuk [1]

[1]*Department of Public Administration, Educational-Scientific Institute of International Relations and Social Sciences, Interregional Academy of Personnel Management, Kyiv, Ukraine*
[2]*Department of Entrepreneurship and Business Administration, O.M. Beketov National University of Urban Economy in Kharkiv, Kharkiv, Ukraine*

ARTICLE INFO

Article history:
Received 20 June 2021
Received in revised form
27 August 2021
Accepted 30 August 2021

Keywords:
Production
Delphi method
Established quality criteria
Strategy for managing

ABSTRACT

This article is devoted to issues of interaction of stakeholders of construction enterprises. First of all, the peculiarities of the construction industry are defined, which form additional requirements for the development of an integrated system for assessing interaction with stakeholders. Second, approaches to the formation of a register of potential stakeholders have been identified. A template for analysis has been developed, and individual examples are grouped by interaction directions. The methodology of identifying potential stakeholders by means of a three-level process of applying different versions of expert assessment methods in order to minimize their negative factor – subjectivity, is proposed. Methods of direct selection of experts and algorithms of their assessment are defined. Proposals to rank stakeholders according to their priority and potential result from their interaction with the construction enterprise have been developed. According to the integral assessment, ways of controlling the processes of interaction with stakeholders of different ranking levels are proposed, recommendations for building a further strategy for managing these processes are given. A system of modeling interaction between construction enterprises and stakeholders to ensure planning, organization, monitoring, and control processes in optimistic, realistic, and pessimistic scenarios has been created. Recommendations for further use of the methodology of integral assessment of the interaction of stakeholders of construction enterprises in practice are given.

1. Introduction

Modern construction enterprises operate under global challenges. The specifics of the construction sector are its high technological efficiency, a large number of labor costs, and a significant production cycle. In view of this specificity, stakeholders who are interested in this production, and who may influence the direct activity of the construction enterprise, play a major role in ensuring the efficiency of construction production (Donaldson and Preston, 1995). The specific nature of the construction industry lies in the substantial dependence of enterprises on the actions of internal stakeholders–employees of the construction enterprise, which is connected with high labor costs and application of new technologies, which requires additional work with employees, their training, development; as well as from the impact of external stakeholders–due to the long production cycle and the significant influence of external factors on it: Currency fluctuations, regulatory regulations, actions of various regulations, work with suppliers, etc. (Clarkson, 1995; Thao et al., 2019). So, the issue of assessing the processes of interaction of construction enterprises with stakeholders is relevant and requires detailed study (Holubka et al., 2019; Nikolaiev and Shcherbyna, 2018).

In view of the high relevance of the subject matter, analyzed in the article, it is useful to note the attention of a number of scientists to this problem. In particular, Donaldson and Preston (1995) analyzed the theory of interaction management with stakeholders at the level of large corporations. Social corporate responsibility has been explored as an element of stakeholder interaction management at

* Corresponding Author.
Email Address: ol.marusheva@uohk.com.cn (O. Marusheva)
https://doi.org/10.21833/ijaas.2021.11.006
Corresponding author's ORCID profile:
https://orcid.org/0000-0001-9126-4674

the strategic management level of the enterprise in Clarkson's (1995) work. Gibson (2000) defined ethical aspects of the formation of management systems of policy interaction with stakeholders and methods of competitive activity (Gibson, 2000). It is useful to highlight Saprykina and Kaba (2011), and Simenko (2010) among the domestic scientists who worked on the development of interaction between business entities and stakeholders (Ryzhakov et al., 2020). However, the issue of integral assessment of interaction with stakeholders taking into account the specifics of the construction industry is not systematic and requires further study (Pugachevska and Gomba, 2020).

According to the relevance and practical significance of the study, its purpose was identified – to find ways to carry out an integral assessment of the effectiveness of interaction between construction enterprises and stakeholders. For the purpose of research, the following tasks have been achieved:

- The specifics of construction production are defined for analysis of the peculiarities of interaction with stakeholders,
- Algorithms and examples of stakeholder register formation are analyzed,
- Parameters of a quantitative assessment of interaction performance with stakeholders are defined,
- An integral indicator of the level of interaction with stakeholders has been developed,
- The methodology of analysis of prospects of interaction with stakeholders has been developed,
- Recommendations for further formation of the strategy of interaction with stakeholders based on the results of the integrated assessment are given.

