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RESEARCH ARTICLE

Prioritizing Critical Success Factors Influencing Construction Projects Performance in Lithuania

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Abstract

This study identifies and prioritizes the critical success factors that influence construction projects performance in Lithuania. A 71 critical success factor were identified and grouped into seven major groups. These factors were assembled into a questionnaire survey and distributed to 30 construction professionals and experts from 12 construction companies who have projects management knowledge and related experience. The data were processed by expert judgment. The results reveal 10 critical success factors for the success of construction projects performance.

Keywords: *Critical success factors, Prioritizing, Construction projects performance, Project management, Lithuania.*

Introduction

Construction sector throughout the world is considered one of the primary industry on which the development of any country depends. To a great extent, the growth of a country and its development status is generally determined by the quality of its construction companies and their capability [1].

The construction sector still faces problems related to time and cost overruns, diminished quality and safety, and serious claims and litigation. In order to overcome these problems, the first mission is to understand how well a project is performed, and how much the end result satisfied the initial objectives. A project manager cannot manage, control, or improve if he cannot measure a project's success. Although there is no universal definition of project success, no one can deny the importance of evaluating project success, particularly in construction [2]. The project success concept in the context of construction industry may be even more complicated as it involves plenty of stakeholders, possesses higher inherent risk and vulnerable to various external factors such as political and economic [3]. Project success is the foundation for managing and controlling current project, and for planning and orienting future project [2]. The primary task of performance control is to ensure that project goals are achieved and to provide feedback on the status of each phase of construction. However, post implementation performance evaluation is resource intensive, time consuming and is important in its influence on the success of the project's implementation. It also does not provide the benefits of real-time monitoring of the current construction status [4].

Pinter and Pšunder [5] discussed a problematic of construction project success evaluation. They established that the success of a construction project depends on success in achieving goals in different success criteria which may or may not be co-dependent;hence, the calculation of construction project success is a multi-dimensional evaluation problem.

There are many factors that contribute to project success. According to different authors, planning [6,7], safety [8], risk management [9], human factors [10,11], procurement methods [12], stakeholders [13,14], contractors [15] can be critical to project success.

Islam and Das [16] mentioned some important project success criteria for stakeholder and project developing companies in sub-contracting situation. Aayushi Gupta et al. [17] identified and analyzed CSFs for build-operate-transfer (BOT) projects in India. Concession agreement, short-construction period, selection procedure of concessionaire, sufficient long-term demand and sufficient net cash inflow emerged as the top five factors critical for the success of the BOT projects in India.

Ejaz et al. [1] explained the impacts of success factors on mega construction developments in Pakistan. By using rank method, top five success

factors i.e., planning effort and scheduling (PES), adequacy of funding (AOF), project manager authority to take decision (PMD), adequacy of planning and specification (APS) and timely decision by client (TDC) were thoroughly investigated.

Ochieng and Price [18] explored the ability of project managers in Kenya and the UK in communicating effectively on multicultural projects. The study examined the cultural factors that influence communication and explored how communication can be made effective in multicultural project environments. The results showed that communications within multicultural project environments can be effective when project managers demonstrate an awareness of cultural variation. Participants further highlighted that, one of the critical components of building multicultural project teams is the creation and development of effective cross cultural collectivism, trust, communication and empathy in leadership.

A. Ogwueleka [19] identified success factors existing in projects and also examined the important index of these success factors on project performance in Nigeria. Based on the result, objective management, management of design, technical factors, top management support and risk management were selected as the most critical success factors in project performance.

Ghanaee and Pourezzat [20] in their research identified and ranked the key success factors of the residential renovation projects in Tehran. Designing appropriate methods of financing, choosing the most effective and appropriate intervention techniques and analysis and learning from the experiences of past projects, respectively, were identified as the most important factors.

Yi and Yang [14] established critical factors for stakeholders in disaster prone areas to plan for and develop new building infrastructure through holistic considerations and balanced approaches to sustainability. The identified critical factors included considerable building materials and construction methods, good governance, multilateral coordination, appropriate land-use planning and policies, sufficient consideration of different social needs, and balanced combination of long-term and short-term needs.

