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Country Selection Model for Sustainable Construction Businesses Using Hybrid of Objective and Subjective Information

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Abstract: An important issue for international businesses and academia is selecting countries in which to expand in order to achieve entrepreneurial sustainability. This study develops a country selection model for sustainable construction businesses using both objective and subjective information. The objective information consists of 14 variables related to country risk and project performance in 32 countries over 25 years. This hybrid model applies subjective weighting from industrial experts to objective information using a fuzzy LinPreRa-based Analytic Hierarchy Process. The hybrid model yields a more accurate country selection compared to a purely objective information-based model in experienced countries. Interestingly, the hybrid model provides some different predictions with only subjective opinions in unexperienced countries, which implies that expert opinion is not always reliable. In addition, feedback from five experts in top international companies is used to validate the model's completeness, effectiveness, generality, and applicability. The model is expected to aid decision makers in selecting better candidate countries that lead to sustainable business success.

Keywords: sustainable construction business; country selection; decision support model; fuzzy approach; hybrid model

1. Introduction

Traditionally, construction businesses have focused on the domestic market because it is less risky and more familiar than the international market [1]. Due to a limited or fluctuating domestic market size, however, many construction companies enter new countries to achieve sustainable revenue and profit [2]. For example, over the past three decades, Korean contractors have increasingly entered new countries, as shown in Figure 1. These companies rank among the top 100 international contractors, and continuously pursue sustainable businesses' portfolios. Nevertheless, these companies have yet to achieve sustainable performance in many countries. Figure 2 shows the number of countries in which Korean contractors won awards for more than one project over each five-year period. This study assumes this number as the number of sustainable construction business countries, which has not exceeded 40% of total entered countries for a long time. This indicates that Korean contractors fail to win a following award within five years in 60% of total entered countries. Thus, how companies select a country to enter is crucial for achieving long-term business success [3,4].

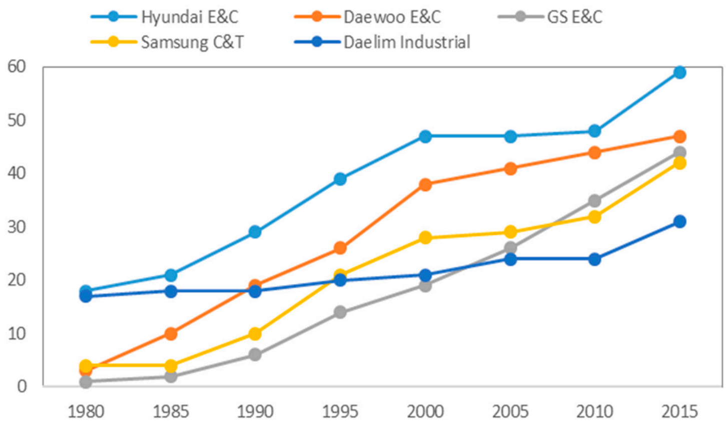

Figure 1. Total country entry of top five Korean international contractors.

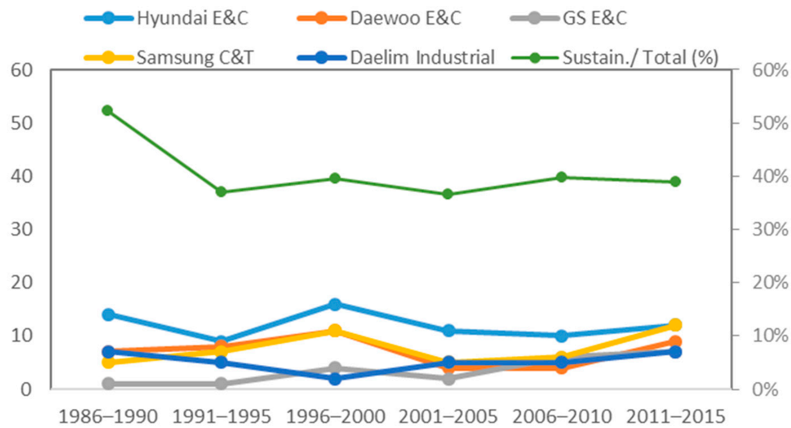

Figure 2. Sustainable country entry of top five Korean international contractors.

Researchers have developed several country selection solutions for international construction businesses. Their solutions can be broadly divided into two different approaches. The first is based on objective information using secondary data, such as indices from global institutions or a company's financial performance data [4–6]. These solutions appear reliable, but do not usually reflect an individual company's specific strategy or the given country's emergent issues, and are problematic when country-level data is lacking. The second solution is modeled using subjective judgement information transformed and developed from various data analysis tools, such as AHP (Analytic Hierarchy Process), SMART (Simple Multi-Attribute Rating Techniques), and the so-called fuzzy approach [7–9]. These approaches have been typically used towards compensating for the first solution's shortcomings, but an expert's wrong opinion and personal biases can influence the results. Therefore, a balanced decision support model requires an appropriate mixture between objective information and subjective opinion.

The purpose of this study is to develop a country selection model that incorporates both objective information and the subjective opinion of decision makers. To achieve this end, the current study takes six steps, as shown in Figure 3. First, this study reviews previous research on country selection for sustainable construction businesses and information-gathering approaches. Second, this study introduces an objective information-based model (OIM) from our earlier study, which uses various objective information related to country risk and project reward [6]. Third, this study applies a fuzzy preference relations-based analytic hierarchy process (Fuzzy LinPreRa-based AHP) to OIM for integrating objective information with subjective opinion. Fuzzy LinPreRa-based AHP is simpler and more intuitive than general fuzzy AHP because the former needs less comparison investigation than the latter. Fourth, an example illustrates how the proposed model combines objective information with experts' subjective opinions, resulting in each candidate country being categorized into one of four types: (1) high-risk, low-reward; (2) high-risk, high-reward; (3) low-risk, low-reward; and (4) low-risk, high-reward. Fifth, this study attempts to validate the model's accuracy by comparing actual performance with the results of OIM and objective and subjective information-based model (OSIM) in countries entered by a company. Further, this study compares predicted performance with the results of OIM and OSIM in countries not yet entered, in order to validate the model's practical applicability. Lastly, this study conducts in-depth-interviews with five industry experts from top Korean contractors to evaluate whether the proposed model is valid for selecting sustainable country entry.

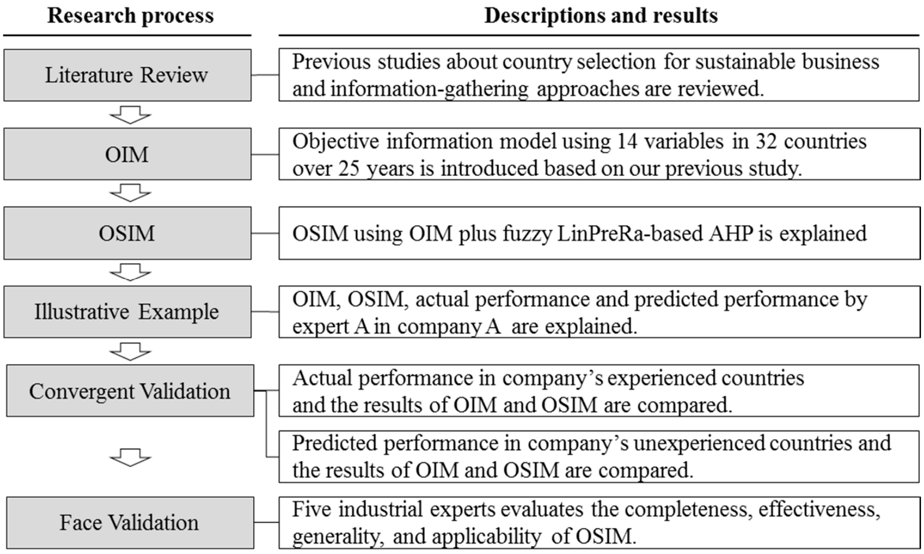

Figure 3. Research process and descriptions.

