

Operational Research in Sustainable Development and Civil Engineering - meeting of EURO working group and 15th German-Lithuanian-Polish colloquium (ORSDCOE 2015)

Preliminaries of the professional engineer's multi-criteria assessment model in Lithuania

Algirdas Juozapaitis^a, Edmundas Kazimieras Zavadskas^b, Jolanta Tamošaitienė^{c*}, Arūnas Aleksandras Navickas^d, Lina Sakalauskienė^e, Dalius Gedvilas^f.

^aDean of Civil Engineering Faculty, Vilnius Gediminas Technical University, Sauletekio av. 11, LT-10223 Vilnius, Lithuania

^bChief of the Department of Construction Technology and Management, Vilnius Gediminas Technical University, Sauletekio av. 11, LT-10223 Vilnius, Lithuania

^cVice-Dean of Civil Engineering Faculty, Vilnius Gediminas Technical University, Sauletekio av. 11, LT-10223 Vilnius, Lithuania,

^dVice-Dean of the Civil Engineering and Architecture Faculty, Kaunas University of Technology, K. Donelaičio g. 73, 44249, Kaunas, Lithuania,

^eDean of the Civil Engineering Faculty, Vilnius College of Technologies and Design, Antakalnio St. 54, LT-10303 Vilnius, Lithuania,

^fPresident of Lithuanian Builders Association, Lukiškių st. 5-501, 502, LT-01108 Vilnius, Lithuania

Abstract

Construction processes planning and effective management are extremely important for success in construction business. The paper deals with an effective model of professional qualification construction engineering industry. Professional Engineer (PE) qualification in construction industry belong to different characteristics are considered to be more or less important for the effective construction industry results. The model of Professional Engineer (PE) qualification based on the requirements of: academic and professional skills in civil engineering area. Identification and definition the requirements of offered a professional qualification and job position in construction industry. The model of Lithuania case study is presented in this research.

Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the Operational Research in Sustainable Development and Civil Engineering - meeting of EURO working group and 15th German-Lithuanian-Polish colloquium

Keywords: Civil engineering, construction industry, professional qualification, competences, assessment, MCDM.

* Jolanta Tamošaitienė. Tel.: +370-5-274-5242; fax: +370-5-274-5240.
E-mail address: jolanta.tamosaitiene@vgtu.lt

1. Introduction

Construction processes planning and effective management are extremely important for success in construction business. The economic, political-economic and sociocultural environment factors influent the construction industry. The success is based on human resources and their professional qualification in construction industry. For this reason the assessment of professional qualification the candidate in construction industry of civil engineering area is most important task. Professional engineer (PE) qualification belong to different characteristics are considered to be more or less important for the effective construction industry results.

2. Preliminaries of the professional engineer's assessment

The mismatches of supply and demand of skills and qualifications in the transitional labor market are influenced by the wide range of external factors related to the economic, political economic and socio-cultural specificities of transitional economy. PE qualification may become the de-facto global standard due to lack of significant competition from the UK or Europe [1].

Despite of growing importance of competence development in the enterprises for the competitiveness of economy and social cohesion, there is a lack of research and information about the process of competence development in enterprises and especially about the approaches and strategies of competence development in the enterprises, considering their relevance and appropriateness to the challenges of transition economies.

These mismatches of skills and qualifications concern not only quantitative disbalance of supplied and demanded qualifications, but also differences between the requirements of employers to skills and contents of qualifications provided by the educational institutions. Approach of research is based on the historical and processual analysis of influences of different factors of socioeconomic transition to the competence development in the enterprises [2-4].

According the requirements of the civil engineers main goal is as being entrusted by society as leaders in creating a sustainable world and enhancing the global quality of life. The original set of 15 outcomes was expanded to 24 outcomes organized into the three categories: of professional qualification assessment are: foundational, technical, professional [5].

