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BUSINESS BENEFITS OF IMPLEMENTING THE DESIGN AND BUILD APPROACH IN THE CONSTRUCTION PROCESS

Edgars Pudzis [1], Researcher, Mg.ing.; **Laura Rozentale – Zalima**[2], Mg.oec.;
Sanda Geipele [3], Associated professor, Dr.oec. and **Ineta Geipele** [4], Professor, Dr.oec.
[1, 3, 4] Riga Technical University, [2] "Avesco" LTD

Abstract. In the entire construction procurement structure, construction procurement makes up the largest part both by the total number of purchases and by the total volume of public procurement; therefore, construction procurement affects the sector and the construction sector plays an essential role in the overall economy of Latvia and its activities. The design and build approach is considered to be an effective project procurement method in which one organisation, in compliance with the concluded contract, is responsible for both design and construction. It is believed that the design and build approach is a leading trend in the construction industry and it is becoming more and more popular all over the world. The aim of the research is to find out whether the design and build approach is used in Latvia, to describe the past experience, and to identify the benefits for the industry from the use of this approach. Within the framework of the research, the following methods have been used: the analysis method of specialised theoretical literature, empirical data analysis, unstructured interview and comparison method. The main conclusions of the research are the following: using the design and build approach, it is possible to ensure a faster construction process, reduce construction costs, provide a quality construction process. There are also drawbacks: the contracting authority's control over the design and construction process decreases, the hardly predictable contract price etc. In Latvia construction projects, using the design and bid approach are not very common, even in spite of the advantages of the approach.

Key words: construction management, public procurement, construction process management, design and build approach.
JEL code: L74

Introduction

According to the data compiled and published by the Procurement Monitoring Bureau of the Republic of Latvia, in the entire construction procurement structure, construction procurement makes up the largest part both by the total number of purchases and by the total volume of public procurement. The uniqueness, uncertainty, long-term nature and complexity of construction projects make it difficult to predict time, costs, and project quality. Along with the increasing complexity of construction projects, the choice of an appropriate procurement system is the basis for the success of the project. Thus, the procurement approach plays an important role in ensuring that the project meets its primary objectives of time, cost and quality. The design and build approach is considered to be an effective project procurement method in which one organisation, in compliance with the concluded contract, is responsible for both design and construction. The design and build approach has been proven to be a leading trend in the construction industry, and it is becoming increasingly popular worldwide (Dang N. C., 2016). In the design and construction projects, the contracting authority agrees with the contractor on both design and construction. The design and delivery of the project are combined, which allows overcoming the existing obstacles and problems in the traditional procurement approach. The main difference between the traditional procurement approach and the design and build approach is that in the traditional procurement approach, design is separated from the construction process, but in the projects, where the design and build approach is used, only one organisation is responsible for design and construction.

The aim of the research is to find out whether the design and build approach is used in Latvia, to describe the past experience, and to identify the benefits for the industry from the use of this approach. The following tasks have been set: to analyse public procurement in construction, to

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

analyse the theoretical and legal aspects of the design and build projects, as well as to evaluate the design and build practice in Latvia. As a result of the research, conclusions and proposals will be made for the further development of the design and build approach in Latvia.

Within the framework of the research, the following methods have been used: the analysis method of specialised theoretical literature, empirical data analysis, unstructured interview and comparison method. The analysis of empirical data related to the period of 2010–2017 has been performed with the aim of identifying changes in the dynamics and structure of public procurement between 2010 and 2017. The empirical data analysis has been used to assess the development trends in the construction industry. In the practical part of the research, the comparison method has been used – by comparing the three design and build regulations and determining which criteria that promote the effective and qualitative construction process are included in the procurement regulations.

Research results and discussion

1. The Analysis of Public Construction Procurement in Latvia

To determine the place of construction procurement in the entire public procurement system, the structure of public procurement in the period of 2010-2016 has been analysed. The analysis of the structure has been performed by first evaluating the number of public purchases (Table 1), then their volume (Table 2). It should be noted that, in order to determine the changes in the structure of public procurement, data for 2016 have been attributed to the data for 2010 due to the availability of incomplete data for 2017. The above-mentioned considerations apply to Tables 1 and 2.