2. Literature Review

2.1. Country Selection for Sustainable Construction Business

Researchers have examined why country selection fundamentally matters to international businesses [10–12]. Company performance and competitiveness are typically studied according to theoretical frameworks including the industrial organization view, resource-based view, and institutional theory. In the institution-based view, economic, political, and social environments are important to sustain a competitive advantage when entering a new country [13–15]. In addition, many studies have described the relationship between location and enterprise performance, especially which business conditions affect location decisions [16–20].

Previous studies of international construction businesses, however, have yet to deal with the specific issue of selecting country or location; they are close to general international business studies. These studies can be divided into two main groups: one examining global construction business strategies towards countries overall, and the other examining construction market analysis of a specific country. Global business strategies in the construction industry have been studied in terms of internationalization [21,22], country diversification [1,5,23], and entry mode decisions [3,24,25]. These studies investigated business decision factors like countries' market size, growth rate, stability, and competition intensity, and suggested global business strategies to stabilize or expand global market share to achieve sustainable success. Meanwhile, market analyses for specific countries have included the countries of China [26,27], India [28], Mexico [29], Russia [30], and the United Arab Emirates [31,32]. These studies scrutinized project environment and characteristics of the country's construction business. This research highlighted successful factors or risk factors for profitable project performance, which are also helpful for attaining a sustainable construction business in a specific country.

More recently, the studies of country selection models have suggested several important factors for international construction business [4,6]. They found that large market potential, small cultural distance, high country risk, and high competitive intensity are significant for Chinese contractors to select new entry country [4]. Another study extracted four group factors important for country classification, namely business environment, market opportunity, possibility of project success, and market experience, when Korean contractors engage in international construction [6]. These studies consider long-term factors and short-term variables for country selections. As such, this study attempts to analyze and develop variables for a country selection model for sustainable construction business.

2.2. Information-Gathering Approaches for Decision Support Models

Country selection models in construction businesses have been developed using two different approaches: the subjective opinion-based approach and objective information-based approach. As stated earlier, most studies adopt a subjective opinion-based approach due to the lack of objective and quantitative data at the country level. Using questionnaire survey data, construction researchers have applied diverse research techniques, like analytic hierarchy process (AHP) [7,8], case-based reasoning (CBR) [33], cross-impact analysis [34], fuzzy inference [9,35], and artificial neural network (ANN) [36]. Using a typical AHP method, Hastak and Shaked [8] proposed an international construction risk assessment model (ICRAM-1) for evaluating potential risk using various risk factors for country, market, and project levels. Dikmen et al. [35] developed a neuronet model as a decision support tool that classifies international projects for attractiveness and competitiveness based on Turkish contractors' experiences. Cheng et al. [9] suggested a three-phased analysis process for employing international market-entry decisions in fuzzy preference relation (FPR) and cumulative prospect theory (CPT). These studies considered the country as one of many factors for business strategies and decision-making, which include risk assessment, bid decision, and market-entry decision.

The objective information-based approach was proposed after country-level construction data became more available starting several years ago [4–6]. Taking advantage of the usefulness and effectiveness of construction industry-specific data, Chen et al. [4] developed an international market selection model based on data from 39 Chinese contractors' performance in 87 countries in 3393 cases. Using multi-objective genetic algorithm (MOGA), Jung et al. [5] proposed a country portfolio optimization model to maximize the expected market growth and market profitability of each company's portfolio. Lee and Han [6] suggested a quantitative approach for analyzing country-specific attributes like country attractiveness and past project performance. To date, these studies have enhanced understanding of country evaluation and selection using objective information.

These two approaches, however, have several weaknesses. Even though the subjective opinion-based approach reflects each company's own strategy and dynamic decision making, this approach sometimes results in wrong decisions due to experts' preconceptions or faulty subjective opinion. On the other hand, while the objective-based approach provides more balanced, unbiased evaluations, it is difficult for these models to account for each company's individual strategic value and market position. For these reasons, a hybrid model, which incorporates both objective information and subjective opinion, can provide support that is both strategic and reliable for the decision maker. While, this kind of hybrid model has not been suggested in the construction business sector, several hybrid models have been introduced in other entrepreneurial sectors such as environment, hazard, and supply chain [37–40]. Thus, this study develops a hybrid model for country selection considering another benchmark model of sectors.

3. Methodology

3.1. Objective Information-Based Model (OIM)

Our previous study [6] introduced a quantitative approach for diagnosing the multi-dimensional aspects of 32 countries using both country- and project-level variables. Because the concept of country risk is comprehensive, as it encompasses a country's political, legal, economic, and sociocultural dimensions, Lee and Han [6] considered both the negative effects and the positive opportunities of eight country-level variables: construction market size (V_1^C), construction market growth (V_2^C), construction market stability (V_3^C), construction market competition (V_4^C), and the quality of the institutional system ($V_5^C \sim V_8^C$). Additionally, six project-level variables were used for the concept of project reward: international contract performance (V_1^P, V_2^P), the bid-hit ratio (V_3^P), and construction market profitability (V_4^P~V_6^P). For the sustainable construction business (e.g., market positioning and diversification), companies must capture construction market-specific risks and project rewards in both the long and short term. The eight country-level variables can explain construction market dynamics throughout each country's past (V_3^C, V_4^C, V_8^C), present (V_1^C, $V_5^C \sim V_7^C$), and future (V_2^C). The six project-level variables not only explain the current level of contract performance (V_1^P, V_2^P), but also presume the future expected project performance ($V_3^P \sim V_6^P$). Among the 14 variables, representative variables towards the long-term sustainable construction businesses are as follows: construction market growth rate (V_2^C), construction market stability (V_3^C), and stability of profit performance (V_5^P).

The authors used construction market- and country-specific data collected from worldwide reputable institutions, such as IHS Global Insight [41], Engineering News Records [42–51], and the World Bank [52,53], to provide quantitative country-tailored information. Furthermore, project-level data from 1990 to 2014 were obtained with the assistance of the International Contractors Association of Korea (ICAK) [54]. Using an exploratory factor analysis, our previous study [6] extracted four group factors (F1: business environment, F2: market opportunity, F3: the possibility of project success, and F4: market experience) to explain each country's strategic position. Table 1 presents detailed results of the factor analysis for country risk and project reward. The authors considered our prior results as inputs for the objective information-based model (OIM). Specifically, using the group factors' factor scores, the level of country risk is measured as a composite average of two country-level factors (i.e., business environment and market opportunity). Similarly, the level of project reward is measured using two project-level factors (i.e., the possibility of project success and market experience).

Table 1. Country selection variables and their factor loadings [6].

