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플랜트 및 건설수출 입찰의 성공 및 실패모델에 관한연구 (A Study on the Regression Models of Success and Failure of Tenders for Plant and Construction Exports)

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Abstract

This paper is to suggest strategic options for improving the export performance of the plant and construction industry. The overall objective of this study is to explore the feasibility of a sustained export performance in the plant and overseas construction industry by an analysis of its international competitiveness and technological competence.

The empirical work of this study relates to a chosen sample of Korean and non-Korean firms in the plant and construction industry sector. Primary data was collected through a comprehensive questionnaire survey administered to plant and construction firms in twelve countries, including Korea. The actual number of firms for which full information at a sufficient level of disaggregation was obtained was 62, a response rate of 44.6%. Of these, 42 firms were drawn from Korean plant and construction firms and the remaining 20 firms from 11 other countries. The structure of responding firms by industry shows a total of 29 plant exporters and 33 construction firms.

Data analysis was carried out using SPSS statistical technique such as Multiple Regression in order to examine the linear relationship among variables.

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The findings of the study indicate that export success and failure in plant and construction export markets is determined by firm size and by various qualitative variables. The high export volume (export success) of plant and construction exporters is more strongly influenced by mutual economic cooperation and number of employees than by sales volume and competent knowledge of the plant and construction markets. It was also found that weak political and diplomatic relation between countries, low sales volume and lack of bid experience have an adverse effect and represent serious barriers to exports.

1. Introduction

The Korean economy experienced sudden cost push factors in the mid-1970s arising from excessive public sector expenditure, foreign borrowing and an increase in international raw material prices. In addition, Korean exports were faced with growing protectionism in world markets. Under these circumstances, the pursuit of plant and construction exports, a sector in which Korea enjoys a comparative advantage and a reputation for economic cooperation with less developing countries, was regarded as the principal means of generating a sustained performance.

Korean overseas construction projects seemed particularly capable of contributing to the growth of the national product by guaranteeing a plentiful supply of skilled and semi-skilled labour to overseas construction sites.

The Korean economy is heavily dependent on exports, particularly machinery, plant and construction exports. However, in international markets these products and services are uncompetitive relative to US, Germany, Japan and U.K. competitors.

Despite the plethora of research, both theoretical and empirical, into the international dimensions of industries and markets, little work has been conducted into the structure, growth and performance of firms involved in international Third World projects in the construction and plant industry. Within

this context, estimates of the competitiveness of the major suppliers have been neglected. In Korea, for example, very little evidence has been presented to allow a study and evaluation of the performance and competitiveness of Korean firms. Most Korean studies to date have emphasized export performance by value rather than by a more objective measure of competitiveness. Therefore, a primary purpose of this study is to suggest strategic options for improving the export performance of the plant and construction industry.

In dealing with the reasons for uncompetitiveness, attention will be given a) to the failure of the industry to achieve sufficient orders for plant and construction exports and b) to an estimation of the international competitiveness of the industry.

The overall objective of this study is to explore the feasibility of a sustained export performance in the plant and overseas construction industry by an analysis of its international competitiveness and technological competence.

It is hoped that the findings of this study can be generalized to explain the relationship between the firm size and various qualitative variables. It is expected that this study will serve as a guideline for MNCs(Multinational Corporations) which are interested in exporting to developing countries, especially in the plant and overseas construction industry.

The empirical work of this study relates to a chosen sample of Korean and non-Korean firms in the plant and construction industry sector. Data was collected through a comprehensive questionnaire survey administered to plant and construction firms in twelve countries, including Korea. The questionnaire was designed for the general managers or managing directors of the plant and construction firms studied. Its main objectives was to investigate the quantitative and qualitative side of the data which could then be subjected to statistical analysis. This questionnaire covers factors influencing the success or failure of tenders for plant exports/overseas construction projects(a copy of this questionnaire is appended on Appendix 1).

