INTERNATIONAL MARKET ENTRY DECISIONS: A KNOWLEDGE-BASED APPROACH

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ABSTRACT

As far as the growing potential in the overseas construction markets is concerned, it is becoming more important for the medium to large-size construction companies to take their parts in the global construction market. An international market selection decision may be considered as a highly complex problem since it involves several correlated parameters regarding the project, market, host country and the company in question. Moreover, there is no mathematical formulation that can easily associate all these factors together with the company strategies to give a bidding decision. There are models developed by many researchers on this subject, using different techniques such as cross impact analysis (Han & Diekmann, 2001), Analytic Hierarchy Process (AHP) (Hastak & Shaked, 2000; Gunhan & Arditi, 2005) and neural networks (Dikmen & Birgönül, 2004). Each tool has its own assumptions and shortcomings in terms of selecting input and output criteria, data collection, solution method and user intervention. The major objective of this paper is to introduce a knowledge-based approach, which adopts case-based reasoning (CBR) approach to facilitate international market entry decisions by the exploitation of past experiences that reside in the organizational memory (OM). One of the main aims of this study is to demonstrate how learning from the experiences of competitors can be utilized to assist strategic decision-making. Within the context of this research, a decision support tool namely, CBR-INT, has been constructed by using 215 real international project data and 16 features related with the project, market and the country. CBR-INT is used to predict the potential profitability of the project and the competitiveness level of the company when giving 'bid/no-bid' decisions in international markets. The reliability of the model is proved to be high for both prediction of potential profitability and level of competitiveness.

Keywords: International Construction, Bidding, Case-based Reasoning, Knowledge Management

INTRODUCTION

During recession periods in domestic markets, internationalization of contracting services becomes the major survival strategy for Turkish contractors (Metin, 1998). As far as the increasing construction demand and competition level in overseas markets are concerned, it becomes a critical issue to follow correct strategies when trying to give market entry decisions. At this point, the prior experiences of other companies that have performed international works or their own previous attempts resulting in success or failure may guide construction companies in the way to take a new job abroad. Considering several variables included in an international construction work, it will be quite hard to evaluate the potential profitability of that specific job and the competitiveness level of the related company.

International market selection is a complex decision as numerous factors related with the country, market and project have to be considered and there is no mathematical formulation that can easily associate these factors as well as company specific factors with the attractiveness of a project and probability of getting the job given the competitive conditions. There are models developed by many researchers on this area, which adopt different techniques such as cross impact analysis (Han & Diekmann, 2001), Analytic Hierarchy Process (AHP) (Hastak & Shaked, 2000; Gunhan & Arditi, 2005) and neural networks (Dikmen & Birgönül, 2004).

Case-based reasoning (CBR), which exploits past experiences to bring solutions to new situations, has been identified as a promising tool to solve international market entry problem. Within this research, a CBR-based decision support system (DSS) has been developed, which facilitates learning from experiences of competitors in international markets. By constructing such a knowledge-based tool, experiences of Turkish contractors are used to demonstrate how experiences of competitors may be utilized to facilitate decision-making in a construction company. This model is proposed as a facilitator and an enabler of organization learning (OL) in construction companies, which helps construction of an organizational memory (OM) through the collection of past project data, processing this data to obtain relevant information, interpreting and sharing this information to obtain valuable knowledge that is later utilized in strategic decision-making.

The proposed system is generated under a software package namely, ESTEEM that adopts CBR principles to solve the problems. The model, CBR-INT is developed by using 215 real international project data that contain previous experiences of Turkish contractors; 200 cases are used for training the program and 15 cases are used for testing purposes. As input information, 16 features related with the project, market and the country are identified and by the help of CBR-INT,

the potential profitability of an international project and the level of competitiveness of a company for that project can be predicted.

INTERNATIONAL MARKET ENTRY

Recession periods in domestic markets, spreading risk through diversification into new markets, competitive use of resources and taking advantage of the opportunities offered by the global economy are among the reasons why construction firms expand their business into international markets (Gunhan & Arditi, 2005). As Han et al. (2005) suggest, bid decisions for international projects are difficult due to uncertainties and complexities associated with the international construction domain such as political, economic, cultural, and legal project conditions, which make international construction riskier than domestic construction.

When assessing potential projects, contractors make subjective judgments based on their gut-feelings, experience and guesses (Ahmad, 1990). Dikmen and Birgönül (2004) state that in overseas market entry decisions, a high number of interrelated parameters at the country, market and project levels should be investigated and analyzed together with their compound effects.