(A) Rotated Component Matrix of Country Risk Factors			
Category	**Variable [Sources]**	**Group Factor**	
		(F1)	**(F2)**
Country risk	(V_1^C) Construction market size [29]	0.136	**0.677**
	(V_2^C) Construction market growth rate [29]	**−0.551**	0.376
	(V_3^C) Construction market stability [29]	−0.010	**0.690**
	(V_4^C) Construction market competition [30–39]	−0.198	**0.774**
	(V_5^C) Quality of national governance [40]	**0.951**	0.028
	(V_6^C) Ease of doing business [41]	**0.882**	0.088
	(V_7^C) Degree of market openness [42]	**0.796**	−0.260
	(V_8^C) Construction market reward [29]	**0.890**	0.140
	Variance explained (%)	43.375	22.136
(B) Rotated Component Matrix of Project Reward Factors			
Category	**Variable [Sources]**	**Group Factor**	
		(F3)	**(F4)**
Project reward	(V_1^P) Cumulative number of contracts [43]	0.162	**0.885**
	(V_2^P) Cumulative contract amount [43]	−0.520	**0.748**
	(V_3^P) Bid-hit ratio [43]	**0.736**	−0.179
	(V_4^P) Average profit rate [43]	**0.817**	−0.129
	(V_5^P) Stability of profit performance [43]	0.389	**−0.682**
	(V_6^P) Surplus ratio of projects completed [43]	**0.859**	−0.061
	Variance explained (%)	39.912	30.985

3.2. Objective and Subjective Information-Based Model (OSIM)

In modifying Rezaei and Ortt's approach [55], this study adopts a five-step approach for country selection as follows:

1. Select the variables of country risk (V_1^C, V_2^C, ..., V_M^C) and project performance (V_1^P, V_2^P, ..., V_N^P) by decision maker. The newly suggested model also uses a total of eight country risk variables and six project performance variables to evaluate 32 candidate countries.
2. Determine the weights of the selected country risk variables (w_1^C, w_2^C, ..., w_M^C) and project performance variables (w_1^P, w_2^P, ..., w_N^P) using a Fuzzy LinPreRa-based AHP, according to the following procedures:

   (1) *Establish the hierarchical structure*

   Define a hierarchical structure that includes the goal and decision variables.

   (2) *Determine the fuzzy judgment matrices*

   Construct the fuzzy judgment matrix $\widetilde{P} = (\widetilde{p_{ij}}) = \left(p_{ij}^L, p_{ij}^M, p_{ij}^R\right)$, which is a pairwise comparison matrix for the variables.

$$\widetilde{P} = \begin{bmatrix} \widetilde{p_{11}} & \widetilde{p_{12}} & \cdots & \widetilde{p_{1n}} \\ \widetilde{p_{21}} & \widetilde{p_{22}} & \cdots & \widetilde{p_{2n}} \\ \vdots & \vdots & \ddots & \vdots \\ \widetilde{p_{n1}} & \widetilde{p_{n2}} & \cdots & \widetilde{p_{nn}} \end{bmatrix} \quad (1)$$

   where $\widetilde{p_{ij}}$ is a fuzzy linguistic assessment variable or its equivalent triangle fuzzy number [56,57] that explains the decision maker's preference for i over j, as shown in Table 2. As Rezaei and Ortt [55] and Wang and Chen [58] indicated, it is necessary to only fill in $n-1$ (n: the number of variables) cells in the pairwise comparison matrix. The remaining cells are calculated based on the equations with respect to the reciprocity and the consistency of a positive additive matrix [55,58].

   (3) *Transform the obtained matrices for the variables*

   If the value of some matrix elements is not between zero and one ($\widetilde{p_{ij}} \notin [0, 1]$), the fuzzy numbers must be adjusted through transformation functions to preserve reciprocity and consistency (i.e., $f : [-c, 1+c] \rightarrow [0, 1]$), where c is the maximum amount of violation from interval $[0, 1]$ among elements of $\widetilde{P}$. The transformation functions ($f(\widetilde{P})$) are as follows:

$$f\left(x^L\right) = \frac{x^L + c}{1 + 2c} \quad (2)$$

$$f\left(x^M\right) = \frac{x^M + c}{1 + 2c} \quad (3)$$

$$f\left(x^R\right) = \frac{x^R + c}{1 + 2c} \quad (4)$$

   where x^L and x^R are the lower and upper bounds of the triangular fuzzy number $\widetilde{P} = \left(x^L, x^M, x^R\right)$, respectively, and x^M is the medium value.

   (4) *Calculate the weights of the variables*

   The fuzzy weight of each variable ($\widetilde{w}_i$) is calculated by using fuzzy number addition ($\oplus$):

$$\widetilde{w}_i = \frac{\widetilde{m_i}}{\widetilde{m_1} \oplus \ldots \oplus \widetilde{m_n}} \quad (5)$$

where $\widetilde{m_i}$ is the mean of the fuzzy comparison value of variable i to each variable and is calculated as follows:

$$\widetilde{m_i} = \frac{1}{n}[\widetilde{p_{i1}} \oplus \widetilde{p_{i2}} \oplus \ldots \oplus \widetilde{p_{in}}],\ i = 1,\ \ldots,\ n. \tag{6}$$

The fuzzy mean [59] is used to defuzzify and rank the fuzzy numbers. Consequently, the final defuzzified weights are calculated as follows:

$$w_i = \frac{w_i^L + w_i^M + w_i^R}{3} \tag{7}$$

3. Assign a standardized score to each country based on the selected country risk variables (z_{i1}^C, z_{i2}^C, ... , z_{im}^C, ... , z_{iM}^C), and project performance variables (z_{i1}^P, z_{i2}^P, ... , z_{in}^P, ... , z_{iN}^P) based on objective, evidence-based data sets. z_{im}^C represents the score of country i with respect to the mth country risk variable, z_{in}^P represents the score of country i with respect to the nth project performance variable, and M and N are the number of country risk variables and the number of project performance variables, respectively. Notably, because most variables are scaled differently, a comparable standard scale is required to compute the aggregated scores. This study uses the standard deviation method to measure the relative difference among candidate countries (standardized score); thus, each country's relative position in the final aggregated score is more accurately assessed [60]. The standardized score for variable j of country i (z_{ij}) is calculated as follows:

$$z_{ij} = \frac{x_{ij} - \mu_j}{\sigma_j} \tag{8}$$

where

x_{ij} = the original score for variable j of country i,
μ_j = the average score for variable j of the candidate countries, and
σ_j = the standard deviation for variable j of the candidate countries.

4. Calculate the final aggregated scores for each country for country risk (S_i^C) and project performance (S_i^P) as follows:

$$S_i^C = \sum\nolimits_{m=1}^{M} w_m^C z_{im}^C,\ \forall i \tag{9}$$

$$S_i^P = \sum\nolimits_{m=1}^{N} w_n^P z_{in}^P,\ \forall i \tag{10}$$

5. Classify the countries based on their final aggregated scores for the X and Y axes, representing the level of country risk and project performance, respectively. In the case of 2 × 2 classification, there are four country types:

Type 1: all countries with $S_i^C < \alpha$ and $S_i^P < \beta$
Type 2: all countries with $S_i^C < \alpha$ and $S_i^P \geq \beta$
Type 3: all countries with $S_i^C \geq \alpha$ and $S_i^P < \beta$
Type 4: all countries with $S_i^C \geq \alpha$ and $S_i^P \geq \beta$

where α and β are cut-off points for the dimensions of country risk and project performance, respectively, and for the case of 2 × 2 classification (i.e., each dimension is divided into two parts: high and low). Note that this study uses a standardized score to evaluate each country's relative position in the final aggregated scores; therefore, a score of zero indicates the average level of candidate countries in the analysis domain (32 countries in this study). Additionally, depending on the decision maker's preference, it is possible not only to adjust the cut-off points (α and β), but also to subdivide the countries into more than four parts (e.g., 3 × 2 and 3 × 3 classifications).

