

# Research on the Strategies of Korean construction companies in advancing into the US infrastructure market : Focused on PPP projects

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**Abstract:** SWOT-AHP method was utilized in the research for the Korean construction companies to advance into the US PPP market. The research was that the SO Strategy “: Advancing through strategic selection of both construction sector type and region”, ST Strategy “Advancing based on the acquired competitive business sector”, WO Strategy ” Developing collaboration model between public financial organization and construction company”, and WT Strategy “Establishing a partnership or M&A with local companies”.

**Key words:** Analytic Hierarchy Pcosess, SWOT analysis, Public-Private-Partnership

## 1. INTRODUCTION

Recently, the focus of the construction market is moving from newly developing nations to advanced nations. Especially, projects in developed nations are evaluated to have high quality as the risks associated with resource/politics/economy/social factors are considerably lower compared to developing nations. As such, global construction companies are expanding into the market.

The project opportunities in the US infrastructure market, which is one of the largest market among the developed nations, is expected to expand. The government’ s policies to revitalize the economy by improving various infrastructure facilities and minimize economic loss due to the aged infrastructure are factors that contributed to the market expansion.

Especially, according to the “2017 Infrastructure Report Card” published by ASCE (American Society of Civil Engineering), US public infrastructure(Aviation: D, Bridges: C+, Dams: D, Drinking Water: D, Energy: D+, Hazardous Waste: D+, Inland Waterways: D, Levees: D, Parks & Recreation D+, Ports: C+, Rail: B, Roads: D, Schools: D+, Solid Waste: C+, Transit: D-, Wastewater: D+) throughout all sectors averaged a D+.

As such, it is expected that the need for new infrastructure facilities or maintenance/repair work is to rise, and an investment of more than \$3 trillion is expected by 2025. However, since both the state and federal government are lacking funds for the related projects, it is expected that the infrastructure facility projects will be based on PPP (Public-Private-Partnership). Also, the market for the US infrastructure PPP projects is estimated to maintain a high growth of 16.5% per year (KOTRA 2017).

## 2. Methodologies for SWOT-AHP method

SWOT(Strengths, weaknesses, opportunities and threats) analysis is performed in order for the Korean construction companies to acquire a strategy to penetrate the US infrastructure market. After

analyzing the market environment, AHP method was utilized to extract a SWOT-Matrix (kim and Jeon, 2016).

**Table 1.** A general presentation of SWOT matrix

SWOT	Strengths (S)	Weaknesses (W)
<b>Opportunities (O)</b>	SO By using strengths take advantage of opportunities	WO By taking advantage of opportunities overcome weaknesses
<b>Threats (T)</b>	ST By using strengths avoid threats	WT By minimizing weaknesses avoid threats

Source: Nikjoo, A. V., & Saeedpoor, M., (2014)

“SWOT approach can provide a quantitative measure of importance of each factor on decision-making (Kurttila et al., 2000; Saaty and Vargas, 2001; Ananda and Herath, 2003)”. AHP enables decision makers to assign a relative priority to each factor through pair-wise comparison.”

Both Strengths and Weakness factors in the analysis were based on large Korean construction companies, and Opportunities and Threats factors were based on the US economy and infrastructure market environment (preliminary studies and expert interviews).

After, based on the US infrastructure-related experts and the extracted categories, AHP analysis was executed. And a SWOT Matrix strategy was suggested based on the analysis results.

Research methodology for the SWOT-AHP is the following:

1. Factor extraction for SWOT
2. Identifying factors with high priority by comparing the factors within the group through SWOT analysis
3. After paired comparison of the factors within the group, importance of the factors were established utilizing the weight derived from AHP analysis

SWOT-AHP analysis was utilized in a number of research fields when identifying and establishing strategies. In this research, it was utilized to extract strategies for the Korean construction companies in penetrating the US PPP market.

### 3. METHODS

#### 3.1. Factor generation

In order to identify competency needed for Korean construction companies to enter the US PPP market, first round of SWOT factors were extracted through previous domestic and international research reports, research papers, and other preliminary research. Then Focus Group Interview was held with experts on overseas construction over the extracted factors. Then SWOT Groups were identified based on the result. SWOT factors were limited to a total of four for in order to make relative comparison possible through AHP analysis process. The SWOT groups and factors are shown in <Table 2> below.