Evaluation of a project may be based on financial analysis which includes net present value, internal rate of return, break-even point or cash flow analysis. However, such analysis is not sufficient to address the crucial effects of all risk factors involved in an international project. The complex variables that affect the performance of construction companies in overseas markets need to be considered in this decision. Furthermore, the threats and opportunities associated with target countries should be well understood (Hastak & Shaked, 2000). Various bid/no-bid models have been developed by different researchers to facilitate international market selection, which are discussed in the forthcoming sections.

'Bid/no-bid' models

Bid/no-bid models may be classified according to the factors incorporated in the model or the computing techniques they adopt. When the decision parameters are considered, it is observed that earlier researches have focused on financial measures, whereas recent studies have also assessed the impact of risk factors on potential projects. When the problem solving methods are concerned, multiattribute rating techniques and artificial intelligent (AI) approaches are found to be dominant. In this paper, bidding models are discussed in terms of the quantitative methods that are used either to find the impact of factors on the decision or to compute the final output such as an index. However, these models have some advantages and shortcomings that are mentioned in the next section.

Models using multiattribute decision-making techniques

Among the early studies, Ahmad (1990) proposed an additive multiattribute hierarchy for determining the desirability of a project in which he organized bid/no-bid factors into four main categories namely, job, firm, market, and resources.

A parametric approach to modeling the *bid/no-bid* decision-making process is provided by Wanous et al. (2000) which is based upon perception of the importance of the factors influencing the decision. There are 13 attributes representing the major objectives of a construction firm which are divided into four hierarchical groups related to the job, market, firm and resource specific conditions. The model, which incorporated 162 real bidding situations, proved to be 85% accurate in simulating the actual decisions.

The model developed by Han and Diekmann (2001) applies the cross impact analysis (CIA) method to assess the various uncertainties associated with international construction. The basic cross-impact relationship between two variables describes how the initial probability of a conditional variable will be inhibited or enhanced if a conditioning variable occurs. Bidding decision is based on two outcome criteria from the CIA calculation; namely, project profitability and other project benefits such as gaining future markets, their need for work, developing new relationships, etc. The decision maker can make a bid/no-bid decision by determining the percent of profitability, assigning weight to these multicriteria outcomes and by setting up a firm's minimum acceptable limit to pursue a project to evaluate its overall conditions.

The International Construction Risk Assessment Model (ICRAM-1), developed by Hastak and Shaked (2000) assists the user in evaluating the potential risks involved in expanding operations in an international market by analyzing risks at the macro (country level), market, and project levels. ICRAM-1 uses the AHP technique to analyze the hierarchy of a total of 73 risk indicators at the macro, market, and project levels and to determine the relative importance of the risk indicators in order to aid decision makers at the early stages of project evaluation.

An innovative approach is proposed by Gunhan and Arditi (2005) who have combined AHP and Delphi approach in their research. Data provided by the Delphi study to the AHP process yielded results that are consistent. This research has investigated the factors affecting international construction in terms of threats and opportunities present in the market and the company strengths. Findings of the study indicate that increased long term profitability, the ability to maintain shareholders' returns, and the globalization and openness of the markets are the most important opportunities available in international works; loss of key personnel, shortage of financial resources, inflation and currency fluctuations are the most important threats relative to international markets; and track record, specialist

expertise, project management capability are the most important company strengths.

Lowe and Parvar (2004) have used logistic regression analysis to model 'bid/no-bid' decisions. Logistic regression is a conditional probability approach used to estimate the probability of occurrence of an outcome or choice. In this research, 21 factors obtained from literature were used in the assessment of 115 historical projects by the original decision-makers. The correlation study revealed that strategic competitive advantage, responsiveness to opportunity and project risk were the underlying dimensions which had significant linear relationship with the decision to bid outcome. This model demonstrated a high prediction capability of 94.8%.

Models using Artificial Intelligence (AI)

AbouRizk et al. (1993) proposed an expert system called *BidExpert*. This model was integrated with a database management program, which retrieved historical information from past bids submitted by the company and its competitors. BidExpert processes the outcomes using its knowledge base and provides the user with a *bid/no-bid* recommendation.

Since the 'bid/no-bid' decision-making is an unstructured process (Ahmad, 1990) and it is characterized by several factors the influence of which is difficult to quantify individually and in combination, the solution would be a potential application of the Artificial Neural Network (ANN) technique. Wanous et al. (2003) proposed an ANN model which computes an index called the Neural Bidding Index based on the provided inputs on a scale from 0 to 1. The model recommends whether to bid or not with a certain degree of confidence.