Table 2. Fuzzy linguistic assessment variables.

Linguistic Variable	Triangular Fuzzy Number
Very low (VL)	(0.0, 0.0, 0.1)
Low (L)	(0.0, 0.1, 0.3)
Medium low (ML)	(0.1, 0.3, 0.5)
Medium (M)	(0.3, 0.5, 0.7)
Medium high (MH)	(0.5, 0.7, 0.9)
High (H)	(0.7, 0.9, 1.0)
Very high (VH)	(0.9, 1.0, 1.0)

4. Illustrative Example

The OSIM model was applied to a large construction company in South Korea. Based on the five-step approach, the authors interviewed the company's responsible director (hereafter expert A) to collect the specific information for the model inputs (i.e., variable selection and pairwise comparison among selected variables). To evaluate the 32 candidate countries, the authors first requested that expert A select the variables of country risk and project performance shown in Table 1. Expert A selected three variables for country risk (V_4^C, V_5^C, V_6^C) and three variables for project performance (V_3^P, V_4^P, V_5^P). To obtain the selected variables' weights, the authors then asked expert A to conduct pairwise comparisons among the variables using linguistic variables. Table 3 shows that linguistic variables were quantified based on triangle fuzzy number. It was necessary to only fill in $n-1$ cells in the pairwise comparison matrix (Section (A) in Tables 3 and 4). The remaining cells were calculated based on reciprocity and consistency (Section (B) in Tables 3 and 4). After the transformation (Section (C) in Tables 3 and 4) and defuzzification processes, the weights of the variables were determined (Section (D) in Tables 3 and 4). The aggregated (weighted) scores for each country were estimated for the two dimensions (level of country risk and project performance).

Table 3. Results of the fuzzy LinPreRa-based AHP (country risk variables).

(A) Pairwise Comparison of Country Risk Variables			
	V_4^C	V_5^C	V_6^C
V_4^C	-	H	-
V_5^C	L	-	M
V_6^C	-	M	-
(B) Fuzzy Judgment Matrix of Country Risk Variables			
	V_4^C	V_5^C	V_6^C
V_4^C	(0.5, 0.5, 0.5)	(0.7, 0.9, 1.0)	(0.5, 0.9, 1.2)
V_5^C	(0.0, 0.1, 0.3)	(0.5, 0.5, 0.5)	(0.3, 0.5, 0.7)
V_6^C	(−0.2, 0.1, 0.5)	(0.3, 0.5, 0.7)	(0.5, 0.5, 0.5)
(C) Transformed Results of the Matrix from (B)			
	V_4^C	V_5^C	V_6^C
V_4^C	(0.50, 0.50, 0.50)	(0.64, 0.79, 0.86)	(0.50, 0.79, 1.00)
V_5^C	(0.14, 0.21, 0.36)	(0.50, 0.50, 0.50)	(0.36, 0.50, 0.64)
V_6^C	(0.00, 0.21, 0.50)	(0.36, 0.50, 0.64)	(0.50, 0.50, 0.50)
(D) Defuzzified Weights of Country Risk Variables			
	V_4^C	V_5^C	V_6^C
Fuzzy weight	(0.299, 0.460, 0.673)	(0.182, 0.270, 0.429)	(0.156, 0.270, 0.469)
Defuzzification	0.447	0.274	0.279

Table 4. Results of the fuzzy LinPreRa-based AHP (project reward variables).

(A) Pairwise Comparison of Project Reward Variables			
	V_3^P	V_4^P	V_5^P
V_3^P	-	L	-
V_4^P	H	-	M
V_5^P	-	M	-
(B) Fuzzy Judgment Matrix of Project Reward Variables			
	V_3^P	V_4^P	V_5^P
V_3^P	(0.5, 0.5, 0.5)	(0.0, 0.1, 0.3)	(−0.2, 0.1, 0.5)
V_4^P	(0.7, 0.9, 1.0)	(0.5, 0.5, 0.5)	(0.3, 0.5, 0.7)
V_5^P	(0.5, 0.9, 1.2)	(0.3, 0.5, 0.7)	(0.5, 0.5, 0.5)
(C) Transformed Results of the Matrix from (B)			
	V_3^P	V_4^P	V_5^P
V_3^P	(0.50, 0.50, 0.50)	(0.14, 0.21, 0.36)	(0.00, 0.21, 0.50)
V_4^P	(0.64, 0.79, 0.86)	(0.50, 0.50, 0.50)	(0.36, 0.50, 0.64)
V_5^P	(0.50, 0.79, 1.00)	(0.36, 0.50, 0.64)	(0.50, 0.50, 0.50)
(D) Defuzzified Weights of Project Reward Variables			
	V_3^P	V_4^P	V_5^P
Fuzzy weight	(0.117, 0.206, 0.388)	(0.273, 0.397, 0.571)	(0.247, 0.397, 0.612)
Defuzzification	0.222	0.387	0.391

After reviewing each country's relative position, expert A set the cut-off points to classify 32 countries into four types using a 2 × 2 matrix ($\alpha = 0.20$, $\beta = 0.60$). As shown in Table 5, eight countries were assigned to Type 1 (high-risk, low-reward), two countries were assigned to Type 2 (high-risk, high-reward), 17 countries were assigned to Type 3 (low-risk, low-reward), and five countries were assigned to Type 4 (low-risk, high-reward). Hence, five countries constitute the most promising group (Type 4) according to the firm's business objective. The remaining 27 countries lacked level of project reward (Type 3), acceptance of country risk (Type 2) or both (Type 1). Based on the country types and aggregated scores, decision makers can prioritize countries, and diagnose the status of their country portfolio based on their own business objectives.

Additionally, to check model accuracy, this study compares the outcomes of the experts' opinions, OIM, and OSIM for country risk and project reward (see Tables 6 and 7). Considering the company's market-specific experience, 32 countries were classified into 18 experienced countries and 14 unexperienced countries. This study presumes that the expert opinion of an experienced country is its actual performance (AP); whereas, opinion of an unexperienced country is predicted performance (PP). Regarding the experienced countries, the rate of coincidence between the experts' opinions and our model's (OSIM) selection was 83.3% for country risk (15 of 18 countries) and 77.8% for project reward (14 of 18 countries), which were much higher than those of the OIM (66.7% for country risk and 55.6% for project reward). For the unexperienced countries, the rate of coincidence between the experts' opinions and the OSIM's selection was 50.0% for country risk (seven of 14 countries) and 64.3% for project reward (nine of 14 countries), which were relatively lower than those of the experienced countries. This is inferred from the low accuracy of PP, which is discussed in more detail in Section 5.2, "Convergent Validation".

Table 5. Types and aggregated scores of 32 countries.