2. Materials and methods

To analyze the effectiveness of interaction with stakeholders according to the established quality criteria, it is proposed to use three methods of expert assessments– brainstorming technique, creation of nominal groups, and application of Delphi method (Gibson, 2000; Tuan and Moretti, 2017; Thao et al., 2019). The use of several expert assessment methods makes it possible to minimize the negative aspects of these methods, in particular, the subjectivity of the assessment carried out. One of the negative factors of the method of expert assessment, which is minimized within the framework of this approach, is the so-called role of the "dominant personality", which, due to its authority, can convince other experts to be mistaken in the discussion process. Also, the combination of several methods ensures efficient interaction of experts, allowing to increase the number of proposals for analysis (Minaeva et al., 2018; Haiduchok and Dmytrenko, 2018; Rakovich, 2018).

The first stage of expert work is to identify possible stakeholders to create their descriptions. This stage is implemented by brainstorming. The next stage is to determine the priority of each stakeholder. The developed methodology assumes that each expert will assess the priority of stakeholders from 1 to 10 points (where 1 is the minimum priority and 10 is the maximum priority). Priority is determined by the degree of possible positive or negative impact on the business entity. The next step is to determine the prospects for cooperation, each of the experts determines the prospects for interaction with each of the stakeholders selected as a result of the brainstorming, also on a 10-point scale. Based on the results of these assessments, a list of stakeholders with whom it is advisable to interact with the construction enterprise in order to achieve its own strategic goals is prepared. The generated list is re-sent to expert groups for possible adjustment, modification, and additions, which again minimizes the factor of "human error" or subjectivity of the assessment. At the last stage, the final identification list of stakeholders is formed, in which they are classified and ranked according to the value of priority and prospects of interaction establishment. Thus, it is proposed to combine the process of identification and qualitative assessment of possible results of interaction with stakeholders of construction enterprises (Chen and Yang, 2012; Volkova et al., 2018). Based on the results of the identification, an indicative list of stakeholders of construction enterprises was formed, which can be used as a basic template for expert assessments (Table 1).

In order to further carry out quantitative analysis of priority and potential opportunities for interaction with stakeholders in construction enterprises, it is proposed to introduce a ranking matrix of the predicted effectiveness of interaction with stakeholders in the developed methodology of integral assessment of the level of interaction with stakeholders, which is shown schematically in Fig. 1.

The ranking matrix of predicted effectiveness of interaction with stakeholders has the form of a square divided into blocks as a result of the projection of a coordinate plane on its surface. On the X-axis, the priority of interaction with stakeholders is noted, determined by the results of expert assessment, and reduced to the interaction identifier, on the 10 point scale, where 10 is the maximum indicator. The Y-axis shows potential effectiveness from future cooperation, rated by experts on a scale of 1 to 10 (where 1 is the smallest, 10 is the largest) (Wang and Islam, 2017; Savchenko et al., 2020). The integral indicator is displayed on the coordinate plane of the matrix by determining it on the basis of the analysis of the results of expert assessments and bringing them into the list of identifiers, a diagonal line is drawn, which represents this integral indicator. The plane of a matrix is divided into sectors between one and ten through the arrangement on a previously drawn diagonal line (the line of an integral indicator) of a point with coordinates 1:1; 2:2 and so on before 10. Lines on axes X and Y are drawn from these points to the corresponding quantitative assessment. As a

result of the planning, the plane of the matrix is divided into 10 sectors. Then on the coordinate plane, there are points corresponding to the values of the stakeholder identifier–priority and potential effectiveness. For each sector where the integral indicator of interaction with stakeholders is recorded, further recommendations for working with them have been developed. A consolidated list of recommendations is proposed in Table 2.

