Analyzing the performance of international contractors according to the organizational capability

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Abstract
Every international construction project is exposed to various uncertainties, but the actual effect of these exogenous risks differs considerably according to not only the severity of the risks but also the organizational capability of contractor. This study begins by investigating the performance of more than 820 international projects performed by Korean contractors during the last decade. Each project is partitioned into corresponding political, economic, sociological and resource risks. The relevant data were comprehensively compiled by the use of secondary data from the various authorized institutions. This study then estimates the organizational capability of each contractor based on the experience within a given host country, the experience of the corresponding project type, accrued experience of whole international projects, total revenue, total number of employees, and growth rate of revenue. Based on these capability backgrounds, each contractor was classified into four groups. A two-step cluster analysis was performed to classify the international contractors according to the quality of organizational capability and the level of risks during the same period of data analysis. This study also investigates the relations between performance level and organizational capability of each group. The results showed that the highly internationalized and large contractor group is likely to enter the high risk market to gain more sound profitability, whereas the lowly internationalized and small contractor group has a tendency to enter low risk market to yield instead unstable profitability. This study is expected to aid international contractors in designing internationalization strategies by revealing the strategic preference of firms in association with the level of risk and degree of organizational capability.

Keywords
International construction, Organizational capability, Risk, Internationalization, Clustering analysis

1. Introduction

Globalization leads to contractors having a greater chance of entering the international markets (Han and Diekman, 2001). However, every international construction project is exposed to various uncertainties, largely stemming from the differences in project circumstances between the domestic and overseas

construction markets. For this reason, a number of researchers have continuously performed investigation into various aspects of international construction risks and their impacts on project performance. In particular, according to Han et al. (2007), the contractor's capability is considered as one of most critical factors affecting project performance. In reality, the actual effect of risks such as political, economic, sociological and resources risks differ according not only to the severity of the risk but also the organizational capability of contractors. Thus, research aims to examine the actual effect of the risks according to the different level of organizational capabilities. First, the authors collected the relevant data from various sources including Korean contractors' project performance data over the last decade (2000-2009). Second, this study performed a two-step cluster analysis to classify the international contractors according to the quality of organizational capability and the level of risks during the same period of data analysis. The authors also investigated the relationship between international construction performance and organizational capabilities. Finally, we provide, based on this investigation, a better understanding of each group's competitive strategic position to assist firms building useful strategies with addressing their degree of organizational capability.

2. Background

Many researchers have emphasized the importance of the experience and capabilities of firms. Ahuaja (2000) suggested that the performance of firms is affected by the firm's experience and capability. In particular, Chang (1992) suggested that the "*experience curve effects results from the firm's culmulative knowledge in learning to improve its business operations*." This experience curve effect would create a learning curve effect which is able to reduce the firms' overheads and average unit cost. Consequently, these advantages affect the firms' success in the competitive global industry.

Likewise, these concepts can be suitably applied in international construction. In general, with increasing experience in overseas construction, the contractor could learn more tacit knowledge of institutional practices, resource management, cultural familiarity, and more adaptability to local customs (Jung et al., 2010). In particular, Madhok (1997) claimed that this sort of knowledge enables firms to not only facilitate more organizational capabilities but also to win more overseas contracts and gain more profit.

In terms of the resource based view (RBV), Dikmen (2009) emphasises that the company's resources and capabilities are the source of their strategy and are major determining factors of performance. The contractor's capabilities are also attained from various types of sources such as human, knowledge and network resources (Dierickx and Cool, 1989). Jung et. al. (2010) also suggested that "*international construction greatly requires construction firms to have advanced organizational capabilities*", which enables firms to cope with the highly risky circumstances of international construction.

Although these previous research studies emphasize the importance of the experience and resources of the firms, there is no thorough understanding as yet of showing how contractors' international experience and resources affect their strategy and profitability in international construction. Thus this research attempts to narrow the gap of knowledge on the contractors' organizational capability in international construction, with real project data obtained from Korean contractors' experiences. This research begins by exploring the issues about the effect of organzational capability in international construction with relevant managerial thoery including resource-based view and instutution theory. Then, the authors performed a strategic group analysis for investigating more detailed insight in relation to level of organization capability and their performance achievement.