Type	Country	Country Risk	Project Reward
Type 1 (high-risk, low-reward)	Bahrain	0.42	−0.11
	Bangladesh	1.38	−0.53
	Brazil	0.35	−0.05
	Egypt, Arab Rep.	0.80	−0.48
	Hungary	0.43	0.57
	Iran. Islamic Rep.	1.38	−0.37
	Jordan	0.62	0.40
	Pakistan	0.99	−0.17
Type 2 (high-risk, high-reward)	Romania	0.30	1.18
	Slovakia	0.36	1.73
Type 3 (low-risk, low-reward)	China	−0.14	0.55
	Germany	−0.61	0.57
	India	0.19	−0.40
	Indonesia	0.15	−0.49
	Japan	−0.25	0.19
	Kuwait	0.18	−1.29
	Malaysia	−0.41	−0.63
	Oman	0.06	−0.67
	Philippines	0.10	−0.15
	Qatar	−0.73	−0.50
	Russian Federation	0.19	−0.17
	Saudi Arabia	−0.99	−1.32
	Singapore	−0.91	−0.75
	Taiwan, China	−0.10	−0.71
	Thailand	−0.01	−0.28
	United Arab Emirates	−1.43	−0.45
	Vietnam	−0.57	−0.47
Type 4 (low-risk, high-reward)	Hong Kong SAR, China	−0.47	0.81
	Mexico	0.12	1.00
	Poland	−0.12	1.51
	United Kingdom	−0.67	0.85
	United States	−0.61	0.64

Table 6. Model accuracy of experienced countries (Expert A, 18 countries).

Experienced Country	Country Risk			Project Reward		
	AP	OIM	OSIM	AP	OIM	OSIM
Brazil	L	H	H	L	H	L
China	H	L	L	L	H	L
Egypt, Arab Rep.	H	H	H	L	L	L
India	L	L	L	L	L	L
Indonesia	L	L	L	L	H	L
Kuwait	L	H	L	H	L	L
Malaysia	L	L	L	L	L	L
Mexico	L	L	L	H	H	H
Oman	L	H	L	L	L	L
Philippines	L	H	L	L	H	L
Qatar	L	L	L	L	L	L
Romania	L	H	H	L	L	H
Saudi Arabia	L	L	L	L	H	L
Singapore	L	L	L	L	L	L
Thailand	L	L	L	L	L	L
United Arab Emirates	L	L	L	L	H	L
United States	L	L	L	L	H	H
Vietnam	L	L	L	H	H	L
Model accuracy	–	66.7%	83.3%	–	55.6%	77.8%

Table 7. Model accuracy of unexperienced countries (Expert A, 14 countries).

Unexperienced Country	Country Risk			Project Reward		
	PP	OIM	OSIM	PP	OIM	OSIM
Bahrain	L	H	H	L	L	L
Bangladesh	H	H	H	H	L	L
Germany	H	L	L	L	H	L
Hong Kong SAR, China	H	L	L	H	H	H
Hungary	H	H	H	L	L	L
Iran, Islamic Rep.	H	H	H	H	L	L
Japan	L	L	L	L	H	L
Jordan	H	H	H	L	H	L
Pakistan	H	H	H	L	L	L
Poland	H	L	L	L	H	H
Russian Federation	H	H	L	L	H	L
Slovakia	H	H	H	L	H	H
Taiwan, China	H	L	L	L	L	L
United Kingdom	H	L	L	L	H	H
Selection coincidence	–	57.1%	50.0%	–	35.7%	64.3%

5. Model Validation

Validating the methodology is an essential part of the research process. Since construction is essentially a social process (i.e., people play significant roles in construction businesses), social science research methods are required for research into the construction business [61]. In social science, when compared to single methods for research design and data collection, alternative mixed-method approaches offer numerous ways to understand reality, which increases the validity of research outcomes [62,63]. Such mixed-method approaches counterbalance the limitations of each method and triangulate multiple methods to obtain realistic results [61]. Further, considering the interdisciplinary nature of construction engineering and management research, Lucko and Rojas [64] emphasize face validation for enhancing research outcomes.

Based on these concepts, this study used two steps for model validation. First, the model's effectiveness was validated. This study adopted a convergent validation method to measure the coincidence rate between AP and OSIM. Then, based on expert feedback, the overall adequacy of the model was reviewed for completeness, effectiveness, generality, and applicability.

5.1. Interviews with Industry Experts

To confirm the model's validity, interviews were conducted with five industry experts from five different firms. As shown in Table 8, each of the experts had more than 15 years of experience in the construction industry. On average, the five experts had 20.0 years of experience, including 10.4 years of international experience. Additionally, the experts were primarily involved in various corporate strategy-related tasks (e.g., diversification planning, portfolio management, and country/project evaluation and selection); thus, this study selected an appropriate group of experts given its research purposes (i.e., country evaluation and selection).

Table 8. Background of industry experts.

Expert	Experience (Years)		Major Tasks Involved
	Total	Int'l	
A	15	3	Corporate strategy
B	21	4	Corporate strategy
C	24	18	Corporate strategy, Bid preparation, Risk evaluation, Project management, International marketing
D	20	20	Corporate strategy, Bid preparation, Risk evaluation, Project management, Project management consulting
E	20	7	Corporate strategy, Bid preparation, Risk evaluation, Project management, Regional director

In-depth interviews and surveys consisted of the following distinct sections:

1. To check the model's effectiveness, the experts were asked to use their knowledge, experience, and intuition to classify 32 countries. First, they answered whether their company experienced each country. Second, for country risk and project performance, the experts were asked to categorize the 32 countries into four types (high-risk, low-reward; high-risk, high-reward; low-risk, low-reward; and low-risk, high-reward). Subsequently, each expert was asked to provide subjective information, such as variable selection and pairwise comparison among selected variables like those shown in Table 3(A). This section was intended to test the model's convergent validity through case applications.
2. The experts were requested to explain their practices and major concerns related to country evaluation and selection. Subsequently, they were asked to assess whether the model's country selection variables in Table 1 appropriately reflected their concerns and sustainable strategy. One week later, the experts received the results of the model application corresponding to their own answers. They were then asked to evaluate the qualitative aspects of the model for completeness, effectiveness, generality, and applicability. Next, the experts were asked to give their final opinions on the model's potential and limitations. This was intended to confirm the model's face validity through expert feedback.

5.2. Convergent Validation

As explained in the illustrative example section, each expert selected different variables and evaluated their relative importance for their company's strategic purpose as shown in Table 9. Contractor B put more weight on construction market competition (V_4^C), and average profit rate (V_4^p), in line with the fact that this expert's company shows the largest revenue and highest profit among Korean international contractors. Contractor C highly weights the construction market size (V_1^C) and bid-hit ratio (V_3^P) in line with the fact that this contractor has achieved the highest revenue growth among Korean international contractors over the past several years but yields low profit, reflecting a short-term strategy for which they are often criticized. Expert D put more weight on construction market growth (V_2^C) and stability of profit performance (V_5^P), reflecting their aim towards sustainable internationalization and zero-risk profit, as shown by this contractor's record of keeping the lowest debt-ratio and highest current ratio for a long time. These examples demonstrate that each company's decision weights may vary according to their short- and long-term strategies, and this hybrid model reflects their flexible needs.

Table 9. Variable weights of five experts.