Dikmen and Birgonul (2004) have also developed an ANN model which has learning and generalization capabilities by generating rules rather than relying on predefined rules. Findings of this model demonstrate that availability of funds, market volume, economic prosperity, contract type and country risk rating are the most important factors that influence the attractiveness of an international project. Similarly, competitiveness is mainly influenced by the level of competition, attitude of host government, existence of strict quality requirements, country risk rating, and cultural/religious similarities.

Shortcomings of 'bid/no-bid' models

As Dikmen and Birgönül (2004) argue, multiattribute rating techniques are not sufficient to determine the market attractiveness and company competitiveness, which are based on gut feeling and subjective judgment; moreover these methods ignore the interrelationships between parameters and nonlinearity. These approaches such as Simple Multi-Attribute Rating Technique (SMART) and AHP

cannot fully reflect lessons learned from previous projects and the conceptual model that resides in the heads of experienced decision-makers. Instead of using a multicriteria decision-making tool, a model that captures the relations between the input parameters in project, market and country level and output parameters (potential profitability and level of competitiveness) using the experience gained from previous projects and expert judgment would be appropriate.

CBR uses past experiences rather than relying on rules, so it may be assumed to be a more dynamic approach than rule-based expert systems, which are based on strict if-then rules.

CBR is also more advantageous than the ANN since it eliminates the 'black box computation problem' present in the ANN models. One of the main advantages of this problem solving approach is that the reasoning process can be easily followed and it is strengthened by the human interference at several steps.

When compared with multicriteria decision-making tools, expert systems and ANNs; CBR has considerable advantages for solving construction problems. It benefits from how humans reason and it is based on experience, which should not be necessarily transformed to rules or models; it addresses ill-defined problems by tolerating human interpretation, which provides acceptable explanations on the solutions derived. By utilizing database techniques, CBR is enabled to manage large volumes of information that increases the reliability of the solutions it proposes. Thus, CBR has been selected as the appropriate tool to predict the potential profitability of a project and level of competitiveness of a company.

CBR-INT: A KNOWLEDGE-BASED APPROACH

CBR is defined as "the process of solving new problems by adapting solutions that were used to solve old problems" (Riesbeck & Schank, 1989). The methodology behind CBR lies in the utilization of previously stored knowledge at the time it is needed. This is achieved through a stepwise procedure as retrieval of similar cases, adaptation of the new case to the retrieved ones, incorporation of the adapted case to the case base and reusing it for the next time when a solution is required.

CBR has been recently attracting the interest of researches in the AI domain. Reasoning in CBR is based on experience or remembering. CBR approach focuses on how to exploit human experience, instead of rules, in problem solving and thus improving the performance of DSSs (Chen & Burrell, 2001). CBR does not require an explicit domain model; main task is gathering case histories since CBR systems can learn by acquiring new knowledge. Case-based systems are preferable when the expert knowledge is hard to be modeled and large amounts of cases are available. In this respect, case-based systems that aid problem solving in con-

struction are assumed to be attractive as they provide a model to store previous construction projects and reuse them when similar new problems occur (Li, 1996).

Using CBR as the problem solving approach in a DSS leads to the provision of exploiting the stored past experiences that constitute a component of the OM. With these features, this tool can be regarded as an enhancer of OL in construction companies.

The model, CBR-INT, is generated under a software package namely, ESTEEM that adopts CBR principles to solve the problems. Experiences of Turkish contractors are used to demonstrate how experiences of competitors may be utilized to facilitate decision-making in a construction company. CBR-INT is developed by using 215 real international project data; 200 cases of which are used for training the program and 15 cases are used for testing purposes. As input information, 16 features, which are obtained from Dikmen and Birgönül (2004) related with the project, market and the country, are identified and by the help of CBR-INT, as important indicators, the potential profitability of an international project and the competitiveness level of a company for that project can be predicted (Table 1).

Table 1. Input and output parameters for CBR-INT

INPUTS	Economic prosperity of the host country
	Host country risk (political, legal and financial)
	Cultural religious similarities
	Distance between Turkey and the host country
	Attitude of host government to Turkish contractors
	Construction demand in the host country
	Size of project
	Type of project
	Technical complexity of project
	Type of client
	Availability of funds for project
	Contract type
	Experience of company in similar works
	Existence of strict time limitations
	Existence of strict quality limitations
	Intensity of competition
OUTPUTS	Potential profitability of the project
	Level of competitiveness of the company

The methodology of the model is based on the storage of previous international project information in the case library and the retrieval of most similar cases

when the potential profitability and level of competitiveness of a target case are sought. The system adopts both manual and automatic weight generation methods offered by the program for similarity assessment and it retrieves similar cases in the order of their similarity scores to the target case. Adaptation is carried out with different manual methods that help final prediction. After trying several adaptation models, the best one is selected based on the performance values. The reliability of the best model is found to be around 90%. Table 2 shows the models developed for predicting the outputs and the reliability values corresponding to these five models which are derived from the average values for potential profitability and level of competitiveness.