Table 1

Public sector procurement structure in Latvia in the period of 2010–2016, % of the total number of purchases

Public procurement sectors	2010	2011	2012	2013	2014	2015	2016	2017	Changes, 2016/2010, percentage points
Construction works	18.11	18.59	18.64	18.01	17.69	16.16	16.42	2.66	-1.69
Petroleum products, fuel, electricity and other energy sources	4.25	4.30	4.80	4.21	4.01	3.71	3.39	0.52	-0.86
Agriculture, forestry, horticulture, aquaculture and beekeeping services	2.08	2.07	1.86	1.99	1.94	2.08	2.02	0.35	-0.06
Financial and insurance services	4.42	1.15	1.78	1.92	1.94	2.15	2.02	0.45	-2.40
Medical devices, pharmaceuticals and personal care products	6.24	5.53	6.03	5.46	5.01	5.15	5.34	1.38	-0,90
Transport equipment and auxiliary transport equipment	3.03	3.15	3.33	3.76	3.74	3.71	3.65	0.62	0.62
Other	61.87	65.21	63.57	64.65	65.69	67.04	67.17	94.01	5.29

Source: The authors' calculations based on the data of the Procurement Monitoring Bureau of the Republic of Latvia

According to the data provided in Table 1, it can be concluded that between 2010 and 2016, the number of purchases decreased in almost all areas. The decrease in the share of construction

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

works during the period under review was the second fastest. According to the calculations in Table 1, the authors conclude that in the period from 2010 to 2016, the majority of public procurement involved construction works.

Table 2

Public sector procurement structure in Latvia in the period of 2010–2016, % of the total procurement volume

Public procurement sectors	2010	2011	2012	2013	2014	2015	2016	2017	Changes, 2016/2010, percentage points
Construction works	44.06	41.59	47.75	32.17	33.89	24.53	32.49	8.03	-11.57
Petroleum products, fuel, electricity and other energy sources	3.56	7.25	8.83	7.48	11.06	8.80	8.34	0.48	4.78
Agriculture, forestry, horticulture, aquaculture and beekeeping services	8.17	4.00	2.82	10.29	3.55	3.03	1.19	4.68	-6.98
Financial and insurance services	11.89	2.54	2.06	2.07	2.07	1.21	5.25	0.32	-6.64
Medical devices, pharmaceuticals and personal care products	6.35	5.80	5.15	5.62	8.09	7.14	5.07	2.32	-1.28
Transport equipment and auxiliary transport equipment	1.58	3.35	3.58	9.61	3.63	5.09	7.70	1.74	6.12
Other	24.39	35.47	29.81	32.76	37.72	50.19	39.96	82.44	15.57

Source: The authors' calculations based on the data of the Procurement Monitoring Bureau of the Republic of Latvia

According to the results of the authors' calculations summarised in Table 2, it can be concluded that construction works made up the largest part in the total volume of public procurement. By 2012, in the total volume of public procurement the construction procurement accounted for slightly more than a half, exceeding the share of other sectors. Since 2013, the share of construction procurement has been uneven in the total volume of public procurement, but retained a significant share. Assessing the change in the share of construction works in the total volume of public procurement, it can be concluded that the share decreased by 11.57 percentage points, but still was a very significant public contribution to both the industry and the national economy as a whole. Taking into account the defined procurement structure for the period from 2010 to 2016, the authors conclude that the construction sector is the most important area of public procurement and its further development directly affects the country's economic development.