**Table 2.** SWOT analysis table

SWOT groups	SWOT factors
<b>Strengths (S)</b>	S <sub>1</sub> Possibility of the group subsidiary to participate
	S <sub>2</sub> Experience in various infrastructure facility projects
	S <sub>3</sub> Experience in privately-funded public facility projects
	S <sub>4</sub> Acquires skills in constructing ICT-based infrastructure facilities
<b>Weaknesses (W)</b>	W <sub>1</sub> Lack of competency in technique and financial procurement compared to other competitive companies
	W <sub>2</sub> Lack of experience in local PPP and construction projects
	W <sub>3</sub> Lack of local network compared to other competitive companies

	W <sub>4</sub> Acquired competitiveness focused on overseas construction projects
<b>Opportunities</b> (O)	O <sub>1</sub> Expansion of PPP public infrastructure projects with the participation of private(overseas) companies
	O <sub>2</sub> Local PPP market is prospected to grow continuously
	O <sub>3</sub> Increase need to invest in major infrastructure facilities due to aging
	O <sub>4</sub> Increase interest in PPP by the federal and state/local government due to lack of funds
<b>Threats</b> (T)	T <sub>1</sub> Process of acquiring licensing and permits for PPP that differs in each state
	T <sub>2</sub> Increase in developed construction company's market share in local PPP market
	T <sub>3</sub> Need for multi-competitiveness due to increase in integrated infrastructure facility orders
	T <sub>4</sub> Increased support in PPP project led by the competitor's government

### 3.2. SWOT-AHP Comprehensive Analysis Result

The significance of the SWOT factors and its each characteristics were analyzed. Then the weight of the sub factors for each group was applied. Among the factors in the SWOT groups, the internal factors, Strength and Weakness, was weighted by the experts as “0.617(61.7%), 0.052(5.2%)” respectively. Meanwhile, external factors, Opportunities and Threats, weighted “0.282(28.2%), 0.049(4.9%)” respectively. According to the evaluation results, internal factor Strength, and external factor, Threats, proved to be the most important, which was followed by Internal factor, Weakness, and external factor, Opportunities. The relative importance of the SWOT factors are shown in <Table 3>.

**Table 3.** Relative importance of SWOT groups

SWOT groups	Weights (W <sub>s</sub> , W <sub>w</sub> , W <sub>o</sub> , W <sub>t</sub> )
Strengths (S)	0.617
Weaknesses (W)	0.052
Opportunities (O)	0.282
Threats (T)	0.049

The importance of the factor subattributes were extracted during the SWOT-AHP analysis. According to the results, factors with the highest importance value for each stage were the following: Strengths stage: S<sub>3</sub>(0.410: Experience in privately-funded public facility projects); Weaknesses stage: W<sub>1</sub>(0.449: Lack of experience in local PPP and construction projects); Opportunities stage: O<sub>1</sub>(0.445: Expansion of PPP public infrastructure projects with the participation of private(overseas) companies); Threats stage: T<sub>1</sub>(0.449: Process of acquiring licensing and permits for PPP that differs in each state).

To examine the rank of all 16 factors, overall weights were calculated and outlined in Table 4. The overall weights of the factor can be obtained by multiplying the weight of SWOT group by the local weight of the factor.

**Table 4.** AHP overall and ranking result

SWOT group weights	SWOT factors weights	SWOT factors local rank	Overall weights	SWOT factors overall rank
Strengths (0.617)	S <sub>1</sub> = 0.082	4	0.617 × 0.082 = 0.051	7
	S <sub>2</sub> = 0.158	3	0.617 × 0.158 = 0.097	4
	S <sub>3</sub> = 0.410	1	0.617 × 0.410 = 0.253	1
	S <sub>4</sub> = 0.350	2	0.617 × 0.350 = 0.216	2
Weaknesses (0.052)	W <sub>1</sub> = 0.449	1	0.052 × 0.449 = 0.023	9
	W <sub>2</sub> = 0.288	2	0.052 × 0.288 = 0.015	11
	W <sub>3</sub> = 0.208	3	0.052 × 0.208 = 0.011	13
	W <sub>4</sub> = 0.054	4	0.052 × 0.054 = 0.003	16

Opportunities (0.282)	O <sub>1</sub> = 0.445	1	0.282 × 0.445 = 0.125	3
	O <sub>2</sub> = 0.258	2	0.282 × 0.258 = 0.073	5
	O <sub>3</sub> = 0.108	4	0.282 × 0.108 = 0.030	8
	O <sub>4</sub> = 0.190	3	0.282 × 0.190 = 0.054	6
Threats (0.049)	T <sub>1</sub> = 0.449	1	0.049 × 0.449 = 0.022	10
	T <sub>2</sub> = 0.170	3	0.049 × 0.170 = 0.008	14
	T <sub>3</sub> = 0.251	2	0.049 × 0.251 = 0.012	12
	T <sub>4</sub> = 0.129	4	0.049 × 0.129 = 0.006	15

Among the 16 categories, there were 7 factors with importance value larger than 0.050. In the Strengths group, S1(Possibility of the group subsidiary to participate), S2(Experience in various infrastructure facility projects), S3(Experience in privately-funded public facility projects), and S4(Acquires skills in constructing ICT-based infrastructure facilities), all four factors were included. For the Opportunities group, O1(Expansion of PPP public infrastructure projects with the participation of private(overseas) companies), O2(Local PPP market is prospected to grow continuously), and O3(Increase need to invest in major infrastructure facilities due to aging) were involved.