Successful construction project delivery requires a coordinated and interconnected performance of several firms from differing disciplines. Few relationships in multi-firm project organizations are contractual; most are based on common work practices, secondary contractual clauses and moral obligations [21]. The well-known success criteria like time cost and quality does not provide any practical information of achieving of project objectives in an efficient way. A comprehensive study of critical success factors (CSFs) can improve the effectiveness of project [1]. Therefore, there is a continuing need to identify the factors that positively influence project success.

Methodology

A questionnaire survey was designed by incorporating the applicable 71 factors affecting or enabling successful construction project performance. For the purposes of the study, the success factors were further classified into 7 groups: *external factors* (Economic environment, Social environment, Political environment, Physical environment, Technological environment, Legal environment, Cultural environment, Nature ecological environment), *institutional factors* (Construction permits, Construction regulations, Product and service certification, Standards), *project related factors* (Value, Size, Clear and realistic goals, Project type, Procurement, Complexity and uniqueness, Realistic schedule, urgency, Planning, Innovations, Materials and equipment, Supervision, Construction methods, Accidents, Profitability, Risk, Adequate funds/resources), *project management/team members related factors* (Relevant past experience, Competence, Trouble shooting, Decision making effectiveness, Control system, Motivation, Project organization structure, Good communication, Risk identification and allocation, Technical capability, Personnel issues), *project manager related factors* (Competence, Experience, Technical capability, Leadership skills, Motivating skills, Organizing skills, Coordinating skills, Effective and timely conflict resolution, Adaptability to changes, management of changes, Delegation of authority and responsibility, Perception of the role and responsibilities, Trust, Contract management), *client related factors* (Experience, Type (private vs. public), Size, Influence, Ability to make timely decision, Clear and precise goals/objectives, Risk attitude, Ability to participate in different phases of project), and *contractor related factors* (Company characteristics, Technical and professional capability, Experience, Economic and financial situation, Owner's management capability, Top management support, Quality issues, Health and safety conditions, Work conditions, Advanced technologies, Extent of subcontracting). The questionnaire was divided into two parts. The first part comprised background questions about the respondents' individual and organizational information. In the second part the experts were asked to rank factors

groups and factors in each group according to their importance. In the survey, the proposed success factors were rated by construction professionals and experts who have project management knowledge and related experience. The questionnaire of survey was distributed either personally or via e-mail to 30 members of top and middle management in 12 construction companies. A sample of 30 practitioners received the questionnaire and 30 valid questionnaires were returned for analysis. The calculation of the evaluation factors weights is carried out in 5 steps with the use of expert judgment method [22,23].

Step 1: An average rank is defined as:

$$\bar{t}_j = \frac{\sum_{k=1}^{r} t_{jk}}{r}$$

where: t_{jk} – k expert's index j evaluation (k = 1,2,…,r); r – number of the expert's.

Step 2: The importance of the factor is defined as:

$$q_j = \frac{t_j}{\sum_{j=1}^{n} t_j}$$

where: n – the number of evaluation factors.

Step 3: Kendall's W is defined as:

$$W = \frac{12S}{r^2(n^3 - n)}$$

where: S is the sum of squared deviations.

If the test statistic W is 1, then all the judges or survey respondents have been unanimous, and each judge or respondent has assigned the same order to the list of objects or concerns. If W is 0, then there is no overall trend of agreement among the respondents, and their responses may be regarded as essentially random. Intermediate values of W indicate a greater or lesser degree of unanimity among the various judges or respondents.

Step 4: The sum of squared deviations, S, is defined as:

$$S = \sum_{j=1}^{n} \left[\sum_{k=1}^{r} t_{j_k} - \frac{1}{n} \sum_{j=1}^{n} \sum_{k=1}^{r} t_{j_k} \right]^2 \quad (4)$$

where: t_{jk} – the rank conferred by the k expert to the j factor.

Step 5: The significance of the concordance coefficient is defined as:

$$\chi^2 = \frac{12S}{rn(n+1)} \quad (5)$$

This value must be greater than $\chi^2{}_{\alpha,\upsilon}$, which depends on the number of degrees of freedom and the chosen significance level, then considered the opinion of expert's agreed. Otherwise, the

$\chi^2 \succ \chi^2{}_{\alpha,\upsilon}$ states that the unmatched expert's opinions.