Table 1 illustrates the distribution of the original sample and the responding firms by country and industry. Initially, a sample of 139 firms(47 Korean and

92 non-Korean firms) was chosen from the population, drawn from the top 160 international contractors(in 1985) as identified by the Engineering News-Record[1],[2],[3],[4],[5],[6],[7] in the case of foreign companies, and among the top 250(between 1983 and 1985) in the case of Korean construction firms. As original sample of Korean plant firms was drawn from those which were registered with the Korean Ministry of Trade and Industry at December 1986.

The actual number of firms for which full information at a sufficient level of disaggregation was obtained was 62, a response rate of 44.6%. Of these, 42 firms were drawn from Korean plant and construction firms and the remaining 20 firms from 11 other countries. The structure of responding firms by industry shows a total of 29 plant exporters and 33 construction firms (See Appendix 2). Fifty firms came from three countries, Korea, the USA and Japan (accounting for 80.6% of the total responses).

Data analysis was carried out using SPSS statistical technique. The attitudes and views revealed by respondents to the questionnaire were analyzed using 15 objective variables and 37 subjective variables.

The creation of an interval data file enabled us to study the relationships among variables using MULTIPLE REGRESSION. The employment of this procedure allowed for the examination of the linear relationship between a set of independent variable (such as number of employees, sales volume, mutual economic cooperation and financial arrangements) and a dependent variable (such as export volume). Certain interesting findings were reached when the success and failure of tenders for plant and construction exports in the sample were examined by multiple regression to produce a linear combination of independent variables which correlate as highly as possible with the dependent variable[8].

The study has been structured into four chapters including: 1) introduction; 2) regression model to explain export success in the plant and construction industry; 3) regression model to explain export failure in the same industry; and 4) conclusion.

<Table 1> Sample structure by country and industry

Country	Original sample		Responding firms*				
	N (A)	%	plant	construction	total (B)	%	B/A(%)
Korea	47	33.8	23	19	42	67.7	89.4
USA	16	11.5	2	3	5	8.1	31.3
Japan	17	12.2	1	2	3	4.8	17.6
UK	10	7.2	0	1	1	1.6	10.0
Germany	10	7.2	1	1	2	4.8	30.0
France	10	7.2	0	1	1	1.6	50.0
Italy	10	7.2	2	1	3	4.8	30.0
Belgium	2	1.4	0	1	1	1.6	50.0
Turkey	3	2.2	0	1	1	1.6	33.3
Sweden	2	1.4	0	1	1	1.6	50.0
Taiwan	1	0.7	0	1	1	1.6	100.0
Singapore	1	0.7	0	1	1	1.6	100.0
Austria	1	0.7	0	0	0	0.0	0.0
Greece	1	0.7	0	0	0	0.0	0.0
Netherlands	4	2.9	0	0	0	0.0	0.0
Canada	2	1.4	0	0	0	0.0	0.0
Switzerland	2	1.4	0	0	0	0.0	0.0
Total	139	100.0	29	33	62	100.0	44.6

Note: * A list of the 62 sample firms: see Appendix 2.

2. A Regression Model of Export Success in The Plant and Construction Industry

This empirical research covers our sample of 42 Korean firms and 20 firms in 11 other countries. However, there are seven returns with missing data for which standard deviations of quantitative variables in the overall sample are too widely distributed for mean values to be substituted. This may be attributed to the following reasons: (1) the sample of Korean firms included small export firms; (2) in contrast, only large-sized export firms, among the top 160 international contractors, are included in the 11 other countries. Thus, to obtain better regression results, fifteen Korean firms (with an export volume < 15 USM$) and four foreign firms (with an export volume > 1 USB$) are excluded from the respective samples. Altogether, 36 international firms from 10 countries (excluding the U. K. and Turkey) constitute the sample for the regression models.

Of two regression models, the second one has a dummy variable to represent export "activity": (i. e. plant or construction).

2.1 Tests

We can test the two hypotheses, which are as follows:

H_1: Export success in plant and construction markets is explained both by firm size and by various qualitative variables.