The approach suggested by Dikmen (2009) that performed a strategic group analysis in the Turkish construction industry was used in this study. From a strategic group analysis, different risk postures could cause different strategies by the firms (Cave et al., 1977). Based on the these points, the authors performed a two-step cluster analysis with various sources of data. On the basis of the classified groups, the authors analyzed their risk postures and profit performance to draw the key differences between each

group and further, to present the strategic implication in establishing firms' internationalization schemes.**3. Research Methodology**

3.1 Data Collection

Data from around 820 international projects performed by Korean international contractors from 2000 to 2009 were collected from ICAK (International Contractors Association of Korea). According to each project's characteristics, the political, economic, sociological and resource risk data were compiled by the use of secondary data from various authorized institutions. These data include the World Bank's WGI (Worldwide Governance Indicators), which consisted of six dimensions of governance risk variables (Voice & Accountability, Political Stability and Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption). These six governance indicators are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes (The World Bank Group, 2010). Moreover, the six dimensions of governance risk variables were reorganized and connected with project-based real international data obtained from ICAK. For assessing the financial status and organization size of each contractor, the authors used formal indices published by the authorized institutions in Korea.

3.2 Two-Step Cluster Analysis

3.2.1 Selection of Variables

Table 1: Variables for Cluster analysis

Variable	Type
Type of contract	Nominal
Experience of total international projects	Continuous
Experience of a given host country	Continuous
Experience of a corresponding project type	Continuous
Experience of a given host country/ project type	Continuous
Experience of prime contractor	Continuous
Total revenue	Continuous
Revenue growth rate	Continuous
Total number of employees	Continuous
Growth rate of revenue per capita	Continuous

Selecting the cluster variables and the multi-collinearity among the cluster variables should be considered highly important when performing the cluster analysis (Ketchen and Shook, 1996). In the step of variable selection, the authors focused on the variables related to the contractors' organizational capabilities. Table 1 represents the variables for the cluster analysis. In the initial stages of the cluster analysis, the authors detected multi-collinearity between the variables of international construction experience. Normally, a high correlation among the cluster variables can cause problems with the cluster analysis results (Ketchen and Shook, 1996). For this reason, Factor Analysis was also applied to the variables that are found highly correlated. As a result, a total of 10 variables was chosen for cluster analysis, with variables that indicate the contractors' organizational capabilities. The two-step cluster analysis is then applied, because it is able to deal with continuous variables as well as categorical variables and automatically select the number of clusters. two-step cluster analysis is also suitable for large-scale data processing (SPSS, 2010).
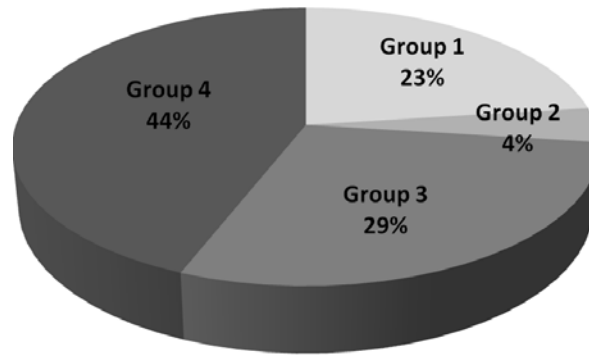
3.2.2 Strategic Groups

Figure 1: Clustering Result by Two-Step Cluster Analysis

As a result of two-step cluster analysis, four different strategic groups were classified accordingly. Fig 1 shows the two-step cluster analysis result, forming the collected groups that consist of 29%, 23%, 4% and 44% of the total of 820 international contractors, respectively. Based on the cluster results, the characteristics of each group were investigated further in more detail.

Table 2: Variables for Clustering Analysis

Main category	Sub categories	Group 1	Group 2	Group 3	Group 4
Experience of total international project	Cumulative contract amounts (million dollar)	14,784	9,521	1,375	1,182
	Cumulative number of projects	153	84	22	20
	Culmulative construction periods (in days)	118,664	66,913	13,155	14,234
Experience of a given host country	Cumulative contract amounts (million dollar)	908	465	134	102
	Cumulative number of projects	12	7	5	2
	Culmulative construction periods (in days)	8,791	3,822	2,371	1,546
Experience of a corresponding project type	Cumulative contract amounts (million dollar)	4,143	2,239	612	582
	Cumulative number of projects	52	26	13	9
	Culmulative construction periods (in days)	37,176	17,753	6,708	6,820
Experience of a given host country/ project type	Cumulative contract amounts (million dollar)	513	243	87	77
	Cumulative number of projects	8	5	3	2
	Culmulative construction periods (in days)	5,327	2,158	1,435	1,167
Total revenue	Average value of each cluster (million dollar)	9,748	545,231	7,028	2003
Total number of employee	Average value of each cluster	4398	13640	1690	1464

