SIMILARITY ASSESSMENT OF COUNTRIES TO FACILITATE LEARNING FROM INTERNATIONAL CONSTRUCTION PROJECTS

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Companies' ability to learn from projects is a source of competitive advantage in project-based industries. Learning from experiences in international markets is particularly important for global contractors so that the right bidding strategy can be developed, effective project governance systems can be established, and similar mistakes are not repeated. In this study, we assert that countries can be clustered according to their similarity so that experiences gained in these markets can be transferred and adapted to forthcoming projects. Thus, similarity factors to be used for clustering of countries can be identified, and a methodology can be developed to store, retrieve and reuse country-related information in international construction projects. In this paper, we report the factors identified for similarity assessment of countries to be used to facilitate learning from projects. As a result of literature review, interviews with experts and an online questionnaire administered to company professionals who have international construction experience, 12 factors have been identified for clustering of countries. As a result of ranking analysis; factors of "development level of and culture in the construction industry", "political condition of the country" and "financial condition of the country" are obtained as the most important factors. The identified factors will be explained and how the clustering of countries can help companies to extract valuable information from previous experiences will be discussed.

Keywords: Cluster analysis, Construction industry, Organizational learning, Questionnaire survey, Ranking analysis.

1 INTRODUCTION

Retaining knowledge and enabling human resource development constitute the main requirements of today's construction organizations. There has been a wide interest and focus on organizational learning and knowledge management in the construction management literature (Chinowsky and Carrillo 2007). Organizational learning is defined as continuous cycle of knowledge generation and use to meet strategic objectives and requirements of changing environment (Ozturk *et al*. 2016). Main drivers of organizational learning are stated as achievement of efficient performance, prevention of knowledge loss due to aging workforce, need of local knowledge due to globalization, need of better solutions to problems, and establishment of continuous growth (Chinowsky *et al*. 2007). However, being a project-based industry, construction industry encounters industry specific barriers to learning. Even if the projects have the same design, they are still unique due to differences in execution teams, external conditions such as ground conditions, locations, etc. (Fong 2005, Alashwal and Abdul-Rahman 2014). Globalization adds another dimension to difficulty of learning and transferring of knowledge. It results in various

participants working in an unfamiliar environment and leads to problems due to cross-national differences. A successful international organization needs to establish understanding of international markets and projects, and develop an ability to make this knowledge available to the members of the organization to achieve strategic advantage by utilizing its global knowledge. Flow of knowledge should be established between the members of the organization and so benefits of acquirement of knowledge can be multiplied (Javernick-Will and Levitt 2010). With the advances in IT, the barriers can be overcome and the success in sharing of this knowledge can be achieved with the support of a learning culture. Knowledge as the main outcome of learning should be kept in organizational memories and successful sharing of knowledge should be established to foster its value by integration of formal and social processes within the knowledge management systems (Fong 2005, Javernick-Will and Levitt 2010, Alashwal and Abdul-Rahman 2014). Thus, effective mechanisms to capture, store, share and maintain knowledge within the organization are required to overcome the barriers such as uniqueness of international projects and loss of individual knowledge acquired within the projects.

When cycle of knowledge within an organization is considered, it is obvious that sharing of explicit knowledge is easier than sharing of tacit knowledge. Explicit knowledge (e.g., in the form of documents) is the easily codified and shared part of knowledge, however tacit knowledge (e.g., lessons learned) constitutes the knowledge held by individuals and it is difficult to identify, codify and share (Chinowsky and Carrillo 2007, Kivrak *et al.* 2008). Thus, management of tacit knowledge constitutes the tedious and most valuable part of knowledge management (Easterby-Smith and Lyles 2011). Mechanisms to keep this individual knowledge are required either by communication between individuals or establishing systems to change this tacit knowledge into information (or explicit knowledge) available to whole organization (Chinowsky and Carrillo 2007). Codification of this knowledge through standard forms and retrieval of the information through different search mechanisms has to be enabled when global contracting is taken into consideration. Accordingly, clustering of countries can be used as a means for classification of this knowledge. Available knowledge may be filtered for the countries in the same cluster. By this way, local knowledge can be easily retained by the global contractors and used in decision-making processes. Simply, the lessons learned in previous projects can be re-used in the forthcoming projects and the similar mistakes may be prevented. Therefore, country similarities need to be identified to establish a link between the projects held in that countries to enable the use of knowledge gained in one project in another (Fong 2005, Chinowsky *et al.* 2007). Within this context, first the factors that the cluster analysis would be based on have to be identified. This study aims identification of country factors specific to construction industry for clustering the countries to facilitate learning between countries. The identified factors may further be used in structuring forms for codification of country specific information.