H_2: In addition, at least one dummy variable to represent export activity in plant or construction can add to the explanation of export success.

A stepwise regression procedure, the maximum R^2 improvement technique (MAXR), is used to test the significance of the variables in the model. MAXR calculates the R^2 improvement and the F-statistic reflecting each variable's contribution to the model if it were to be included. The MAXR method begins by picking the independent variable that explains most of th variation of the dependent variable and constructs a regression model with that variable. It then adds the second independent variable that would yield the greatest

increase in R^2 by comparing each variable with all other independent variables and doing all possible switches until no further switch could increase R^2. Thus, independent variables continue to be brought into the model as lond as the unexplained variation continues to decrease. In this manner, the "best" model can be obtained.

For testing purposes, the specification of the first model is given in the linear form:

$$V14 = b_0 + b_1V21 + b_2V28 + b_3V29 + b_4V32 + b_5V33 + b_6V11 + b_7V13 + e \quad (1)$$

where V14 = high export volume in 1986: US 0.1M$

V21 = competent knowledge of the plant and construction markets

V28 = mutual economic cooperation

V29 = mutual cooperative arrangements, with a consulting firm taking charge of feasibility study

V32 = quality guarantee of products expected

V33 = financial arrangements

V11 = number of employees

V13 = sales volume in 1986: USM$

We can test the null hypothesis that there is no relationship between export volume and the seven independent variables.

H_0: $b_1 = b_2 = b_3 = b_4 = b_5 = b_6 = b_7 = 0$

Ha: at least one $b \neq 0$

where b_1 to b_7 are the coefficients of each independent variable. The critical (rejection) region to test the null hypothesis is:

$$\text{Reject } H_0 \text{ if } F_0 > F_{\alpha, v_1, v_2}$$

where F_{α, v_1, v_2} is the F-value of F-distribution with v_1, v_2 degrees of freedom which is exceeded with probability α.

Amongst seven independent variables, V11 and V13 are quantitative raw variables as a measure of firm size; the remaining five are qualitative ones (measured from a seven point bi-polar rating scale).

The second model is represented by nine independent variables including one

dummy variable, D_2, which takes a value of one when the export activity refers to construction and zero value otherwise.

The model specification, using the one dummy variable, is also given in a linear form:

$$V14 = b_0 + b_1V20 + b_2V22 + b_3V28 + b_4V29 + b_5V31 + b_6V32 + b_7V33 + b_8V11 + b_9D_2 + e \quad (2)$$

where V14 = high export volume in 1986: US 0.1M$

V20 = reputation and past record

V22 = experience of tender process

V31 = negotiating ability with foreign government officials

D_2 = export activity (construction)

V28, V29, V32, V33 and V11 were defined previously in equation (1).

The null hypothesis that there is no relationship between export volume and the nine independent variables is represented as follows:

H_0: $b_1 = b_2 = b_3 = b_4 = b_5 = b_6 = b_7 = b_8 = b_9 = 0$

Ha: at least one $b \neq 0$

2.2 Regression Results

The test results for equation (1) are presented in Table 2.1. In step one, MAXR procedure entered V28 (mutual economic cooperation) first as the best one-variable model with R^2 equal to 21.2%. As shown in the table, the predictive power of the model increased to 41.4% when V11 (number of employees) was included, to 53.1% for V32 (quality guarantee of products exported), and to 61.4% for V29 (mutual cooperation with a consulting firm). When all seven variables were included, the predictive power of the model increased to 72.9%.

According to the output of SPSS Multiple Regression Analysis, F_0 is 10.772 and $F_{0.025,7,29}$ is 2.78[9]. Therefore, H_0 is rejected ($F_0 > F_{0.025,7,29}$) and we can conclude that there is a significant difference in the coefficients of each independent variable.