Table 2 shows the detailed characteristics of each group's international construction experience. In terms of experience of international construction, the authors compared each group's level of experience in

international construction. The contractor's experience values were calculated by finding the accumulated sum of contract amount / number / construction periods of executed projects in a specific country and project type. Group 1 is the most experienced group, whereas group 4 has less experience in international construction. Table 2 shows more detailed information including sub-category values (cumulative contract amounts, cumulative number of projects, cumulative construction periods). These values represent the average of each group.
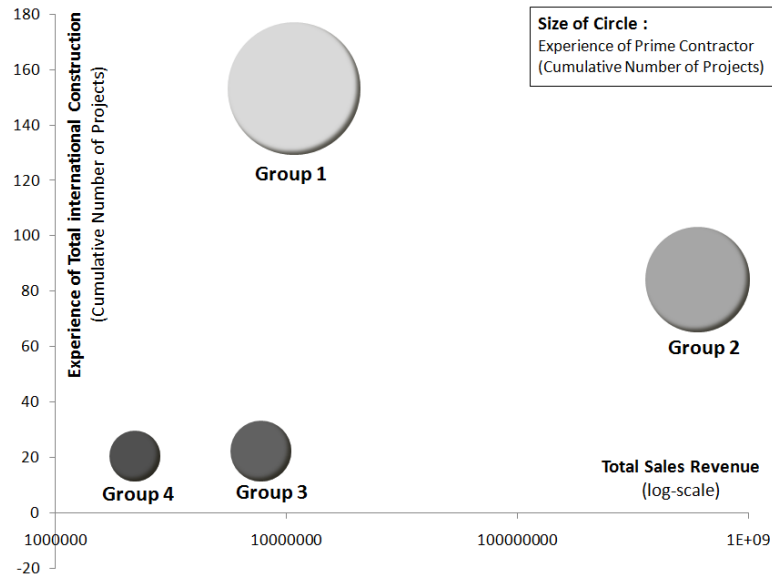

Figure 2: Organizational Capability of Strategic Group

As shown in Fig. 2. group 2 was positioned at the biggest zone from the perspective of organization size. Group 2 is composed of firms with an average of 13,640 employees. Meanwhile, group 4 is the smallest group which is composed of firms with an average of 1,465 employees. Figure 2 also shows that group 1 and group 2 are considered to have a relatively higher level of organizational capability; thereby implying that they are more internationalized groups. On the other hand, group 3 and group 4 are considered to have a lower level of organizational capability (less internationalized groups). Moreover, each group shows the different characteristics in terms of prime contractor experience which means group 1 and group 2 are considered to have a relatively higher level of experience as prime contractor than group 3 and group 4. Through intensive investigation, it was found that most of firms in group 3 and group 4 engaged into business as sub-contractors in international construction. In other words, group 3 and group 4 are mainly experienced in sub-contractor's role.

4. Analysis of strategic Groups

The profit performances of each strategic group are depicted in Fig 3. The results show that each group's profit performance is considerably different. In particular, group 1, which corresponds to the relatively highly internationalized and larger contractor, gain more stablized profitability (Mean: 5.1%, SD: 6.5%). On the other hand, relatively small and lowly-internationlized contractors (group 4) yield very fluctuated profitability (Mean: 4.1% SD: 11.4%). In addition, in veiw of percent of loss projects, group 1 reveals an average project failure rate of 25.1% in international construction projects. However, group 4 shows an average project failure rate of 36.4%. This highlights the fact that profit performance is relevant to its degree of organizational capability of each group.
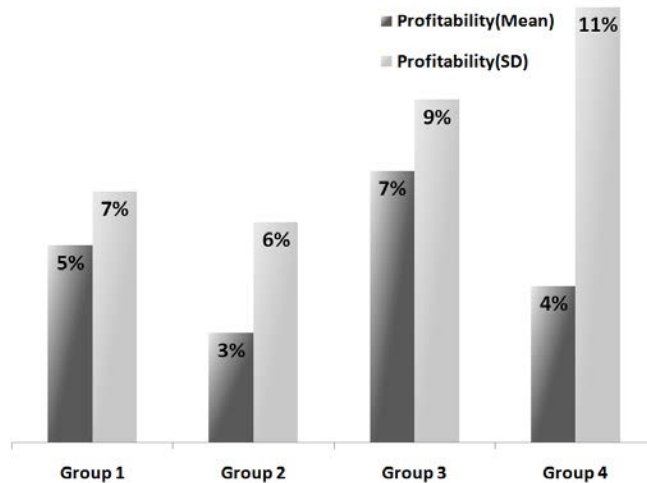
Figure 3: Profit Performance of Strategic Group