Especially, S3 accounted for 41% within the Strength group and O3 accounted for 44% within its group which represents how the two factors are much more important compared to other factors.

Converted weight(L') was calculated in order to show the result of the SWOT-AHP analysis on a graph. The length of the diagonal line on the graph portrays the importance of the factor. The factor that lies on the end of the line represents the most important factor in the group. The weight conversion equation used is the following.

$$L' = \frac{G_w \times f_L^n}{f_L^1}$$

L': Location of SWOT factors on the graph

G<sub>w</sub>: Importance of SWOT group attributes

f<sub>L</sub><sup>1</sup>: Relative importance of the most important factors within a group attribute

f<sub>L</sub><sup>n</sup>: Relative importance of the factor being the n<sup>th</sup> important within the group

Source: Kim and Jung, (2012)

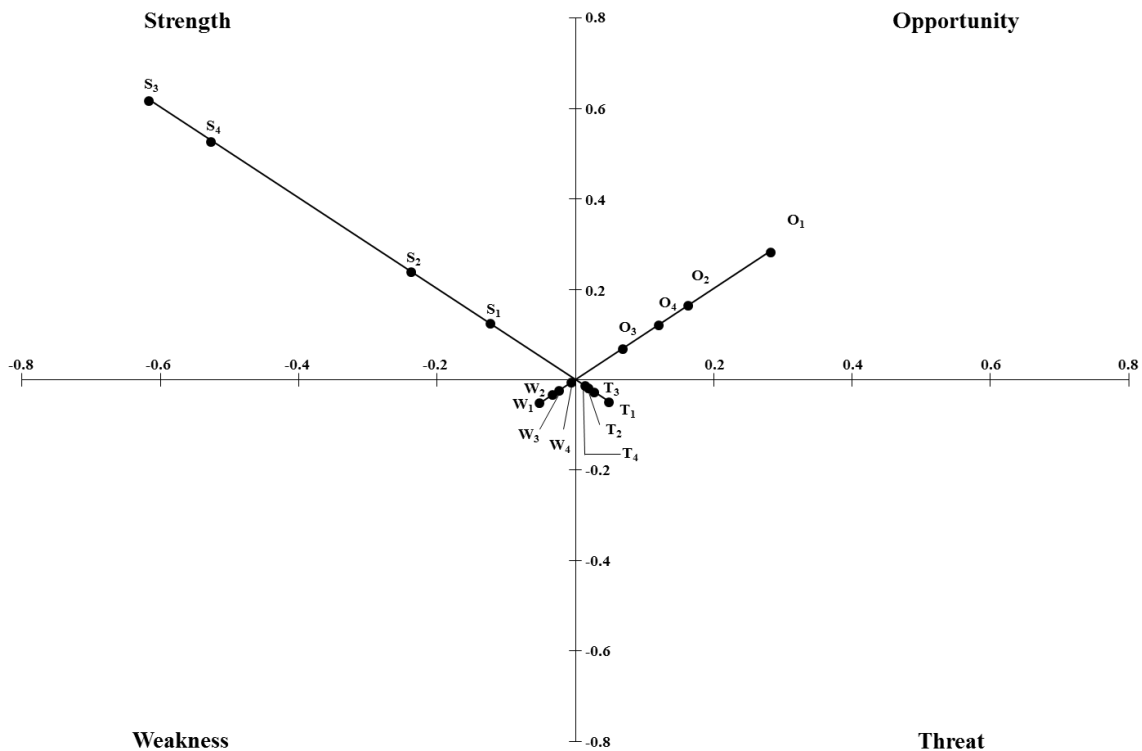
Utilizing the conversion equation above, the result of the SWOT factors is shown in <Table 5> below.