2. Theoretical aspects of the design and build contract

In general, construction procurement can be implemented using one of the following approaches:

- design-bid-build (DBB) – a traditional approach that is based on the contracting authority's separate contractual obligations with the architect and contractor. The project is implemented on the basis of competitive supply of construction works made in accordance with the procedure stipulated in the regulatory enactments for a fully developed and approved construction project;
- construction management – the organisation of the construction process is outsourced to the construction manager who takes on the risk of project delivery, mediation;

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

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- design and build (DB) contract – implies only one contract for the development of the construction project and the execution of construction works;
- integrated project delivery – the cooperation process between the contracting authority, building users, managers, designers, builders, consultants, manufacturers and other parties involved in the project, which promotes the maximum capacity of all participants and the use of the information base to achieve effective and sustainable results at all stages of construction (Projekta…, 2015).

The DB is considered to be an effective project procurement approach, in which one organisation or consortium is responsible for both design and construction in compliance with the contract concluded (Songer E., 1997). The DB approach has been shown to be a leading trend in the construction industry, and it is becoming increasingly popular worldwide (Dang N. C., 2016). In DB projects, the owner agrees on a single entity to carry out both a specific project design and construction (Hale D. R., 2009). DB contractor offers both design and construction services to the owner. The design and delivery of the project are combined, which allows overcoming the existing obstacles and problems in the traditional DBB approach (Dang N. C., 2016). Konchar and Sanvido define the concept of DB as a project system, in which the owner concludes a contract with one organisation that carries out both the design of a building and its construction within a single contract (Konchar M., 1998). DB is the acquisition of a building from a single contractor who is responsible for both design and construction (Akintoye A., 1995).

The main difference between DBB and DB projects is that in DBB projects, design is separated from the construction processes, but in DB projects only one organisation is responsible for both design and construction (Lu W., 2017). Contrary to the traditional procurement procedure, where the construction project is initially drawn up, then the construction procurement is carried out, the DB is a type of construction, in which one person – usually the construction company or the contractor – is responsible for the design and construction works. In this case, both services are simultaneously purchased from one person. The advantage of such a contract is that one person is responsible for the entire construction process, including design. This reduces the risks associated with disputes among the designer, contractor and contracting authority (Rokasgramatas, 2017). Different materials, with the exception of scientific publications, highlight the advantages and disadvantages of the DB. Advantages and disadvantages of the DB are summarised in Table 3.

DB provides the opportunity to reduce project costs, which can be explained by the possibility of developing alternative, cheaper project solutions in the construction process. Faster delivery of the DB is due to the fact that there is no "empty" stage between the project design, its completion and the start of construction. Construction can be started at the early stages of the project, before the 100 % developed project. It is possible to use the latest technologies in the DB process. The DB contractor chooses the equipment and designs the building using the equipment selected. There is the possibility to receive support from equipment manufacturers who are willing to "test in practice" the new equipment and technologies (Design, 2017).

Although, while summarising and analysing the theoretical and methodological aspects of the DB, it has been concluded that regardless of the scientists' knowledge, the nature of the DB is explained in a similar way, according to the authors of the research, there are various factors that influence the successful implementation of the DB project. The uniqueness, uncertainty, long-term nature and complexity of construction projects make it difficult to predict time, costs, and project

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

quality (Attalla M., 2003). Along with the increasing complexity of construction projects, the choice of an appropriate procurement system is the basis for the success of the project (Mafakheri F., 2007). The procurement approach plays an important role in ensuring that the project meets its primary objectives of time, cost and quality (Yong Y. C., 2012).

Table 3

Advantages and disadvantages of the DB

Advantages	Disadvantages
One person is responsible to the contracting authority	Less control
Reducing the risk of disputes among the contracting authority, designer, builder	Project requirements have to be defined in advance
Faster process	
Greater clarity about total costs	Difficult selection and attraction of subcontractors
Project optimisation	
Opportunity to incorporate innovations	The result of the project may be far away of the expected result
Quality	
Fast conflict resolution	
Possible cost reduction	A project that is not scheduled correctly can be delayed significantly
Possibility to faster foresee costs	
Reducing administrative burden	An inexperienced team can make mistakes, which may require expensive repairs
Easy to adapt to real circumstances	