Table 1: Template for identification of potentially attractive stakeholders of construction enterprises

Identifier of stakeholders	Interaction priority	Effectiveness of interaction	Integral indicator
Technical and environmental group			
Suppliers	7	7	49
Service companies	4	3	12
Contractors	4	4	16
Subcontractors	6	6	36
State construction inspection	1	8	8
Customers	10	6	60
Public utilities	2	4	8
Local authorities	3	4	12
Environmental services and public organizations	1	9	9
Financial and economic group of experts			
Customers	6	5	35
Investors	5	5	25
Accounting department of the construction enterprise	5	4	20
Planning and economic department of construction enterprise	1	5	5
Banking and other financial institutions	1	5	5
Shareholders	5	5	25
Suppliers	2	4	8
Sales departments of the construction enterprise	1	5	5
Marketing services of the construction enterprise	1	2	2
Tender committees	1	4	4
Intellectual group			
Design department of the construction enterprise	1	6	6
HR department of the construction enterprise	2	3	6
Innovation department of the construction enterprise	1	6	6
Project bureaux, research institutes, design organizations	2	5	10
Institutions which trained personnel for the construction industry	2	5	10
Legal department			
Legislative authorities	5	3	15
Local authorities	3	3	9
Legal services	4	3	12
Contractual departments	5	8	40
Social group			
Trade-union organizations	6	6	36
Services of social protection of the population, employment, social insurance fund, etc.	3	2	6
Public organizations	2	2	4

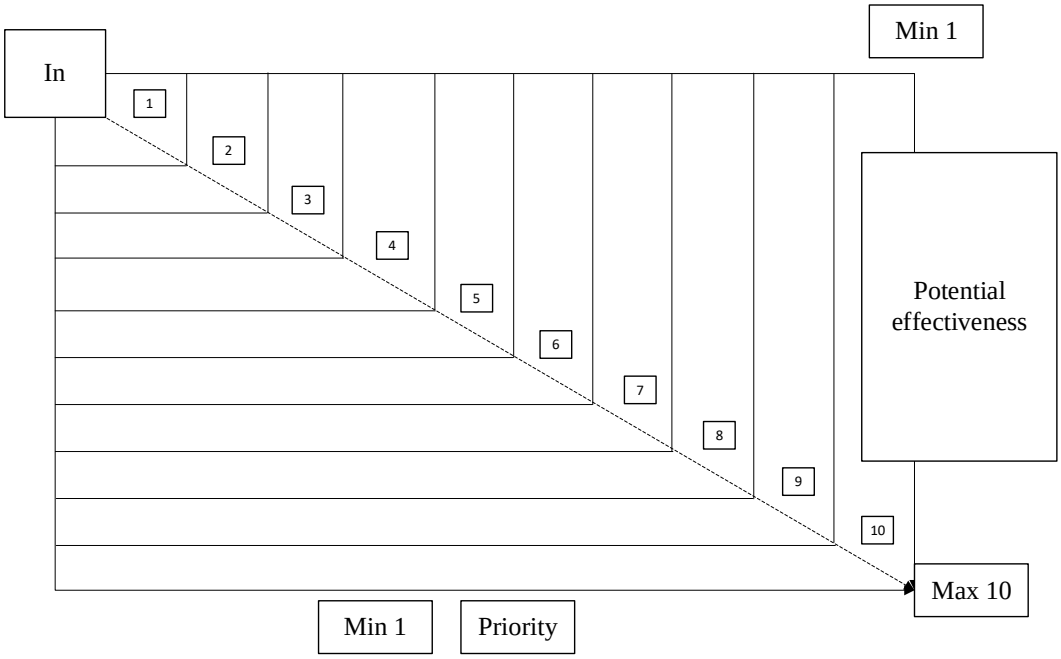

Fig. 1: Ranking matrix of predicted effectiveness of interaction with stakeholders, where Iп is an integral indicator

3. Results and discussion

For further quantitative analysis of the assessment of the predicted effectiveness of interaction between the construction enterprise and stakeholders (it is possible not to take into account stakeholders who are placed in squares 1-2), it is proposed to apply the RERT simulation within the framework of the developed methodology. This system of modeling of processes of interaction with stakeholders performs modeling in 3D prediction: optimistic, pessimistic, realistic. Using the developed methodology, it is useful to use the method PERT for quantitative analysis of the stakeholder identifier. The first stage will be the creation of a table of automatic calculations, for which it is proposed to use the program Microsoft Project, where quantitative indicators determined by the results of expert evaluations will be recorded. Thus, the first column will contain a risk identifier (in the program it is a task column), the second–an integral indicator of interaction, which corresponds to a specific stakeholder (in the program it is a "duration"). The PERT Analysis panel in Microsoft Project will be used to perform the integral assessment. You select the View–Toolbars–PERT Analysis commands in sequence to use it. The analysis can be actually represented as the following algorithm (Cheung and Qi, 2017; Kubasova et al., 2018; Demenev et al., 2019):