**Table 5.** The exchange Importance

Factor	L'-weight	Factor	L'-weight	Factor	L'-weight	Factor	L'-weight
S <sub>1</sub>	0.123	W <sub>1</sub>	0.052	O <sub>1</sub>	0.282	T <sub>1</sub>	0.049
S <sub>2</sub>	0.238	W <sub>2</sub>	0.033	O <sub>2</sub>	0.163	T <sub>2</sub>	0.019
S <sub>3</sub>	0.617	W <sub>3</sub>	0.024	O <sub>3</sub>	0.068	T <sub>3</sub>	0.027
S <sub>4</sub>	0.527	W <sub>4</sub>	0.006	O <sub>4</sub>	0.120	T <sub>4</sub>	0.014

To summarize the overall analysis results, threat factors such as T1(Process of acquiring licensing and permits for PPP that differs in each state), T2(Increase in developed construction company's market share in local PPP market) needs to be reduced. Meanwhile, strength factors, S3(Experience in privately-funded public facility projects) and S4(Acquires skills in constructing ICT-based infrastructure facilities) needs to be reinforced while taking advantage of opportunity factors such as O1(Expansion of PPP public infrastructure projects with the participation of private(overseas) companies), O2(Local PPP market is prospected to grow continuously). However, weaknesses such as W1(Lack of competency in technique and financial procurement compared to other competitive companies) and W2(Lack of experience in local PPP and construction projects) needs to be supplemented.

Therefore, based on the analysis results of each SWOT attributes and the importance value of the factors, this research utilized the SWOT Matrix to derive strategies with high probability in penetrating the US PPP market for the Korean construction companies.



**Fig. 1.** SWOT-AHP Relative Importance graph

#### 4. Conclusions

This research suggests strategies for the Korean construction companies to enter the US PPP market based on factors with higher relative importance that was analyzed using SWOT-AHP method. Based on the SWOT analysis result, the SO strategy, utilizing the strength for the opportunity, the WO strategy, strengthening the weakness for the opportunity, the ST strategy, utilizing the strength to overcome the threat, and the WT strategy, strengthening the weakness and overcoming the threat, were developed. The developed SWOT-Matrix strategy utilizing the evaluated factor weight from the SWOT-AHP analysis is shown in <Table 6>.

**Table 6.** SWOT-AHP strategy type configuration

		Internal environment	
		Strengths	Weaknesses
External environment		S <sub>1</sub> (0.082) / S <sub>2</sub> (0.158) S <sub>3</sub> (0.410) / S <sub>4</sub> (0.350)	W <sub>1</sub> (0.449) / W <sub>2</sub> (0.288) W <sub>3</sub> (0.208) / W <sub>4</sub> (0.054)
Opportunities	O <sub>1</sub> (0.445) / O <sub>2</sub> (0.258) O <sub>3</sub> (0.108) / O <sub>4</sub> (0.190)	SO strategy S <sub>3</sub> O <sub>1</sub>	WO strategy W <sub>1</sub> O <sub>1</sub>
	Threats	T <sub>1</sub> (0.449) / T <sub>2</sub> (0.170) T <sub>3</sub> (0.251) / T <sub>4</sub> (0.129)	ST strategy S <sub>3</sub> T <sub>1</sub>

SO(Strength-Opportunity) strategy: : Advancing through strategic selection of both construction sector type and region

Korean construction companies have a number experience on privately-funded projects that is not limited to infrastructure but also education, museum, distribution complex, military living facilities and other public facilities. The US is planned to expand projects not only for road/transportation, energy,

water resource and other traditional infrastructure projects but also other public facilities. Therefore, participating in public facility projects where Korean construction companies have a competitive edge under the intensifying competition for large scale infrastructure facilities would be advantageous.

WO(Weakness-Opportunity) strategy: Developing collaboration model between public financial organization and construction company

It is possible to utilize Korean government's public resource and establishing a partnership or M&A with local companies to enter the US market considering Korea has public financial organizations such as the Export-Import Bank of Korea, and Korea Development Bank. Also, acquisition of small/medium scaled companies competitive in the region can be advantageous. However, there is a need to identify strategies for the Korean companies to localize in the long term perspective.

ST(Strength-Threat) strategy: Advancing based on the acquired competitive business sector

Korean companies need to analyze their performance of privately-funded public facilities. Also, identifying methods to participate in small/medium based projects rather than large projects in the beginning can help penetrate the market. Then, selecting the region within the US to enter, and acquiring information for PPP based permits and other administrative process based on the state/local government would be essential. Also, actively utilizing local firms and consulting companies to gather information can be beneficial. Although the initial investment price exists, it is relatively a competitive and strategic method in entering the market.

WT(Weakness-Threat) strategy: Establishing a partnership or M&A with local companies

The WT can be overcome by establishing a partnership or M&A with a competitive local small/medium company in consideration of the local firm's presence in the region. As such it is essential to identify localization strategies in the long term.

This research utilized SWOT and AHP analysis method to quantify and establish strategic methods for the Korean construction companies in advancing into the US PPP market. The limitation of this research is that the SWOT factors were limited to a total of 4 each, and the subject for the survey were based on Koreans. In the future study, utilizing Fuzzy-AHP analysis method and expanding the survey pool to acquire a more reliable result.

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