<Table 2.1> Regression Results as a Measure of Export Volume

Variable Number	Factors	Coefficients of Intercept	F Value	F Improvement	Adj R^2
V28(1)	Mutual economic cooperation	619.2	10.360[a]	.212	
V11(2)	Number of employees	.108	12.4361[a]	414	
V32(3)	Quality guarantee of product exported	471.4	0.512[a]	.531	
V29(4)	Mutual cooperation with a consulting firm	443.8	5.772[c]	614	.662
V33(5)	Financial arrangements	407.0	9.220[b]	.675	
V13(6)	Sales volume in 1986	.318	4.280[d]	714	
V21(7)	Competent knowledge of pla and construction markets	-251.4	1.609	729	
b_0	Constant	2960.0	5.154[d]		
	Overall		10.772[a]	.729	.662

Source: The output of SPSS (Regression Analysis) for question No.2 and 3.

Note: The numbers in parentheses denote the sequence in which each variable entered the model, and [a, b, c, d] represent the significance level of 0.1%, 1%, 2.5% and 5%, respectively.

The regression results in Table 2.1 indicate that about 73.0% of export volume is explained by these explanatory variables at 0.000 significance level. The results also indicate that the high export volume of plant and construction exporters is more strongly influenced by mutual economic cooperation and number of employees rather that by sales volume and competent knowledge of the overseas plant and construction markets.

A linear form of the regression model can be represented as follows:

High export volume = −2960.0 + 619.2V28 + 0.108V11 + 471.4V32
−443.8V29 + 407.0V33 + 0.318V13 − 251.4V21 + e

The regression model of equation (1) does not suffer from multi−collinearity problem[10] because the largest inter−correlation coefficient between

dependent variables is smaller than 0.40.

The test results for equation (2), using one dummy variable, are presented in Table 2.2. Among the nine variables, V28 again entered first as the best one-variable model with R^2 equal to 21.2%. The predictive power of the model increased up to 85.1% after all nine explanatory variables entered equation (2). That is to say, about 85% of high export volume is explained by these nine variables in the model at 0.000 significance level.

<Table 2.2>

Regression Results Using Dummy Variable As A Measure of Export Volume

Coefficient of

Variable Number	Factors	Intercept	F Value	F Improvement	Adj R^2
V28(1)	Mutual economic cooperation	827.1	26.381[a]	.212	
V11(2)	Number of employees	.110	24.157[a]	.414	
D_2(3)	Construction	1760.5	25.359[a]	.548	
V29(4)	Mutual cooperation with a consulting firm	-373.2	6.098[c]	.653	
V32(5)	Quality guarantee of product exported	406.0	11.351[a]	.744	.800
V22(6)	Experience of tender process	-301.6	6.287[c]	.779	
V20(7)	Reputation and past records	368.5	3.689[d]	.801	
V33(8)	Financial arrangements	277.4	6.581[b]	.829	
V31(9)	Negotiating ability with foreign government officials	284.7	3.905[d]	.851	
b_0	Constant	-4094.8	13.274[a]		
	Overall		16.547[a]	.851	.800

Source: The output of SPSS (Multiple Regression Analysis) for question No.2 and No.3.

Note: The numbers in parentheses denote the sequence in which each variable entered the model, and [a, b, c, d] represent the significance level of 0.1%, 1%, 2.5% and 5%, respectively.

The coefficients of V28 and V11 among the nine independent variables are highly significant (at the 0.1% level), suggesting that mutual economic cooperation (trade, joint-venture, loans and technology supply) and the size variable, number of employees, contribute to export volume in the model containing the dummy variable (D_2).

Comparing D_1(plant) with D_2(construction), the coefficient of D_1 is negative and statistically insignificant. Thus, D_1(plant) was not included in equation (2). However, that of D_2 is positive and statistically significant (at the 0.5% level), suggesting that the high export volume of plant and construction exporters can be explained not by plant exports but by construction exports. This result might arise because: (1) the export volume(group mean of 15 construction export firms) of construction firms is about five times as much as that(group mean of 10 plant export firms) of plant exporters (US 16.7M$ vs. 3.3M$) and (2) the sales volume(group mean) of construction firms is about two and half times as much as that of plant exporters (US 972M4 vs. 394M$).