A new concept of engineering education called 'successful education'. First, the paper provides a brief discussion of the major forces driving the evolution of engineering education. These include the evolution in general of our civilisation from knowledge-based to creativity-based and the corresponding emerging challenges this transformation presents. Next, presented overview of selected sources of our inspiration and knowledge used to develop successful education, including an interpretation of the evolution of engineering education from both the systems and theory of inventive problem solving perspectives. It includes basic information about the theory of successful intelligence. The model include the concept of a successful department, its organisation, teaching based on the use of the theory of successful intelligence, its physical environment and various ways to create an appropriate ambience within it which stimulates creative learning. This concept is understood in pragmatic terms as an engineering activity that is focused on inventing engineering systems which are new, feasible, useful and potentially patentable [6].

There are various PE qualification systems. One of the states that adopted qualifications-based selection (QBS) of architectural/engineering (A/E) services is New York state [7]. British civil engineers can live and work an here in the EU but, despite a raft of Directives aimed at creating a level playing field, their professional qualifications are not automatically recognized [8]. Mutual recognition of professional engineers (PE) and opening of domestic market are encouraging the enhancement of domestic professional engineers' global competitiveness. In this context a strategic improvement plan for PE system to enhance the global competitiveness of domestic professional engineers, through the establishment of the advanced supply and management system of professional engineer [9].

Professional engineer (PE) qualification system is based on the criteria, which are used for the assessment the candidates. Identified a set of general qualification criteria for design-builders and compares their relative importance by a thorough content analysis of 97 Requests for Qualification (RFQ) for public DB projects advertised between 2000 and 2011 in various regions of the United States. The thirty-nine qualification criteria found are summarized and classified into eight categories comprising: experience; project understanding, and approach; organizational structure and capacity; past performance record; professional qualifications; responsiveness to RFQs,

office location, and familiarity with local environment; and legal status in descending order of their relative importance [10].

Six dimensions of competence present: 1) industry-specific and generic skills over activity management knowledge/expertise; 2) activity management knowledge/expertise over industry-specific and generic skills; 3) (senior) managerial skills; 4) (positive) personal traits; 5) activity management methodology experience and professional qualifications; and 6) risk management over a project life cycle [11, 12]. The professional engineer competences are important in activity success and influent general results.

3. Professional engineer's multi-criteria assessment model

The construction sector is one of the most important sectors in the Lithuania economy. The construction sector employs about 10% of total employment of Lithuania. In the construction sector is dominated by small and small enterprises. The construction sector employs about 100 thousand employees of total number of Lithuania [13].

The PE qualification system developed experts together the construction industry employer representatives. The developing of the model of PE qualification system Lithuania case consists from these steps:

1) Defines the framework of professional engineer qualification. The construction sector is seen as a static construction, including reconstruction, repair, design, research, maintenance, and demolition and construction supervision of the use. Construction industry objects - buildings - are divided in general into buildings and civil engineering structures.

2) The construction industry was divided in to subsectors. Was an analysed national and international legal document regulating the construction industry. Lithuania case the main subsectors are: buildings, engineering structures, transport and logistic communication, hydro-technical structures, engineering networks, other structures.

3) Establishing the candidate PE qualification activity fields. The main activities are: design, construction works, and maintenance or facility management services.

4) Analysis and developing PE qualification system level according existing Lithuanian qualifications system LQF and European Qualifications Framework. After analysis was suggest three PE qualification levels: charter civil engineer; civil engineer and junior civil engineer. The candidate assesses according the developed model of professional engineer qualification system in Lithuania assesses be applying skills: academic and practical experience skills.

Conclusion

PE qualification system intend to strengthen public and stakeholders confidence in the system of qualifications and qualifications framework and appropriate as advisory and information tool for companies and organizations in human resource management and the development of guidelines to identify, develop job descriptions, requirement and selection criteria, training programs, performance assessment tools, career plans and other.