2 RESEARCH METHODOLOGY

The methodology of this research consists of 3 parts, which include conducting a literature review for determination of the country factors affecting project performance and enable learning, designing and conducting a questionnaire survey with Turkish company professionals working abroad to test validity and rank importance of identified factors, and analyzing the collected data.

Literature review on studies related with country factors affecting construction projects has been conducted (Kaming *et al.* 1997, Akinci and Flscher 1998, Jaselskis and Talukhaba 1998, Fraser and Fraser 2000, Hastak and Shaked 2000, Birgonul and Dikmen 2001, Han and Diekmann 2001, Chan and Tse 2003, Chua *et al.* 2003, Dikmen and Birgonul 2004, Gunhan and Arditi 2005, Iyer and Jha 2005, Dikmen and Birgonul 2006). The identified country factors are

grouped under 12 major categories. The "face-validity" of these factors was ensured by interviews that were arranged with 2 experts who have been working in big-size and reputable construction companies in Turkey and are experienced in international construction. Main categories of the identified factors are as follows;

1. Financial condition of the country (e.g., level of difficulty in money transfer)

2. Economical condition of the country (e.g., gross domestic product per capita)

3. Political condition of the country (e.g., status of international relations)

4. Social condition of the country (e.g., existence of internal conflicts)

5. Legal condition of the country (e.g., level of development of the legal system)

6. Development level (maturity) of and culture in the construction industry (e.g., level of corruption)

7. Regulations and requirements associate with construction to be applied (e.g., level of environmental policies and requirements)

8. Difficulties/constraints issued to foreign construction companies (e.g., level of constraints for partner and partnerships)

9. Level of bureaucracy (e.g., bureaucratic procedures and stages)

10. Quality and availability of local resources (e.g., availability of materials)

11. Religious, linguistic and cultural structure (e.g., perspective attitudes of local people)

12. Geographical/physical/climatic conditions of the country (e.g., suitability of the climate and weather conditions).

Following the determination of country factors, a web-based questionnaire consisting of 3 sections was formed. In the first section of the questionnaire, as an introduction part, description and objective of the survey are presented. In the second section, the questions about general information of the respondent are inquired. The last section of the questionnaire includes only one question that is related to importance levels of the identified country factors. In this section, previously identified country factors are listed and asked for evaluation by assigning ratings according to their importance level in similarity assessment of the countries for global contractors. The evaluation of importance levels of the factors was performed based on the five-point Likert scale where, "1" indicates the least importance and "5" indicates the highest importance. In addition, respondents are asked to define any other country factor that may affect construction projects and to rate its importance in similarity assessment, if there exists any.

The questionnaire was distributed online through electronic mail invitations. The questionnaire survey administered to company professionals who have international construction experience in various types of projects (i.e., industrial, building, engineering, etc.) and work in a company that is a member of the Turkish Contractors Association. A total of 84 responses were obtained. Characteristics of the respondents and their company information are presented in the Table 1.

The collected data through the questionnaire survey were analyzed by calculation of indices. Importance index of each country factor was calculated according to Eq. (1) (Abdul-Rashid *et al*. 2007).

$$I = \sum_{i=1}^{5} \frac{a_i \times X_i}{5} \tag{1}$$

In Eq. (1), "I" indicates the importance index of each factor; "i" is the response category index where i = 1, 2, 3, 4, 5; "a_i" indicates the weight of the ith response ranging from 1 to 5; "X_i" indicates the frequency of the ith response given as a percentage of the total responses for each factor.

Table 1. Characteristics of respondents and their companies.