(A) Defuzzified Weights of Country Risk Variables					
Defuzzification	**Expert**				
	A	**B**	**C**	**D**	**E**
V_1^C	–	–	0.262	0.145	0.274
V_2^C	–	0.296	0.232	0.155	0.200
V_3^C	–	–	0.166	0.142	–
V_4^C	0.447	0.408	0.195	0.130	0.200
V_5^C	0.274	–	–	0.108	0.327
V_6^C	0.279	–	0.145	0.120	–
V_7^C	–	0.296	–	0.099	–
V_8^C	–	–	–	0.101	–
(B) Defuzzified Weights of Project Reward Variables					
Defuzzification	**Expert**				
	A	**B**	**C**	**D**	**E**
V_1^P	–	–	0.323	0.172	0.152
V_2^P	–	0.213	0.187	0.168	–
V_3^P	0.222	0.332	0.490	0.137	0.238
V_4^P	0.387	0.455	–	0.189	0.327
V_5^P	0.391	–	–	0.191	0.282
V_6^P	–	–	–	0.143	–

The experts' opinions and model outputs (OIM and OSIM) were compared to measure the coincidence rate of country selection (see Table 10). The coincidence between AP and OIM, or between AP and OSIM in experienced countries, indicates the model's accuracy. Similarly, the in-coincidence between PP and OIM, or between PP and OSIM in unexperienced countries, implies the potential error of experts' opinions.

Table 10. Summary of model accuracy.

(A) Coincidence Rate of Model in Experienced Country				
Expert	**Country Risk**		**Project Reward**	
	OIM	**OSIM**	**OIM**	**OSIM**
A	67% (12/18)	83% (15/18)	56% (10/18)	78% (14/18)
B	52% (14/27)	70% (19/27)	44% (12/27)	67% (18/27)
C	74% (14/19)	79% (15/19)	74% (14/19)	68% (13/19)
D	62% (13/21)	76% (16/21)	57% (12/21)	67% (14/21)
E	100% (3/3)	100% (3/3)	67% (2/3)	100% (3/3)
Avg. accuracy	71%	82%	59%	76%
(B) Coincidence Rate of Model in Unexperienced Country				
Expert	**Country Risk**		**Project Reward**	
	OIM	**OSIM**	**OIM**	**OSIM**
A	57% (8/14)	50% (7/14)	36% (5/14)	64% (9/14)
B	60% (3/5)	60% (3/5)	60% (3/5)	40% (2/5)
C	62% (8/13)	69% (9/13)	54% (7/13)	77% (10/13)
D	45% (5/11)	64% (7/11)	18% (2/11)	45% (5/11)
E	59% (17/29)	66% (19/29)	52% (15/29)	66% (19/29)
Avg. coincidence	57%	62%	44%	58%

With respect to country risk, the rate of coincidence between the AP and OSIM is calculated at 82%, which is more accurate than the 71% coincidence rate between AP and OIM. In the project reward, the rate of coincidence between the AP and OSIM is 76%, which is also more accurate than the 59% coincidence rate between AP and OIM. These results show that OSIM has more accurate selection than OIM because OSIM can reflect the company's market position and business capability to the entry country, but OIM cannot. For example, OIM indicated that Kuwait and the Philippines are high-risk countries, but for expert A, OSIM showed that Kuwait and the Philippines are low-risk countries. Because expert A's company has a longstanding relationship with its clients in Kuwait and the Philippines, the expert's opinion was localized to the two countries: expert A ranked Kuwait and Philippines as AA or low-risk countries, and accordingly weighted the quality of national governance, average profit, ease of doing business, and stability of profit performance in the OSIM process. These considerations increased the accuracy of OSIM more than OIM.

Interestingly, when OIM and OSIM are applied to unexperienced countries, the accuracy is lower than that of experienced countries. Thus, experts' subjective opinions of an unexperienced county can be significantly mistaken for several reasons. First, the experts do not have enough knowledge to evaluate unexperienced countries as well as they can evaluate experienced countries. Second, when experts are interested in a new country for entry, they tend to evaluate the country as low risk, but when a new country is not their candidate country, they tend to consider the country as high risk. Thus, decision makers need to compare the results of OIM and OSIM with experts' opinions to improve the accuracy of country selection decisions.

5.3. Face Validation

After evaluating convergent validity, this study tested the model's overall validity through the expert interview and survey. In practice, during country evaluation and selection, construction companies usually review both country-specific information (e.g., accessible market size, sustainable market growth potential, intensity of local competition, and required institutional knowledge) and firm-specific conditions (e.g., level of local experience, sustainable relationships with local governments and partnering firms, existence of a local subsidiary, and past profit performance) [5,6]. From these perspectives, the experts in the current study assessed the appropriateness of the country selection variables, shown in Table 1. Overall, the experts agreed that the model contains important factors and relevant information for evaluating country risks and opportunities. More specifically, most experts were interested in Korean companies' actual performance (i.e., both contract and actual project performance). Because many companies lack information for a wide range of countries, this type of objective evidence-based information could be beneficial as a strategic reference for decision makers during the country evaluation and selection process.

Additionally, to confirm face validity, this study evaluated the OSIM's qualitative aspects through expert feedback. Modifying Fidan et al.'s [65] approach, this study evaluated the model's completeness, effectiveness, generality, and applicability. Based on these criteria, eight questions were asked and evaluated on a 7-point rating scale, ranging from 7 for very positive to 1 for very negative. Detailed information about the expert ratings is provided in Table 11. Overall, the average rating of 5.2 indicates that experts believed the proposed model is acceptable. The average ratings for completeness (5.5), effectiveness (5.4), and applicability (5.3) were positive. In particular, two questions related to sustainable business such as "Are the model factors sufficient for country entry evaluation from the sustainable business perspective?" and "Does the model provide meaningful information and sustainable strategic guidance for practitioners and decision makers?" score higher than the average rating. However, the average rating for generality was 4.6, which is lower than the ratings for other criteria. Most experts suggested that improving the generality of the proposed model required providing specific information to represent a variety of firms (e.g., different firm sizes and types) and projects (e.g., different project types, regions, and funding sources). In particular, some experts stated that although they have sufficient experience in the construction industry, their opinion can be irrational: they might have personal biases in country selection stemming from their limited knowledge, experience, and intuition. Therefore, this hybrid model of objective information and subjective opinion is helpful to provide clues for making country evaluations and selection decisions, particularly for less experienced practitioners.

Table 11. Summary of face validation.

Criteria	Question	Expert Rating					Mean
		A	B	C	D	E	
Completeness (average: 5.5)	Are the model factors sufficient for country entry evaluation from the sustainable business perspective?	5	6	5	6	5	5.4
	Overall, is the model complete, including analytic processes and methods?	6	6	5	5	6	5.6
Effectiveness (average: 5.4)	Does the model provide meaningful information and sustainable strategic guidance for practitioners and decision makers?	7	6	4	5	4	5.2
	Does the model have the potential to improve corporate decision-making?	6	5	6	6	5	5.6
Generality (average: 4.6)	Does the model have the ability to represent a variety of companies? (e.g., different company sizes and types)	4	5	4	5	5	4.6
	Does the model have the ability to represent a variety of projects? (e.g., different project types, regions, and funding sources)	4	6	4	4	5	4.6
Applicability (average: 5.3)	Does the model reflect the needs of practitioners and decision makers?	5	5	5	6	4	5.0
	Is the model applicable in practice?	7	5	5	6	5	5.6

6. Discussions and Conclusions

This study incorporated both objective information and expert opinion to propose a fuzzy-based decision support model for sustainable country selection. To provide a comprehensive framework for country selection, the proposed model used a 2 $\times$ 2 matrix based on two dimensions (country risk and project reward) of country evaluation variables. A Fuzzy LinPreRa-based analytic hierarchy process (AHP) rooted in objective information was applied to reduce the ambiguity and uncertainty of human opinion. This study evaluated the model's validity through case applications, expert interview, and survey. Convergent validation showed that the coincidence rate of the objective and subjective information-based model (OSIM) is higher (country risk: 82%; project reward: 76%) than that of the objective information-based model (OIM) (country risk: 71%; project reward: 59%). Face validation indicated an overall positive response to completeness, effectiveness and applicability of the hybrid model.