The model of PE qualification system Lithuania case consists from: Defines the framework of professional engineer qualification, divided in to subsectors, establishing the candidate PE qualification activity fields, Analysis and developing PE qualification system level steps. In the suggest model PE qualification system Lithuania case consists from two main assessment skills: academic and practical experience. The literature analysis of this paper will be helpful to develop PE qualification system a confrontation policy against the mutual recognition for professional engineers in the national and international market. For the realize the developed model of professional engineer qualification in Lithuania following steps are: (1) a model of PE qualifying examination system and institution, (2) an improvement plan for the national professional engineer qualification grading system, and (3) an improvement plan for the award system of PE certificate. For the professional engineer's assessment and establishing the priority line, can be used MCDM methodology.

Acknowledgement

The authors grateful the Qualifications and Vocational Education and Training Development Centre, Ministry of Education and Science of Lithuania, Lithuanian Confederation of Industrialists for the support of this research.

References

- [1] Anwar, A.; Richards, D. Is the USA set to dominate accreditation of engineering education and professional qualifications? *Proceedings of the institution of civil engineers-civil engineering*, 166(1) (2013) 42-48.
- [2] Nazelskis, E.; Tutlys, V. Involvement of enterprises and sectors of economy in the designing and implementation of the national qualifications framework: experience of Lithuania. 6th Annual EuroMed Conference of the EuroMed-Academy-of-Business Location: Cascais, PORTUGAL, SEP 23-24, 2013, Edited by: Vrontis, D; Weber, Y; Tsoukatos, E; Confronting contemporary business challenges through management innovation (2013)1649-1683.
- [3] Nazelskis, E.; Tutlys, V. Mismatches of supply and demand of skills and qualifications in the transitional economy: the case of business and management qualifications in Lithuania. Conference: 5th Annual EuroMed Conference of the EuroMed Academy of Business Location: Montreux, Switzerland Edited by: Vrontis, D; Weber, Y; Kaufmann, R; et al. Date: OCT 04-05, 2012
- [4] Tutlys, V.; Nazelskis, E. Competence development in the enterprises in the transitional economy model: the case of Lithuania, 3rd Annual EuroMed Conference of the EuroMed-Academy-of-Business Location: Univ Nicosia, Nicosia, CYPRUS Date: NOV 04-05, 2010 3rd Annual euromed conference of the euromed academy of business: Business Developments Across Countries and Cultures Edited by: Vrontis, D; Weber, Y; Kaufmann, HR; et al. (2010) 1135-1156.
- [5] Civil engineering body of knowledge for the 21st century: preparing the civil engineer for the future/prepared by the Body of Knowledge Committee of the Committee on Academic Prerequisites for Professional Practice.—2nd ed. p. cm.
- [6] Arciszewski T. Future of engineering education. *Proceedings of the ICE - Management, Procurement and Law*, 167(1), (2014) 46 –59
- [7] Christodoulou, S.; Griffis, F.; Barrett, L.; Okunbowa, M. Qualifications-Based Selection of Professional A/E Services, *Journal of Management in Engineering* , 20(2) (2004) 34-41.
- [8] Grimsno, O. Europe: an open if uneven field for civil engineers, *Proceedings of The Institution of Civil Engineers-Civil Engineering* 157(1) (2004) 3-3.
- [9] Kuk, K. S.; Yu, J. A Strategic Plan of PE System for Enhancing the Global Competitiveness, *Journal of the Architectural Institute of Korea Structure & Construction* 22(5) (2006) 195-202.
- [10] Xia, B.; Skitmore, M.; Zuo, J. Evaluation of Design-Builder Qualifications through the Analysis of Requests for Qualifications, *Journal of Management in Engineering* 28(3) (2012) 348-351.
- [11] Chipulu, M.; Jun G. N.; Ojiako, U.; Williams, T. A Multidimensional Analysis of Project Manager Competences, *IEEE Transactions on Engineering Management* 60(3) (2013) 506-517.
- [12] Zavadskas, E. K.; Vainiūnas, P.; Turskis, Z.; Tamošaitienė, J. Multiple criteria decision support system for assessment of projects managers in construction. *International journal of information technology & decision making*, 11(2) (2012) 501-502.
- [13] Lithuanian Confederation of Industrialists. Report (2012).