Equation (2) in linear form can be represented as follows:

$$\begin{aligned}\text{High export volume} = {} & -4094.8 + 827.1V28 + 0.110V11 + 1780.5D_2 \\ & -373.2V29 + 406.0V32 - 301.6V22 + 368.5V20 \\ & + 277.4V33 - 284.7V31 + e\end{aligned}$$

According to the output of SPSS Multiple Regression Analysis, using one dummy variable, F_0 is 16.547 and $F_{0.025,9,26}$ is 2.65[9]. Thus, the null hypothesis is again rejected ($F_0 > F_{0.025,9,26}$), and we can conclude that there is a significant difference in the coefficients of each independent variable and the two hypotheses defined above (H_1 and H_2) can be accepted.

The regression model of equation (2) does not suffer from a multi-collinearity problem [10] because the largest inter-correlation coefficient between dependent variables is smaller than 0.57.

Comparing Table 2.1 with Table 2.2, the predictive power of the model increased from 67.7% to 75.2%, most of which may be attributed to the dummy variable, D_2. That is to say, discrimination by export activity (construction) improves the predictive power of the export success (high export volume)

model.

It is expected that the above models could be used as a guideline for predicting export success in the international plant and construction industry.

3. A Regression Model of Export Failure in The Plant and Construction Industry

The sample firms analyzed in this chapter are the same as those of the previous model. Two regression models are again presented in this chapter with the same method used in the previous one.

3.1 Tests

We can test the following hypotheses:

H_1: Export failure in plant and construction markets is determined both by firm size and by various qualitative variables.

H_2: In addition, at least one dummy variable to represent export activity in (plant or construction) can add to the explanation of export failure (low export volume).

The stepwise regression procedure, the maximum R^2 improvement technique (MAXR), is again used to test the significance of the variables in the model.

The multiple regression model given in linear form is as follows:

$$V14 = b_0 + b_1V34 + b_2V36 + b_3V37 + b_4V40 + b_5V42 + b_6V45 + b_7V47 + b_8V11 + b_9V13 + e \quad (3)$$

where V14 = low export volume in 1986: US 0.1M$

V34 = price disadvantage

V36 = weak package (e, g. technology, installation, construction and funds)

V37 = late delivery date

V40 = lack of bid experience

V42 = unsatisfactory payment conditions

V45 = weak political and diplomatic relation between countries

V47 = lack of mutual economic co-operation (trade, joint-ventures, loans and technology supply)

V11 = number of employees

V13 = sales volume in 1986: USM$

The second model is represented by one dummy variable, D_1 , which takes a value of one when the export activity refers to plant and zero value otherwise.

The model specification, using the one dummy variable, is also given in linear form:

$$V14 = b_0 + b_1V35 + b_2V36 + b_3V40 + b_4V45 + b_5V46 + b_6V47 + b_7V11 + b_8V13 + b_9D_1 + e \quad (4)$$

where V14 = low expert volume in 1986: US 0.1 M$

V35 = low technology

V46 = lack of traditional cultural link

D_1 = export activity (plant)

V36, V40, V46, V11 and V13 were defined in equation (3).

The null hypothesis is again used to test whether there is a relationship between low export volume and nine independent variables.

Ho: $b_1 = b_2 = b_3 = b_4 = b_5 = b_6 = b_7 = b_8 = b_9 = 0$

Ha: at least one $b \neq 0$

3.2 Regression Results

Table 3.1 shows the regression results for equation (3).

Among the nine variables, the MAXR procedure entered V45 first as the best explained by these variables including D_1 at 0.000 significant level.