To sum up, the OSIM has three strengths. First, it provides a customized solution for improving decision accuracy depending on a company's individual short- and long-term strategies. Thus, this solution is differentiated from the uniform country evaluation provided by many consultants. Second, expert intuition and subjectivity cannot easily bias the results of OSIM because objective information is always the model's bottom line. This means that decision makers can recheck the marketing practitioner's opinion. Third, through the model's simplicity, rationality, and inclusiveness, this approach will enable practitioners to not only perform country classification analyses quickly, but also to address country-related problems, such as diversification planning and portfolio management, at an early stage of corporate strategy development.

Despite its contributions, this study has several limitations that require further consideration. First, this model uses mostly macro information; however, in practice, micro-approach data, such as detail construction institution, contract practice, local practice, and resource availability, should be considered. Second, the model's accuracy can vary depending on the representativeness of expert opinion. Thus, our future research will concentrate on addressing more in-depth variables in relation to sustainable country entry, and analyzing accuracy by using more expert involvement.

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References

1. Han, S.H.; Kim, D.Y.; Jang, H.S.; Choi, S. Strategies for contractors to sustain growth in the global construction market. *Habitat Int.* **2010**, *34*, 1–10. [CrossRef]
2. Teo, E.A.L.; Chan, S.L.; Tan, P.H. Empirical investigation into factors affecting exporting construction services in SMEs in Singapore. *J. Constr. Eng. Manag.* **2007**, *133*, 582–591. [CrossRef]
3. Chen, C. Entry mode selection for international construction markets: The influence of host country related factors. *Constr. Manag. Econ.* **2008**, *26*, 303–314. [CrossRef]
4. Chen, C.; Wang, Q.; Martek, I.; Li, H. International market selection model for large Chinese contractors. *J. Constr. Eng. Manag.* **2016**, *142*, 04016044. [CrossRef]
5. Jung, W.; Han, S.H.; Lee, K.W. Country portfolio solutions for global market uncertainties. *J. Manag. Eng.* **2012**, *28*, 372–381. [CrossRef]
6. Lee, K.W.; Han, S.H. Quantitative analysis for country classification in the construction industry. *J. Manag. Eng.* **2017**. [CrossRef]
7. Dikmen, I.; Birgonul, M.T. An analytic hierarchy process based model for risk and opportunity assessment of international construction projects. *Can. J. Civ. Eng.* **2006**, *33*, 58–68. [CrossRef]
8. Hastak, M.; Shaked, A. ICRAM-1: Model for international construction risk assessment. *J. Manag. Eng.* **2000**, *16*, 59–69. [CrossRef]
9. Cheng, M.Y.; Tsai, H.C.; Chuang, K.H. Supporting international entry decisions for construction firms using fuzzy preference relations and cumulative prospect theory. *Expert Syst. Appl.* **2011**, *38*, 15151–15158. [CrossRef]
10. Chan, C.M.; Isobe, T.; Makino, S. Which country matters? Institutional development and foreign affiliate performance. *Strateg. Manag. J.* **2008**, *29*, 1179–1205. [CrossRef]
11. Christmann, P.; Day, D.; Yip, G.S. The relative influence of country conditions, industry structure, and business strategy on multinational corporation subsidiary performance. *J. Int. Manag.* **1999**, *5*, 241–265. [CrossRef]
12. Makino, S.; Isobe, T.; Chan, C.M. Does country matter? *Strateg. Manag. J.* **2004**, *25*, 1027–1043. [CrossRef]
13. Barney, J. Firm resources and sustained competitive advantage. *J. Int. Manag.* **1991**, *17*, 99–120. [CrossRef]
14. Oliver, C. Sustainable competitive advantage: Combining institutional and resource based views. *Strateg. Manag. J.* **1997**, *18*, 697–713. [CrossRef]
15. Peng, M.W.; Wang, D.Y.L.; Jiang, Y. An institution-based view of international business strategy: A focus on emerging economies. *J. Int. Bus. Stud.* **2008**, *39*, 920–936. [CrossRef]
16. Cantwell, J. Location and the multinational enterprise. *J. Int. Bus. Stud.* **2009**, *40*, 35–41. [CrossRef]
17. Dunning, J.H. Location and the multinational enterprise: John Dunning's thoughts on receiving the Journal of International Business Studies 2008 Decade Award. *J. Int. Bus. Stud.* **2009**, *40*, 20–34. [CrossRef]
18. Flores, R.; Aguilera, R.V. Globalization and location choice: An analysis of US multinational firms in 1980 and 2000. *J. Int. Bus. Stud.* **2007**, *38*, 1187–1210. [CrossRef]
19. Galan, J.I.; González-Benito, J.; Zuñga-Vincente, J.A. Factors determining the location decisions of Spanish MNEs: An analysis based on the investment development path. *J. Int. Bus. Stud.* **2007**, *38*, 975–997. [CrossRef]
20. Mataloni, R.J. The structure of location choice for new U.S. manufacturing investments in Asia-Pacific. *J. World Bus.* **2011**, *46*, 154–165. [CrossRef]
21. Jung, W.; Han, S.H.; Koo, B.; Jang, W. Which strategies are more effective for international contractors during boom and recession periods? *J. Manag. Eng.* **2012**, *28*, 281–290. [CrossRef]
22. Low, S.P.; Jiang, H. Internationalization of Chinese construction enterprises. *J. Constr. Eng. Manag.* **2003**, *129*, 589–598.