Table 2. Reliability values of prediction models

Final prediction model	Explanation	Reliability (%)
M1	Best match among the retrieved cases	87
M2	Average of the feature values of all cases in the retrieved cases list	88
M3	Mode of the feature values of all cases in the retrieved cases list	86
M4	Average of the feature values of top ten cases in the retrieved cases list	88
M5	Mode of the feature values of top ten cases in the retrieved cases	89

The system produces different importance weights for potential profitability and level of competitiveness. Availability of funds, construction demand in the host country, contract/payment type and country risk level have been found as the most important determinants of potential profitability, which is an expected result. Also, the level of competitiveness of Turkish contractors in international markets are denoted to be mostly associated with number of bidders entering the bid, experience of the company in similar projects and country/government related factors, such as attitude of the host government towards Turkish contractors and the cultural/religious similarities between the host country and Turkey. Table 3 shows the importance weights of the input parameters on the potential profitability and the level of competitiveness. These findings also support previous work on competitiveness of Turkish contractors in international markets (Öz, 2001; Dikmen & Birgönül, 2004).

Table 3. Importance weights of features

Feature name	Importance weight for potential profitability	Importance weight for level of competitiveness
Economic prosperity of the host country	0.019	0.001
Host country risk (political, legal and financial)	0.069	0.030
Cultural religious similarities	-*	0.150
Distance between Turkey and the host country	-*	0.005
Attitude of host government to Turkish contractors	0.022	0.230
Construction demand in the host country	0.212	0.001
Size of project	0.031	0.035
Type of project	0.024	0.001
Technical complexity of project	0.059	0.001
Type of client	0.019	0.020
Availability of funds for project	0.377	0.050
Contract type	0.103	0.003
Experience of company in similar works	0.009	0.200
Existence of strict time limitations	0.005	0.001
Existence of strict quality limitations	0.025	0.002
Intensity of competition	0.025	0.270

* negligible

Although CBR-INT is not a fully automated system, it guides decision-makers in the international business development stage by helping them prepare market/project priority lists and it may facilitate strategic decision-making while giving bid/no-bid decisions in overseas markets.

CONCLUSION

International market entry decision is a highly complex problem, which consists of several interrelated variables at the project, market, and country level together with the company specific strategies. Although potential projects are evaluated by the contractors based on their intuition, experience and expertise, there are several researches on the development of models to serve companies in international market selection. In developing such systems, besides financial indicators, corresponding risk factors should also be considered. All influencing parameters

should be identified and their impacts on the bidding decision should be computed by appropriate techniques. So far, *bid/no-bid* decisions have been modeled by using both multiattribute rating techniques such as AHP and CIA and by AI approaches such as expert systems and ANN.

In order to recover the drawbacks of multiattribute techniques which are insufficient to incorporate subjective judgments of the experts, a knowledge-based system is proposed as an aid for contractors in international market selection. This DSS requires the utilization of OM that is constructed through the deposition of both project and company information resulting from past experiences.

As CBR is an analogical learning technique, it seems to be a suitable approach for strategic problems, which are generally solved through past experience and knowledge of experts. CBR applies human reasoning when examining cases and uses past experiences to give decisions about future events rather than relying solely on strict rules, so it appears to be an effective solution method for international market selection.

Within the context of this research, a CBR-based tool is developed to demonstrate how experiences of competitors in international markets may be used to support international market entry decisions of contractors. 215 cases from the Turkish construction industry have been used to build the model, namely CBR-INT. The reliability of CBR-INT in predicting attractiveness of international projects and competitiveness of Turkish contractors is around 90%. Moreover, CBR-INT has proven to be an effective tool for decision makers due to its high explanation capability and easy to use features.

As CBR-INT necessitates the storage, interpretation and utilization of past experiences in the strategic decision-making process, it is a knowledge-based model so, its potential as an enhancer of OL in construction companies is emphasized in addition to its use as an aid for international market entry problems.

CBR-INT is not a generic tool applicable to all company, market and country conditions; it reflects the experiences of Turkish contractors. However, using the proposed architecture of CBR-INT, similar models may be built by creating similar case libraries that comprise of experiences of contractors from other countries in international markets. Also, the proposed model provides an adequate ground for development of further company-specific models that can take individual firm objectives, strategies, and capabilities into account.

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