We can express the equation (3) in linear form as follows:

$$\text{Low export volume} = -10719.4 + 627.7V45 + .548V13 - 775.0V40 + 501.6V36 + .083V11 + 293.7V42 + 418.6V47$$

one-variable model with R^2 equal to 24.8%. As shown in the table, the predictive power of the model increased to 41.7% when V47 was included in step two, to 48.6% for V40, to 54.3% for V36, and to 58.6% for V11. When all nine variables were included in equation (3), the predictive power of the model

increased to 69.1%. That is to say, the regression results indicate that 69% of low export volume is explained by firm size and the qualitative variables at 0.000 significance level.

<Table 3.1>

Regression Results Using Dummy Variable As A Measure of Export Volume

Variable Number	Factors	Coefficient of Intercept	F Value	F Improvement	Adj R^2
V45(1)	weak political and diplomatic diplomatic relation	627.7	5.967[a]	.248	
V13(2)	Sales volume in 1986	.548	9.154[b]	.417	
V40(3)	Lack of bid experience	-775.0	13.658[a]	.486	
V36(4)	Weak package (e. g. techno-logy, construction and fund)	501.6	5.532[c]	.543	
V11(5)	Number of employees	.083	4.044[d]	.586	
V42(6)	Unsatisfactory payment conditions	293.7	3.740[d]	.616	0575
V47(7)	Lack of mutual economic cooperation	418.6	2.417	.634	
V34(8)	Price disadvantage	1129.9	3.168[a]	.658	
V37(9)	Late delivery date	-337.7	2.522	.691	
b_0	Constant	-10719.4	5.236[c]		
	Overall			.691	0575

Source: The output of SPSS (Multiple Regression Analysis) for question No.2 and No.4.

Note: The numbers in parentheses denote the sequence in which each variable entered the model, and [a, b, c, d] represent the significance level of 0.1%, 1%, 2.5% and 5%, respectively.

Among the nine explanatory variables, the coefficients of V45, V13 and V40 are statistically very significant (at the 2.2%, 0.6% and 0.1% level, respectively), suggesting that weak political and diplomatic relation between countries, low sales volume and lack of bid experience have an adverse effect

and represent serious barrier to exports.

We can express the equation (3) in linear form as follows:

$$\text{Low export volume} = -10719.4 + 627.7V45 + .548V13 - 775.0V40 + 501.6V36 + .083V11 + 293.7V42 + 418.6V47 + 1129.9V34 - 337.7V37 + e$$

Since Fo is 5.955 and $F_{o.025,9,24}$ is 2.70[9]. Hence, Ho is rejected ($F_o > F_{o.025,9,24}$) and we can conclude that there is a significant difference in the coefficients of each independent variable.

The regression model of equation (3) does not suffer from multi-collinearity problem[10] because the largest intercorrelation coefficient between dependent variables is smaller than 0.55.

Comparing Table 2.1 with Table 3.1, the predictive power of the export success model is stronger than that of the export failure model.

Table 3.2 shows the regression results, using the one dummy variable (D_1), for equation (4). Among the nine variables, the MAXR procedure again entered V45 first as the best one-variable model with R^2 equal to 24.8%.

As shown in the table, the increase in the predictive power of the model exactly matches Table 3.1 up to and including V11. When all nine variables, including D_1 (plant), entered equation (4), the predictive power of the model increased up to 70.2%. That is to say, about 70% of low export volume is explained by these variables including D_1 at 0.000 significance level.

we can express the equation (4) in linear form as follows:

$$\text{Low export volume} = -631.7 + 511.2V45 - .505V13 - 366.2V40 + 784.9V36 + .105V11 - 1356.3D_1 - 672.7V35 + 388.6V47 - 384.V46 + e$$

Since F_0 is 6.293 and $F_{0.025,9,24}$ is 2.70[9], Ho is also rejected ($F_0 > F_{0.025,9,24}$) and we can conclude that there is a significant difference in the coefficients of each independent variables. However, the regression model of equation (4) suffers from an extreme multi-collinearity problem[10] because the largest inter-correlation coefficient between the dependent variables is bigger than 0.80 (the simple correlation between V35 and V36: 0.846).