Table 2: Assessment scale of integral indicator of interaction with stakeholders

No. of a square	Assessment	Further actions
1	minimum	may not be included in the quantitative analysis
2	insignificant	
3	small	to develop an algorithm for further cooperation
4	moderate	
5	realistic	to develop a detailed algorithm for further cooperation with clear effectiveness monitoring
6	essential	
7	considerable	to develop a strategy for further cooperation with clear effectiveness monitoring and focus on operational activities
8	big	
9	very big	to develop a strategy for further cooperation with clear effectiveness monitoring, monitor continuously the implementation of the developed cooperation strategy
10	crisis	

1. The PERT Analysis panel, the PERT Input Letter button opens the assessment table of the integral indicator.
2. In the columns of optimistic, expected, and pessimistic duration record the integral value of each individual stakeholder identifier. In the column realistic scenario, we record the indicator that was raised as an average integral indicator for a separate expert group. For optimistic and pessimistic development scenarios, a new integral indicator is calculated. An optimistic integral indicator is the product of the lowest priority value of the stakeholder identifier for a particular expert group and the value of its potential effectiveness. The pessimistic scenario takes into account the highest values of these indicators in the identifier based on the results of expert assessments.
3. PERT Analysis–PERT Calculations–Start Calculations toolbar–open a dialog window to prevent changes to the original data (integral indicators entered at the beginning of the analysis algorithm)–confirm the action.
4. The program calculates the three effectiveness analysis scenarios by assessing the integral indicator based on the impact of each stakeholder`s identifier. Automatically optimistic and pessimistic variants are rated at 1 point, and realistic scenario–4 points.

So, based on the results of the proposed methodology, the algorithm of PERT-modeling of integral assessment of potential interaction of construction enterprises with stakeholders was determined. After the analysis and the integral assessment, it is useful to define a strategy for managing the interaction of the construction enterprise for each of the stakeholder identifiers that are identified as relevant.

The issue of integral assessment of the effectiveness of interaction with stakeholders in construction enterprises is relevant and requires investigation of ways to improve the processes of analysis, planning, identification, monitoring, and control of interaction with stakeholders taking into account the specific characteristics of the construction industry, in particular a large number of uncertainties, long project implementation time, high labor costs and technical and technological peculiarities of the production process. Assessment of interaction processes with stakeholders can have both quantifiable results–growth of financial and economic activity indicators, as well as qualitative indicators consisting in the improvement of production processes, the establishment of marketing, communication system (external and internal), implementation of innovative technological solutions, new construction materials, etc. (Gibson, 2000; Saprykina and Kaba, 2011; Tuan and Moretti, 2017). Thus, it is difficult to determine the immediate economic effect of some types of interactions with stakeholders. In order to assess qualitative transformations in construction enterprises, which take place within the framework of cooperation with stakeholders, it is proposed to use methods of expert assessments to identify the most effective cooperation, further deepening and development (Loosemore and Reid, 2019). Since stakeholder groups may belong to different production activities of construction enterprises, it is necessary to involve specialized specialists of the construction enterprise for their comprehensive impact assessment (Saprykina and Kaba, 2011; Chicu et al., 2016). As a result of the analysis, expert groups have been identified, which can provide a comprehensive assessment of the level of impact of the interaction between the construction enterprise

and stakeholders in different directions of the construction enterprise. The main areas of analysis of the effectiveness of interaction with stakeholders are financial, economic, intellectual, legal, social, and technical-environmental indicators (Bharadwaj and Saxena, 2009; Simenko, 2010; Tian et al., 2016; Chernysh et al., 2018; Ryzhakov et al., 2020).