Source:
Learn About Using Design-Build Contracts. Retrieved: https://www.thebalance.com/when-to-use-design-build-contracts-844914, Access: 21.11.2017., Design and Build Contract (DB). Retrieveid: https://www.thebalance.com/when-to-use-design-build-contracts-844914. Acccess: 21.11.2017., Desging and build procurement route.
Retrieved: https://www.designingbuildings.co.uk/wiki/Design_and_build_procurement_route. Acess: 21.11.2017.
Rokasgramatas projekts apvienoto projektesanas un buvdarbu iepirkumu veiksanai (Handbook for design and build construction works). Retrieved: http://www.latvijasbuvnieki.lv/position/rokasgramatas-projekts-apvienotajiem-projektet-un-buvet-iepirkumiem/. Access: 28.10.2017.

All development stages of the construction project correspond to the traditional method of project delivery. The delivery of construction projects is a contractual relationship between the owner (contracting authority) and other parties involved in the construction (Hale D. R., 2009).

The delivery method of a construction project is a system of practical measures for organising, managing and financing activities related to the implementation of the project – the pre-project stage, project development, construction procurement, construction works, construction exploitation and maintenance. The criteria for choosing a method include safety, costs, quality, time, site context and compliance with the set goals, as well as an assessment of all risks. The project delivery method is closely related to the procurement strategy, contract terms, types of payment, and the project management and coordination implemented by the architect (Lam E. W. M., 2008).

The success of the project is the goal of almost all project participants in any construction project. However, in recent years, project participants have been facing difficulty in achieving success of construction projects in cases when traditional procurement or DBB is used. The DBB process is based on the contracting authority's separate contractual obligations with the architect and the contractor. The project is implemented in compliance with a specific supply of construction works made in accordance with the procedure specified by regulatory enactments for a fully developed and approved construction project. Project stages are implemented in a linear order. The architect's qualification and experience are the main criteria for choosing an architect (project)

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

(Chan A. P. C., 2004). However, the study performed by Dang and Le-Hoai states that customers are dissatisfied with this procurement approach, as it involves a complicated, uncertain and dynamic nature of construction projects. Therefore, the authors propose using a less traditional method in the delivery of a construction project – the DB (Dang N. C., 2006).

The success of the project is the function of project characteristics, procedures, management strategies, participants, work atmosphere and environmental interaction (Dang N. C., 2006).

Analysing the theoretical aspects and success factors of the DB, the authors of the research conclude that various scientists and specialists explain the DB project in a very similar way – the construction process, in which design and construction are carried out by one organisation. Using the DB, it is possible to ensure a faster construction process, reduce construction costs, provide a quality construction process. However, there are also disadvantages, such as the contracting authority's control over the design and construction process decreases etc.

3. Legal aspects of the design and build contract

The authors of the research have concluded that the construction projects implemented on the basis of the DB are governed by the same regulatory enactments that regulate general public procurement. The most important regulatory enactment is the Public Procurement Law (PPL), which was adopted on 12 December 2016 and came in force on 1 March 2017 (Publisko…, 2017). The aim of the PPL is to ensure procurement transparency, free competition of suppliers, as well as equal and fair treatment of them and effective use of the contracting authority's funds, maximally reducing their risk (Publisko…, 2017).

The new PPL in the construction sector envisages the abandonment of the lowest cost principle in favour of economic profit, following the guidelines developed for the evaluation of the most economically advantageous tender; in construction procurement there are essential prerequisites not only for reducing the shadow economy in the construction sector but also for promoting the quality of construction. Transparent, fair and competitive procurement practices undoubtedly create business opportunities and jobs, as well as contribute to economic growth. However, in the procurement sphere one should not stop at just a legal procurement procedure, but try to use public procurement as a strategic tool in promoting innovations, making targeted public resource investments, investing in sustainable resources, and choosing sustainable solutions.

To improve the quality of DB procurement, the Partnership of Latvian Contractors in cooperation with the Latvian Association of Architects has developed guidelines for evaluating the most advantageous tender in the DB and DBB procurement. The criteria included in the guidelines are of a recommendatory nature. The specific criteria that the contracting authority will use in a particular procurement will be chosen by the contracting authority on the basis of specific conditions that characterise the procurement. To evaluate the economic benefit of DB procurement, it is recommended to apply the following criteria: DB construction costs; project management structure; the experience of the responsible personnel in similar construction sites; experience of the responsible staff in a specific area; BIM system usage; team experience in the past cooperation.