Results and Discussion

At first the experts ranked the groups of critical success factors. A 7-point scale was adopted, where 1 represented "very important" and 7 "not important at all". Table 1 shows how the seven groups of critical success factors were ranked.

Among the 7 critical success factors groups affecting construction projects, the project management/team members related factors were found as the most important group with q_4 = 0.1552, as can be seen in Table 1. Thus, we can conclude that the appropriate selection of team members makes the biggest influence to the success of construction projects. The institutional and the external factors were found as the least important groups with q_2 = 0.1298 and q_1 = 0.1308. These factors belong to the macro environment. They may affect the whole construction business in the country or outside it, but the company that performs construction projects, cannot control and influence them.

The respondents agree as regards the critical success factors groups, what can be judged by values W = 0.595; χ^2 = 107.024 (α = 0.01).

Table 1: The results of ranking of critical success factors groups

Experts	Critical success factors groups						
	X1	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*
E1	7	6	5	2	1	3	4
E2	6	7	3	1	2	5	4
E3	6	7	5	1	2	4	5
E4	6	7	4	1	3	5	2
E5	7	6	1	3	2	4	5
E6	6	5	1	3	7	4	2
E7	7	5	2	1	3	6	4
E8	4	7	2	1	3	5	6
E9	7	6	5	2	1	3	4
E10	5	7	4	1	3	6	2

Experts	Critical success factors groups						
	X1	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*
E11	4	7	6	3	1	5	2
E12	6	7	2	1	3	5	4
E13	5	7	2	1	3	6	4
E14	7	5	1	2	4	6	3
E15	4	5	2	1	3	7	6
E16	7	6	2	1	3	4	5
E17	7	5	6	4	3	1	2
E18	6	7	1	2	3	4	5
E19	7	4	2	5	6	1	3
E20	7	6	3	2	1	4	5
E21	6	7	5	2	1	3	4
E22	6	7	2	1	3	5	4
E23	4	7	1	2	6	5	3
E24	7	6	1	2	5	4	3
E25	7	6	1	4	5	2	3
E26	7	6	1	2	3	5	4
E27	6	7	1	4	3	2	5
E28	7	6	2	1	3	4	5
E29	6	7	3	1	2	5	4
E30	4	5	3	1	2	6	7
Sum of ranks	181	186	79	58	90	129	119
Average rank	6.03	6.20	2.63	1.93	3.00	4.30	3.97
Weight	**0.1308**	**0.1298**	**0.1510**	**0.1552**	**0.1489**	**0.1411**	**0.1431**
Priority	**6**	**7**	**2**	**1**	**3**	**5**	**4**

The same calculations were done with each group of critical success factors.

In the external factors group the economic environment was found as the most important factor with q_1 = 0.1370. We can only confirm that both the success of the project depends on the economic stability of the country, as well as the economic growth of the country depends on the successful implementation of projects. The cultural and nature ecological environments were found as the least important factors with q_7 = 0.1158 and q_8= 0.1163. The results show that the culture of the country: values, attitudes and norms of behavior have no particular effect on the success of the projects. The concordance coefficient is equal to 0.569, so the experts are in agreement.

In the institutional factors group the most important factors was construction permits with q_1 = 0.2800, the least important factor – product and service certification with q_4 = 0.2156. The results show that the construction permits in the country are still a problem and have influence on the successful implementation of projects.

The project value was the most important factor under the project related factors group with q_1 = 0.0652. The next two important factors were clear and realistic goals with q_2 = 0.0651 and realistic schedule with q_3 = 0.06473. Thus, we can conclude that in order to ensure the success of the project, the project must start with clearly indicated objectives and completed in time. Project delays are usually caused by disagreements and disputes. This has a negative impact on the reputation of the company, increases the project budget and reduces the likelihood of project success. The accidents was the least important factor under this group with q_{13} = 0.0593. Although the safety in the literature is often attributed to the critical success factors, likely the experts did not face this problem in a five-year period and did not give it a special significance comparing to other factors.