Since the construction enterprises have created a functional organizational structure with a clear system of subordination, and, in individual cases, elements of the project organization of the structure are introduced, it is useful to outline the range of personnel of this group of experts by issuing the corresponding regulation for the construction enterprise in accordance with the above-mentioned structure of interaction effectiveness directions and the degree of work of each expert in certain directions (Saprykina and Kaba, 2011). Also, this regulation should allocate a specific time of work of experts, the criteria for which should be assessed with a mandatory introduction with all members of the expert group on these indicators. This form of process organization will avoid misunderstandings between experts and systematize their work. Each subgroup of experts can make proposals to create a system of integral assessment of interaction with stakeholders, which will allow adjusting the assessment mechanisms depending on the needs of the market, external or internal factors of development of the construction enterprise (Donaldson and Preston, 1995; Clarkson, 1995). The complex control system of interaction with stakeholders taking into account specifics of the construction enterprises can be presented by the following complex of processes:

1. Identification and creation of the list of stakeholders by means of expert assessments, on the basis of which further interaction in the system "tasks-lines–responsible" is planned.
2. Determination of integral indicator of interaction assessment through assessment by experts and ranking by integral indicator using a ranking matrix of the predicted effectiveness of interaction with stakeholders.
3. Analysis of interaction scenarios by PERT-modeling, formation of optimistic, realistic, and pessimistic predicted scenarios.
4. Identification of further strategic management actions.
5. Search for organizational mechanisms for implementing stakeholder interaction plans.
6. Monitoring and control of interaction according to recommendations after ranking.
7. Creation of a communication system in a complex of interaction with stakeholders.
8. Final choice of interaction strategy, identification of KPI.

4. Conclusion

As a result of the study, a methodology for the integral assessment of potential interaction with stakeholders of construction enterprises was developed. This methodology takes into account the specifics of the construction industry, in particular the high role of technical and technological aspects of operational processes, high labor costs, and long life of the project, which is a consequence of the high degree of influence of the external environment on the implementation of construction projects and riskiness. Strategic relationships with stakeholders are important in this regard. The developed methodology includes several stages: Identification and assessment of priority and potential impact of work with stakeholders carried out through the use of the methodology of expert assessments. The second step is to analyze the stakeholder`s identifier and perform an integrated assessment of their interaction, followed by modeling the processes of developing these relationships. With PERT analysis, it is proposed to rank stakeholders quantitatively, according to the ranking are proposed strategies for further action. Monitoring of implementation of these strategies is also carried out by using PERT-modeling due to the introduction of data of optimistic, realistic, and pessimistic scenarios with the possibility of their further correction.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Bharadwaj SS and Saxena KBC (2009). Building winning relationships in business process outsourcing services. Industrial Management and Data Systems, 109(7): 993-1011. https://doi.org/10.1108/02635570910982328

Chen XR and Yang W (2012). Large-scale intelligent building energy-saving measures based on BA system. Applied Mechanics and Materials, 178: 144-146. https://doi.org/10.4028/www.scientific.net/AMM.178-181.144

Chernysh I, Glebova A, and Maksymenko O (2018). Business processes outsourcing in building enterprises. International Journal of Engineering and Technology (UAE), 7(3): 59-64. https://doi.org/10.14419/ijet.v7i3.2.14376

Cheung SO and Qi X (2017). Managing for innovation developments in construction organisations. International Journal of Project Organisation and Management, 9(3): 249-273. https://doi.org/10.1504/IJPOM.2017.087576

Chicu D, Valverde M, Ryan G, and Batt R (2016). The service-profit chain in call centre services. Journal of Service Theory and Practice, 26(5): 616-641. https://doi.org/10.1108/JSTP-10-2014-0243

Clarkson MB (1995). A stakeholder framework for analyzing and evaluating corporate social performance. The Academy of Management Review, 20(1): 92-117. https://doi.org/10.5465/amr.1995.9503271994

Demenev AV, Lopatko RN, and Zharov VG (2019). Operation of buildings and structures based on BIM standards in the digital economy. In the International Multi-Conference on Industrial Engineering and Modern Technologies, IEEE, Vladivostok,

Russia: 1-5. https://doi.org/10.1109/FarEastCon.2019.8934034

Donaldson T and Preston LE (1995). The stakeholder theory of the corporation: Concept, evidence, and implications. Academy of Management Review, 20(1): 65–91. https://doi.org/10.5465/amr.1995.9503271992