4. The design and build approach practice in Latvia

Until the present research, the most significant DB purchases, in the framework of which the contracts have been concluded, are the development, construction and author's supervision of the

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

first stage of technical project of the Academic Centre of the University of Latvia (UL) in Torņkalns, Riga; the development, author's supervision and construction works of technical projects of Ziedoņdārzs and Grīziņkalns Park revitalization plans; development of the reconstruction project of Daugava Stadium's Western Tier, author's supervision and construction. Having interviewed the contracting authorities and analysed the procurement regulations, the authors of the research have obtained the following information. In the construction process of both Daugava Stadium's Western Tier and the UL Academic Centre in Torņkalns, the DB procurement approach was used. The choice of this approach was based on time saving in the whole project delivery. In the DB process of Daugava Stadium's Western Tier, six months were saved compared to the traditional procurement method. It should be noted that time saving is also emphasised by such authors as N.C. Dang and L. Le-Hoai, who in their research "Critical Success Factors for Implementation Process of Design – Build Projects in Vietnam" (2016) have found that time saving of DB projects is related to such project management factors as efficient planning of overall management work, organisation management and control, effective monitoring and approval mechanism of structural changes, control mechanisms of subcontractors' working efficiency, appropriate organisational structure, culture, roles and levels of authority.

Comparison of the three DB procurement regulations and the analysis of the data obtained from the interviews have enabled the authors to conclude that, to a large extent, time saving in DB projects in Latvia can be explained by factors such as management planning, organisation, administration and control, which consist in requiring tenderers to develop a detailed work plan for the design and build project broken down by calendar days. This way, the contracting authority has the opportunity to control whether the planned works will be carried out within the specified deadlines and whether the delay of the project will occur. It should be noted that meeting deadlines is ensured by imposing on contractors' penalties for delinquencies.

By conducting the interviews and analysing the procurement regulations, it has been found that the quality of the construction project can be achieved in two ways. Firstly, for each procurement a minimum guarantee period is set, where a higher evaluation of the tenderer is obtained if the tenderer offers a longer guarantee period to the contracting authority. However, the analysed scientific literature has not demonstrated a criterion – a guarantee that would characterise the success and qualitative implementation of the DB project. According to N. C. Dang and L. Le-Hoai (2016), qualitative implementation implies the competence of the parties involved. According to the interviews conducted, the competence of the parties involved has scarcely been mentioned; however, in the procurement regulations analysed, the authors have found that general contractors were imposed obligations taking into account their previously performed design and construction works, financial status, qualification and experience of the staff involved in the project delivery.

Conclusions, proposals and recommendations

1) In Latvia, the most important area of public procurement during the period of 2010-2016 was construction works, which was demonstrated by the ratio of public construction procurement to the total volume of public procurement.
2) The DB project is explained as a construction process, in which design and construction is carried out by one organisation. By using DB, it is possible to ensure a faster construction process, reduce construction costs, provide a quality construction process. However, there are

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*

also disadvantages, such as the contracting authority's control over the design and construction process decreases etc.

3) One of the main factors influencing the effective delivery of the DB project is the costs.
4) In DB projects, time saving is related to such project management factors as efficient planning of overall management work, organisation management and control, effective monitoring and approval mechanism of structural changes, control mechanisms of subcontractors' working efficiency, appropriate organisational structure, culture, roles and levels of authority.
5) In Latvia, construction projects on the basis of the DB approach are not widely used, even though the approach has the advantages, such as time saving, the possibility of project delivery at the prices affordable to the contracting authority, the contractors' experience and other benefits.