Further, this study performed a more detailed analysis of the strategic groups. Fig 4 portrays the different risk postures of the strategic groups and their profit performance. The six dimension of host country's governance risk variables were partitioned into the corresponding group's international construction project data (2000–2009). From the perspecitve of risk posture, group 4 mainly entered the low risk markets. However, it is evident that their profit performance is considerably less stablized than the other groups. This result indicates that group 4 is not able to manage the risky situation effectively, due to the lower organizational capability including less experience of international construction and poor ability of resource management. This group also shows less market preference than the other groups. On the other hand, firms in group 3 have more experience as sub-contractor in international construction than group 4. The group 3 shows less fluctuation in profit performance than group 4. These results suggest that experience curve effects (Chang, 1992) exists even for the subcontractors in international construction.
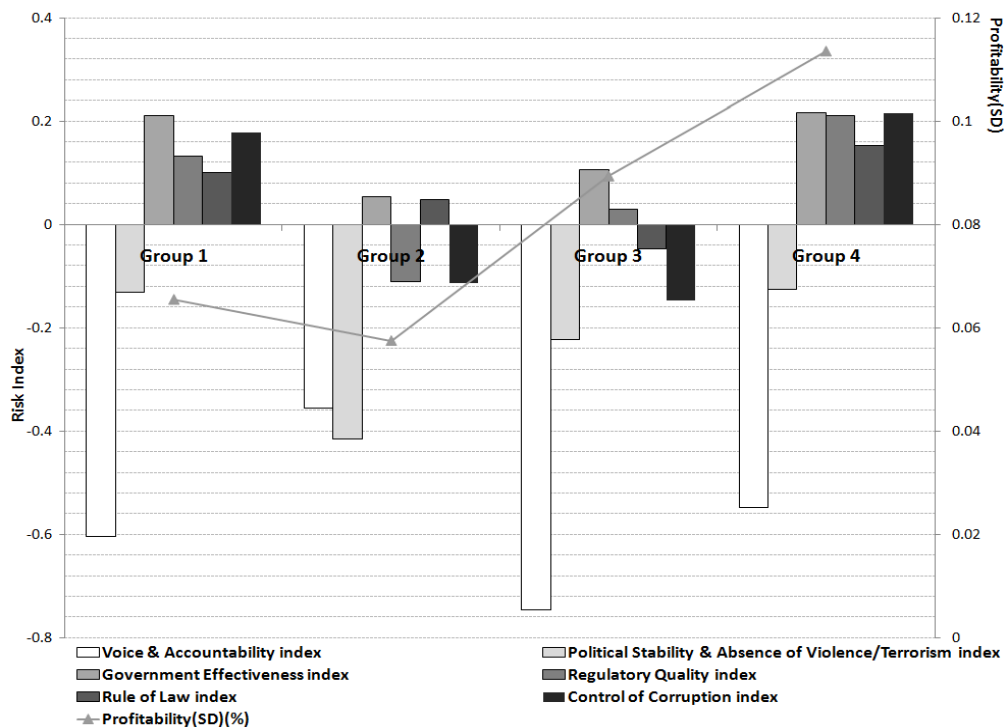

Figure 4: Risk Variables Vs. Strategic Group Profit Performance

In the same manner, another important finding is that group 1 relatively prefers risky market in terms of WGI value compared to the others. In return to the risk-taking attempt, this group gained more stable profitability. Group 2 (the highly internationalized and largest contractor group) also showed more stable profitability even though many of their project took place in highly risky countries. Considering the higher organizational capability of group 1 and group 2, they could manage risks more effectively without suffering from severe losses. Especially, group 2 usually prefer lower risk market than group 1 and focuses on gaining more stable profits. From the these results, the authors captured the fact that international construction strategies should vary accoding to contractor's size and their risk posture. Moreover it is found that there exist clear difference in profit performance between prime contractors and sub-contractors in accordance with their risk posture and organizational capability. All these findings are also well supported by the aforementioned experience curve effects (Chang, 1992) as well as a resource based view (Wernerfelt, 1984)

5. Conclusions

This research principally focuses on the contractors' organizational capability in international construction. The authors explored how the contractors' experience and resources affect their strategy and profitability with a detailed cluster analysis. Through a two-step cluster analysis, four different groups were identified depending on the firms' degree of organizational capability. From the strategic group analysis, it was found that the highly internationalized and large contractors' group is likely to enter the high risk market to gain more sound profitability. On the other hand, the lowly internationalized and small contractors group have a tendency to enter low risk market to yield instead unstable profitability. In detail, the contractors which were categorized into four different groups, showed different profit performance according to their capability as indicated by figure 2. The capability is determined by the contractor's experience, organizational size, and resources. These results are also well supported by managerial theories and past studies. This research, however, has several limitations. Mainly, this research could not fully examine the member of contractors' organizational capability and level of contractors' localization due to limited data about the firms such as the revenue generated from overseas, total employees involved in international business and more detailed information about the contractors' capability. Therefore, future procedural research will be more concentrated on analyzing the classified groups with more valuable project/firm data and specific case studies. Consequently, this research is expected to aid international contractors in developing their internationalization strategy by revealing the basic nature and strategic preference of international contractors according to the level of risk and degree of organzational capability.

6. Acknowledgements

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