23. Lee, S.; Ahn, Y.; Shin, S. The impact of multinational business diversification on the financial sustainability of construction firms in Korea. *Sustainability* **2016**, *8*, 997. [CrossRef]
24. Chen, C.; Messner, J.I. Permanent versus mobile entry decisions in international construction markets: Influence of home country- and firm-related factors. *J. Manag. Eng.* **2011**, *27*, 2–12. [CrossRef]
25. Li, H.; Jin, Z.; Li, V.; Liu, G.; Skitmore, R.M. An entry mode decision-making model for the international expansion of construction enterprises. *Eng. Constr. Archit. Manag.* **2013**, *20*, 160–180. [CrossRef]
26. Chan, A.P.C.; Yeung, J.F.Y.; Yu, C.C.P.; Wang, S.Q.; Ke, Y. Empirical study of risk assessment and allocation of public-private partnership projects in China. *J. Manag. Eng.* **2011**, *27*, 136–148. [CrossRef]
27. Martek, I.; Chen, C. Localization typologies evident among foreign enterprises active in the Chinese construction market. *J. Constr. Eng. Manag.* **2013**, *139*, 04013001. [CrossRef]
28. Ling, F.Y.Y.; Hoi, L. Risks faced by Singapore firms when undertaking construction projects in India. *Int. J. Proj. Manag.* **2006**, *24*, 261–270. [CrossRef]
29. Fernandez-Dengo, M.; Naderpajouh, N.; Hastak, M. Risk Assessment for the Housing Market in Mexico. *J. Manag. Eng.* **2013**, *29*, 122–132. [CrossRef]
30. Zarkada-Fraser, A.; Fraser, C. Risk perception by UK firms towards the Russian market. *Int. J. Proj. Manag.* **2002**, *20*, 99–105. [CrossRef]
31. El-Sayegh, S.M. Risk assessment and allocation in the UAE construction industry. *Int. J. Proj. Manag.* **2008**, *26*, 431–438. [CrossRef]
32. El-Sayegh, S.M.; Mansour, M.H. Risk assessment and allocation in highway construction projects in the UAE. *J. Manag. Eng.* **2015**, *31*, 04015004. [CrossRef]
33. Dikmen, I.; Birgonul, M.T.; Gur, A.K. A case-based decision support tool for bid mark-up estimation of international construction projects. *Autom. Constr.* **2007**, *17*, 30–44. [CrossRef]
34. Han, S.H.; Diekmann, J.E. Making a risk-based bid decision for overseas construction projects. *Constr. Manag. Econ.* **2001**, *19*, 765–776. [CrossRef]
35. Dikmen, I.; Birgonul, M.T.; Han, S. Using fuzzy risk assessment to rate cost overrun risk in international construction projects. *Int. J. Proj. Manag.* **2007**, *25*, 494–505. [CrossRef]
36. Dikmen, I.; Birgonul, M.T. Neural network model to support international market entry decisions. *J. Constr. Eng. Manag.* **2004**, *130*, 59–66. [CrossRef]
37. Chung, E.S.; Abdulai, P.J.; Park, H.; Kim, Y.; Ahn, S.R.; Kim, S.J. Multi-criteria assessment of spatial robust water resource vulnerability using the TOPSIS method coupled with objective and subjective weights in the Han River basin. *Sustainability* **2017**, *9*, 29. [CrossRef]
38. Wang, T.C.; Lee, H.D. Developing a fuzzy TOPSIS approach based on subjective weights and objective weights. *Expert Syst. Appl.* **2009**, *36*, 8980–8985. [CrossRef]
39. Wang, Y.M.; Parkan, C. A general multiple attribute decision-making approach for integrating subjective preferences and objective information. *Fuzzy Sets Syst.* **2006**, *157*, 1333–1345. [CrossRef]
40. Zhou, S.; Chen, G.; Fang, L.; Nie, Y. GIS-based integration of subjective and objective weighting methods for regional landslides susceptibility mapping. *Sustainability* **2016**, *8*, 334. [CrossRef]
41. IHS Global Insight. *Global Construction Outlook*; IHS Global Insight Inc.: Lexington, MA, USA, 2014.
42. Engineering News Records. The Top 225 International Contractors. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Contractors/2010-Top_225_International_Contractors.pdf (accessed on 4 May 2017).
43. Engineering News Records. The Top 200 International Design Firms. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Design-Firms/2010-Intl_Design_Global_Firms.pdf (accessed on 4 May 2017).
44. Engineering News Records. The Top 225 International Contractors. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Contractors/2011-Top_225_International_Contractors.pdf (accessed on 4 May 2017).
45. Engineering News Records. The Top 200 International Design Firms. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Design-Firms/2011-Intl_Design_Global_Firms.pdf (accessed on 4 May 2017).
46. Engineering News Records. The Top 225 International Contractors. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Contractors/Top225List.pdf (accessed on 4 May 2017).

47. Engineering News Records. The Top 200 International Design Firms. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Design-Firms/ENR_IDF_Top200_Overview_07232012.pdf (accessed on 4 May 2017).
48. Engineering News Records. The Top 250 International Contractors. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Contractors/enr_the_top_250_international_contractors_2013.pdf (accessed on 4 May 2017).
49. Engineering News Records. The Top 225 International Design Firms. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Design-Firms/ENR-The-Top-225-International-Design-Firms-2013--2.pdf (accessed on 5 August 2013).
50. Engineering News Records. The Top 250 International Contractors. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Contractors/2014_enr_top_250_intl_cont.pdf? (accessed on 4 May 2017).
51. Engineering News Records. The Top 225 International Design Firms. Available online: http://www.enr.com/ext/resources/static_pages/PDFs/national_toplists/Intl-Design-Firms/enr_top_225_international_design_firms_2014.pdf (accessed on 4 May 2017).
52. World Bank. Worldwide Governance Indicators. Available online: http://info.worldbank.org/governance/wgi/#home (accessed on 4 May 2017).
53. World Bank. Doing Business. Available online: http://www.doingbusiness.org/ (accessed on 4 May 2017).
54. International Contractors Association of Korea (ICAK). International Construction Information Service. Available online: http://www.icak.or.kr/ (accessed on 4 May 2017).
55. Rezaei, J.; Ortt, R. Multi-criteria supplier classification using a fuzzy preference relations based AHP. *Eur. J. Oper. Res.* **2013**, *225*, 75–84. [CrossRef]
56. Giachetti, R.E.; Young, R.E. A parametric representation of fuzzy numbers and their arithmetic operators. *Fuzzy Sets Syst.* **1997**, *91*, 185–202. [CrossRef]
57. Van Laarhoven, P.J.M.; Pedrycz, W. A fuzzy extension of Saaty's priority theory. *Fuzzy Sets Syst.* **1983**, *11*, 199–227. [CrossRef]
58. Wang, T.C.; Chen, Y.H. Applying fuzzy linguistic preference relations to the improvement of consistency of fuzzy AHP. *Inf. Sci.* **2008**, *178*, 3755–3765. [CrossRef]
59. Lee, E.S.; Li, R.J. Comparison of fuzzy numbers based on the probability measure of fuzzy events. *Comput. Math. Appl.* **1988**, *15*, 887–896. [CrossRef]
60. International Institute for Management Development (IMD). *IMD World Competitiveness Yearbook 2015*; IMD: Lausanne, Switzerland, 2015.
61. Abowitz, D.A.; Toole, T.M. Mixed method research: Fundamental issues of design, validity, and reliability in construction research. *J. Constr. Eng. Manag.* **2010**, *136*, 108–116. [CrossRef]
62. Henderson, K.A. *Dimensions of Choice: A Qualitative Approach to Recreation, Parks and Leisure Research*; Venture: State College, PA, USA, 1991.
63. Merriam, S.B. *Case Study Research in Education: A Qualitative Approach*; Jossey-Bass: San Francisco, CA, USA, 1988.
64. Lucko, G.; Rojas, E.M. Research validation: Challenges and opportunities in the construction domain. *J. Constr. Eng. Manag.* **2010**, *136*, 127–135. [CrossRef]
65. Fidan, G.; Dikmen, I.; Tanyer, A.M.; Birgonul, M.T. Ontology for relating risk and vulnerability to cost overrun in international projects. *J. Comput. Civ. Eng.* **2011**, *25*, 302–315. [CrossRef]