The results show that human factors such as relevant past experience with q_1 = 0.0973, competence with q_2 = 0.0951, decision making effectiveness with q_3 = 0.0942 and good communication q_4 = 0.0913 were the most important factors under the project management/team related factors group and have a very significant impact on the success of the project. The experience and competence were also the most important factors under the project manager related factors group with q_1= 0.0815 and q_2 = 0.0805. Project managers, team members, clients and contractors acquire various knowledge and skills through the experiences they go through in their working life. The relevance of such experience derives from the changing conditions of their business environment. Successful communication can previously identify problems, help avoid duplication of activities, eliminate mistakes and generate ideas, which may be important for better decisions. Furthermore, it promotes teamwork, motivation and ensures the participation of all main team members. Respectively, experience with q_1 = 0.1361 was the most important factor under the client related factors group as well as under the contractor related factors group with q_1 = 0.0969. The least important factors in those two groups were client influence with q_8 = 0.1169 and owner's management capability with q_{11} = 0.0862.

The concordance coefficient W of each group is shown in Table 2.

Table 2: The concordance values of each group

	Critical success factors groups						
	X1	*X2*	*X3*	*X4*	*X5*	*X6*	*X7*
W	0.5609	0.6112	0.5551	0.5225	0.6002	0.6003	0.6255

Based on the experts defined importance of factors groups and factors under the groups the factors significances were calculated in the overall row. The influence of the factors on the implementation of projects depends not only on the size of factor

weight in the group, but also on the number of factors in the group and on the importance of the group. Critical success factors with local and global weights are ranked in Table 3.

Based on the results calculated by expert method 10 factors were determined as the most important factors for construction projects in Lithuania.

Table 3: CSF's ranking with local and global weights

	Groups of CSF's	Weights of groups	CSF's	Local weights	Global weights
1	2	3	4	5	6
Prioritization of CSF's of construction projects	External factors	0.1308	Economic environment	0.1370 (1)	0.1434 (48)
			Social environment	0.1221 (6)	0.1278 (67)
			Political environment	0.1311 (2)	0.1372 (57)
			Physical environment	0.1223 (5)	0.1280 (66)
			Technological environment	0.1266 (4)	0.1325 (64)
			Legal environment	0.1287 (3)	0.1347 (61)
			Cultural environment	0.1158 (8)	0.1212 (69)
			Nature ecological environment	0.1163 (7)	0.1218 (68)
	Institutional factors	0.1298	Construction permits	0.2800 (1)	0.1454 (40)
			Construction regulations	0.2778 (2)	0.1443 (44)
			Product and service certification	0.2156 (4)	0.1120 (71)
			Standards	0.2267 (3)	0.1177 (70)
	Project related factors	0.1510	Value	0.0652 (1)	0.1575 (5)
			Size	0.0626 (8)	0.1514 (24)
			Clear and realistic goals	0.0651 (2)	0.1573 (6)
			Project type	0.0601 (14)	0.1452 (41)
			Procurement	0.0600 (15)	0.1450 (43)
			Complexity and uniqueness	0.0629 (7)	0.1521 (22)
			Realistic schedule, urgency	0.06473 (3)	0.1564 (7)
			Planning	0.0636 (5)	0.1537 (14)
			Innovations	0.0613 (13)	0.1481 (34)
			Materials and equipment	0.06197 (10)	0.1497 (29)
			Supervision	0.0621 (9)	0.1499 (27)
			Construction methods	0.0614 (12)	0.1483 (33)
			Accidents	0.0593 (16)	0.1434 (49)
			Profitability	0.0631 (6)	0.1524 (21)
			Risk	0.0620 (11)	0.1497 (30)
			Adequate funds/resources	0.0647 (4)	0.1563 (8)
	Project management/team related factors	0.1552	Relevant past experience	0.0973 (1)	0.1661 (1)
			Competence	0.0951 (2)	0.1623 (2)
			Trouble shooting	0.0886 (9)	0.1513 (25)
			Decision making effectiveness	0.0942 (3)	0.1608 (3)
			Control system	0.0898 (7)	0.1534 (16)
			Motivation	0.0878 (10)	0.1498 (28)
			Project organization structure	0.0909 (6)	0.1552 (13)
			Good communication	0.0913 (4)	0.1558 (9)
			Risk identification and allocation	0.0896 (8)	0.1530 (17)
			Technical capability	0.0912 (5)	0.1557 (11)
			Personnel issues	0.0842 (11)	0.1437 (47)
	Project manager related factors	0.1489	Competence	0.0805 (2)	0.1557 (10)
			Experience	0.0815 (1)	0.1578 (4)
			Technical capability	0.0804 (3)	0.1555 (12)
			Leadership skills	0.0760 (8)	0.1471 (36)
			Motivating skills	0.0754 (10)	0.1460 (39)
			Organizing skills	0.0788 (4)	0.1526 (18)
			Coordinating skills	0.0778 (5)	0.1506 (26)
			Effective and timely conflict resolution	0.0764 (7)	0.1478 (35)
			Adaptability to changes, management of changes	0.0770 (6)	0.1490 (31)
			Delegation of authority and responsibility	0.0758 (9)	0.1467 (37)
			Perception of the role and responsibilities	0.0735 (12)	0.1422 (51)
			Trust	0.0739 (11)	0.1431 (50
			Contract management	0.0729 (13)	0.1410 (53)
	Client related factors	0.1411	Experience	0.1361 (1)	0.1537 (15)
			Type (private vs. public)	0.1187 (6)	0.1340 (62)
			Size	0.1179 (7)	0.1331 (63)
			Influence	0.1169 (8)	0.1320 (65)
			Ability to make timely decision	0.1218 (5)	0.1375 (56)
			Clear and precise goals/objectives	0.1351 (2)	0.1525 (20)
			Risk attitude	0.1276 (3)	0.1441 (46)
			Ability to participate in different phases of project	0.1259 (4)	0.1422 (52)
	Contractor related factors	0.1431	Company characteristics	0.0922 (5)	0.1452 (42)
			Technical and professional capability	0.0964 (2)	0.1517 (23)
			Experience	0.0969 (1)	0.1526 (19)
			Economic and financial situation	0.0943 (3)	0.1485 (32)
			Owner's management capability	0.0862 (11)	0.1357 (60)
			Top management support	0.0867 (10)	0.1364 (59)
			Quality issues	0.0929 (4)	0.1463 (38)
			Health and safety conditions	0.0874 (8)	0.1376 (55)
			Work conditions	0.0872 (9)	0.1372 (58)
			Advanced technologies	0.0916 (6)	0.1442 (45)
			Extent of subcontracting	0.0881 (7)	0.1387 (54)