Frequencies of Respondent and Company Characteristics					
Respondent Characteristics		**Company Characteristics**			
Education Level		*Age*		*Types of Projects*	
Undergraduate	57%	0-10 years	2%	Residential	54%
Master Degree	43%	10-20 years	14%	Commercial	75%
		20-30 years	23%	Transport	70%
Professional Experience		30-40 years	25%	Energy	70%
0-5 years	17%	40 years and over	36%	Water Construction	57%
6-10 years	25%			Industrial	54%
11-15 years	26%	*Type of Company*		Other	10%
16-20 years	17%	Owner	62%		
21 years and over	15%	Contractor	89%	*Annual Turnover*	
		Designer	2%	0-100 Million TL	8%
		Consultancy	2%	100-500 Million TL	18%
		Other	2%	500 Million TL and over	74%

3   RESEARCH FINDINGS

Importance index of each factor was calculated by using the given formula. Following this process, averages for ratings and importance weights for the factors were calculated. The obtained rankings of each country factor are presented in Table 2.

Table 2. Importance weights of the country factors.

Country Factors	Average Rating	Rank	Importance Index (%)	Importance Weight (%)
Financial condition of the country	3.559	3	71.18	0.0876
Economical condition of the country	3.417	8	68.34	0.0842
Political condition of the country	3.583	2	71.66	0.0882
Social condition of the country	3.167	10	63.34	0.0780
Legal condition of the country	3.226	9	64.52	0.0794
Development level of and culture in the construction industry	3.607	1	72.14	0.0888
Regulations and requirements associate with construction to be applied	3.44	7	68.8	0.0847
Difficulties/constraints issued to foreign construction companies	3.476	6	69.52	0.0856
Level of bureaucracy	3.535	4	70.7	0.0871
Quality and availability of local resources	3.523	5	70.46	0.0868
Religious, linguistic and cultural structure	2.929	12	58.58	0.0721
Geographical/physical/climatic conditions of the country	3.143	11	62.86	0.0774

According to the results; "development level (maturity) of and culture in the construction industry", "political condition of the country" and "financial condition of the country" factors are

obtained as the most significant factors for similarity assessment of countries with the average ratings of "3.607", "3.583", and "3.559" respectively. On the other hand, results show that the least important factor is "religious, linguistic and cultural structure of the country" with the average rating of "2.929". As it can be observed from Table 2, importance index and average ratings of the all factors are close to each other. So, it can be said that all of these factors have significant roles on the similarity assessment of countries.

In the forthcoming parts of this study, countries will be clustered using these factors and how construction companies can transfer knowledge within the same cluster to facilitate learning will be investigated in detail. In the following part, how the research findings can be used to facilitate learning is explained by a hypothetical example.

4   ILLUSTRATIVE EXAMPLE

A global contractor company example can be given as follows: If the company is considering undertaking a project in "Country X", then company professionals may want to investigate previous international projects in order to understand how country related factors affected project success or lead to failure. We assert that rather than looking at all the countries, they can search for similar countries (within the same cluster according to the most significant country factors). Of course, if the company worked in "Country X" before, the lessons learned in "Country X" are the most valuable ones; however, this may result in limited number of lessons learned and lessons learned within the same cluster of countries which could be transferrable to "Country X" might be lost. For example; country specific information related with the most similar countries such as "Country Y" and "Country Z" in the same cluster with "Country X" can be obtained and the projects held in these countries may be investigated to learn about previous experiences. As a summary, clustering gives companies an indicator to be used during knowledge retrieval. As a result of clustering, the main factors that the similarity between the country pairs originates can be identified as "learning opportunities". For instance, "learning opportunities" between "Country X" and "Country Y" can be identified as "financial condition of the country"; then lessons learned in "Country Y" about management of the financial risks can be transferred to "Country X". Thus, retrieving cases by clustering can create and enhance "learning opportunities" for international projects.

5   CONCLUSIONS

Within the context of the study, 12 factors to be used for clustering of countries were identified following the literature survey, preliminary interviews and questionnaire findings. The most significant factors are obtained as "development level (maturity) of and culture in the construction industry", "political condition of the country" and "financial condition of the country". In the forthcoming steps, the countries that the Turkish contractors have been working will be carried out by the hierarchical clustering method. Thus, the lessons learned in similar countries (within the same cluster) can be used in forthcoming projects. Investigation of lessons learned can guide the contractors in market research, business development and while formulating bidding strategy as well as operational strategy. In addition to retrieval benefits, the identified factors may further be used in creating a standard country evaluation form to capture country data. The scope of this paper is limited with Turkish contractors; however, the methodology is repeatable for the other global contractors around the world.

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