Gibson K (2000). The moral basis of stakeholder theory. Journal of Business Ethics, 26: 245-257. https://doi.org/10.1023/A:1006110106408

Haiduchok T and Dmytrenko O (2018). Use of a balanced scorecard in strategic management accounting of enterprises. Scientific Horizons, 11(72): 46–56. https://doi.org/10.33249/2663-2144-2018-72-11-46-55

Holubka YV, Nesterova SV, and Myhalchinets HT (2019). Features of financial support of national construction companies. Scientific Bulletin of Mukachevo State University, 1(11): 117–123. https://doi.org/10.31339/2313-8114-2019-1(11)-117-123

Kubasova T, Tkach V, and Tsvigun I (2018). Priorities of the logistics risks management in the resource support of construction projects. In the MATEC Web of Conferences, EDP Sciences, 212: 08010. https://doi.org/10.1051/matecconf/201821208010

Loosemore M and Reid S (2019). The social procurement practices of tier-one construction contractors in Australia. Construction Management And Economics, 37(4): 183-200. https://doi.org/10.1080/01446193.2018.1505048

Minaeva E, Lastochkina V, Gusev V, Fadeev A, and Manukhina L (2018). Formation of the strategy of management of innovation and investment activity of the enterprise. In the MATEC Web of Conferences, EDP Sciences, 193: 05082. https://doi.org/10.1051/matecconf/201819305082

Nikolaiev VP and Shcherbyna AA (2018). Maintenance management of the residential buildings of inefficient owners. Bulletin of Mukachevo State University, 1(9): 11–17. https://doi.org/10.31339/2313-8114-2018-1(9)-11-18

Pugachevska KYo and Gomba MV (2020). Genesis of essence of enterprise competitive advantages. Scientific Bulletin of Mukachevo State University, 1(13): 113–117. https://doi.org/10.31339/2313-8114-2020-1(13)-113-118

Rakovich O (2018). Integration of management by enterprise potential of rural territories. Scientific Horizons, 11(72): 62–73. https://doi.org/10.33249/2663-2144-2018-72-11-62-72

Ryzhakov D, Dikiy O, Druzhynin M, Petrenko H, and Savchuk T (2020). Innovative tools for management the lifecycle of strategic objectives of the enterprise-stakeholder in construction. International Journal on Emerging Trends in Engineering Research, 8(8): 4526-4532. https://doi.org/10.30534/ijeter/2020/78882020

Saprykina M and Kaba D (2011). Dialogue with stakeholders: recommendations to companies. Farbovanyi lyst, Kyiv, Ukraine.

Savchenko N, Savchenko R, and Sulimenko L (2020). The role of the brand in the enterprise sustainable development. Scientific Horizons, 8(93): 31–38. https://doi.org/10.33249/2663-2144-2020-93-8-31-38

Simenko IV (2010). Problems of formation of analytical information on the quality of enterprise management systems: Definition of analytical tools. Visnyk ZHDTU, 3(53): 237–241.

Thao LHN, Anh DNP, and Velencei J (2019). Measuring corporate social performance. Serbian Journal of Management, 14(1): 193–204. https://doi.org/10.5937/sjm14-18009

Tian L, Ma LY, Huang Y, and Li H (2016). Risk study of service outsourcing projects undertaken by high-tech innovative enterprise. Journal of Discrete Mathematical Sciences and Cryptography, 19(3): 635-647. https://doi.org/10.1080/09720529.2016.1178921

Tuan A and Moretti A (2017). Engaging consumers on social media: Empirical evidence from the communications analysis of a CSR oriented company. International Journal of Technology Marketing, 12(2): 180-205. https://doi.org/10.1504/IJTMKT.2017.083371

Volkova N, Shoshinov V, Kosova L, Lavrova L, and Zemlyanskaya N (2018). Development of methods for managing innovation activities of economic systems. In the MATEC Web of Conferences, EDP Sciences, 193: 05081. https://doi.org/10.1051/matecconf/201819305081

Wang H and Islam SM (2017). Construction of an open innovation network and its mechanism design for manufacturing enterprises: A resource-based perspective. Frontiers of Business Research in China, 11(1): 1-21. https://doi.org/10.1186/s11782-017-0006-6