The results are shown in Table 4. It is clear from Table 4 that project management/team related factors were most important of the CSFs. Out of the 10 factors, 4 of them were project management/team related factors that revolve around the subject of experience (1), competence (2), effective decision making (3) and communication (9). Project related factors such as project value (5), clear and realistic goals (6), realistic schedule (7) and adequate funds/resources (8) and project manager related factors such as experience (4) and competence (10) also played a crucial role in contributing to the construction project success.

Table 4: The top 10 critical success factors identified

Rank	CSF's of construction projects	Factor groups
1	Relevant past experience	Project management/team related factors
2	Competence	Project management/team related factors
3	Decision making effectiveness	Project management/team related factors
4	Experience of project manager	Project manager related factors
5	Project value	Project related factors
6	Clear and realistic goals	Project related factors
7	Realistic schedule, urgency	Project related factors
8	Adequate funds/resources	Project related factors
9	Good communication	Project management/team related factors
10	Competence	Project manager related factors

Conclusion

In this study, 71 factor influencing construction projects performance in Lithuania were examined by bringing them together in 7 main groups constituted from external, institutional, project related, project management/team members related, project manager related, client related and contractor related factors. A questionnaire was distributed among to construction professionals and experts who have projects management knowledge and related experience. The analysis of the information collected from the survey was carried out using the expert judgment method.

Relevant past experience of the project management/team is the major factor critical to the success of a construction projects performance. Participants of the survey opined that project management/team related factors such as experience, competence, effective decision making and communication are significant factors ensuring the success of a construction project performance. Project related factors such as project value, clear and realistic goals, realistic schedule and adequate funds/resources and project manager related factors such as experience and competence also played a crucial role in contributing to the construction project performance success.

Based on the findings of the study it is recommended that more emphasis should be given on improving the human-related or "soft" factors such as experience, competence, effective decision making and communication in order to ensure the success of a construction project performance in the future. The findings would be valuable for future studies in this area. The research would benefit from a larger sample for the questionnaire survey. This would increase the general credibility and wider applicability of the findings.

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