Bibliography

1. Akintoye, A., Fitzgerald, E. (1995) Design and Build: a Survey of Achitects' views. Engineering, Construction and Architectural Management, vol.2, No.1, pp. 27 – 44.
2. Attalla, M., Hagazy, T. (2003) Predicting Cost Deviations in Reconstruction Projects: Artificial Neutral Networks Versus Regression. Journal of Construction Engineering and Management, Vol.129., No.4., pp. 405-411
3. Chan, A.P.C., Scott, D., Chan, A.P.L. (2004) Factors Affecting the Success of a Constructions Project. Journal of Construction Engineering and Management., Vol.130., No.1., pp. 153-155
4. Dang, N.C., Le-Hoai, L. (2016) Critical Success Factors for Implementation Process of Design-Build Projects in Vietnam. Journal of Engineering, Design anh Technology, Vol.14, No.1., pp. 17-32.
5. Desging and Build Procurement Route. Retrieved: https://www.designingbuildings.co.uk/wiki/Design_and_build_procurement_route. Acess: 21.11.2017.
6. Design and Build Contract (DB). Retrieveid: https://www.thebalance.com/when-to-use-design-build-contracts-844914. Acccess: 21.11.2017.
7. Hale, D.R., Shrestha, P.P., Gibson, G.E., Migliaccio, G.C. (2009) Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods. Journal of Constructions Engineering and Management, Vol.135, No.7, pp. 579-587
8. Hale, D.R., Shrestha, P.P., Gibson, G.E., Migliaccio, G.C. (2009) Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods. Journal of Constructions Engineering and Management, Vol.135, No.7, pp. 579-587
9. Konchar, M., Sanvido, V. (1998) Comparison of US Project Delivery Systems. Journal of Construction Engineering and Management., Vol.124, No.6, pp. 435-444
10. Lam, E.W.M., Chan, A.P.C., Chan, D.W.M. (2008) Determinants of Successful Design-Build Projects. Journal of Construction Engineering and Management., Vol.134, No.5, pp. 333-341
11. Learn About Using Design-Build Contracts. Retrieved: https://www.thebalance.com/when-to-use-design-build-contracts-844914, Access: 21.11.2017.
12. Lu, W., Hua, Y., Zhang, S. (2017) Logistics Regression Analysis for Factors Influencing Cost Performance of Design-bid-buils and Design-buil Projects. Engineering, Construction and Arhitectural Management., Vol.24, No.1, pp. 118-132
13. Mafakheri, F., Dai, L., Slezek, D., Nasiri, F. (2007) Project Delivery System Under Uncertainty: Multilevel Decision Aid Model. Journal of Management in Engineering. Vol.23, No.4, pp. 200-206.
14. Projekta stadijas projekta istenosanas process. Project Implementation Phase - Project Phases (2015). Retrieved: http://www.latarh.lv/f/profesijas_standarts.pdf. Access: 21.11.2017.
15. Publisko iepirkumu likums. Public procurement law. (2017) Retrieved: https://likumi.lv/doc.php?id=287760. Access: 24.10.2017.
16. Rokasgramatas projekts apvienoto projektesanas un buvdarbu iepirkumu veiksanai. Handbook for Design and Build Construction Works. Retrieved: http://www.latvijasbuvnieki.lv/position/rokasgramatas-projekts-apvienotajiem-projektet-un-buvet-iepirkumiem/. Access: 28.10.2017.
17. Songer, A.D., Molenaar, K.R. (1997) Project Characteristics for Successful Public-sector Sesign-build. Journal of Construction Engineering and Management, Vol.123, No.1, pp. 34-40
18. Yong, Y.C., Mustaffa, N.E. (2012) Analysis of Factors Critical to Construction Project Success in Malaysia. Engineering Constructions and Architectural Management, Vol.19, No.5, pp. 543-556

[1]*Corresponding author. E-mail address: edgars.pudzis@rtu.lv*
[2]*Corresponding author. E-mail address: laurarozentale@inbox.lv*
[3]*Corresponding author. E-mail address: sanda.geipele@rtu.lv*
[4]*Corresponding author. E-mail address: ineta.geipele@rtu.lv*