Therefore, there is no acceptable way to perform regression analysis using

the given set of independent variables.

It can be argued that whereas equation (3) could be used as a guideline for predicting export failure in the international plant and construction industry, equation (4) suffers from an extreme multi-collinearity problem.

In conclusion, the results of this study show that export successes and failures in plant and construction export markets are determined by firm size and various qualitative variables. The results also show that in addition to these variables, the one dummy variable (D_2) to represent export activity in construction can add to the explanation of export success.

<Table 3.2>

Regression Results Using Dummy Variable As A Measure of Export Volume

Variable Number	Factors	Coefficient of Intercept	F Value	F Improvement	Adj R^2
V45(1)	weak political and diplomatic relation	511.2	3.006[c]	.248	
V13(2)	Sales volume in 1986	.505	9.135[b]	.417	
V40(3)	Lack of bid experience	-366.2	2.994[a]	.486	
V36(4)	Weak package (e. g. technology, construction and fund)	784.9	5.570[c]	.543	
V11(5)	Number of employees	.105	6.502[c]	.586	
D_1 (6)	Plant (export activity)	-1356.3	4.945[c]	.621	.591
V35(7)	Low technology	-672.7	3.845[d]	.654	
V47(8)	Lack of mutual economic cooperation	388.6	2.271	.677	
V46(9)	Lack of traditional cultural link	384.9	2.078	.702	
b_0	Constant	-631.7	0.243		
	Overall		6.293[a]	.702	.591

Source: The output of SPSS (Multiple Regression Analysis) for question No.2 and No.7.

Note: The numbers in parentheses denote the sequence in which each variable entered the model, and [a, b, c, d] represent the significance level of 0.1%, 1%, 2.5% and 5%, respectively.

The data used in this study was published in 1987; therefore, it should be updated. Unfortunately, there have not been similar studies since 1987.

If a researcher successfully collects data from worldwide extensive sample firms, updates data, and extracts a new success and failure model, and if Korean industrial plants and construction export companies apply this model successfully, their export volume will increase significantly.

4. Conclusion

The overall objective of this study is to explore the feasibility of a sustained export performance in the plant and overseas construction industry by an analysis of its international competitiveness and technological competence. The empirical work of this study relates to a 62 chosen sample of Korean and non-Korean firms in the plant and construction industry sector. Primary data was collected through a comprehensive questionnaire survey administered to 29 plant and 33 construction firms in twelve countries, including 42 Korean firms.

Data analysis was carried out using SPSS statistical technique such as Multiple Regression in order to examine the linear relationship among variables.

The findings of the study indicate that exports success and failure in plant and construction export markets is determined by firm size and by various qualitative variables. In addition to these variables, the one dummy variable (D_2 for construction) to represent export activity in construction adds to the explanation of export success.

The high export volume (export success)of plant and construction exporters is more strongly influenced by mutual economic cooperation and number of employees than by sales volume and competent knowledge of the plant and construction markets. It was also found that weak political and diplomatic relation between countries, low sales volume and lack of bid experience have an adverse effect and represent serious barriers to exports.

The predictive power of the model is improved with the inclusion of the dummy variable. In other words, the industry effect (construction) cannot by ignored in explaining high export volume.

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[8] Lyu, K. Y., Internationalization of Korea Industry: A Study of the Performance of the Plant and Construction Industry, Ph.D Thesis, University of Manchester Institute of Science and Technology, Manchester, U. K., 1989, pp.302-315.

[9] Donald L. Harnett, Statistical Methods, Third edition (Addition-Wesley Publishing Company), Appendix B pp. A-51, Table Ⅷ(b), Critical Values of the F-Distribution(α=.025), 1982.

[10] Norman H. Nie et al, SPSS: Statistical Package for the Social Science (2nd Edition), McGraw-Hill Book Co., New York, pp. 340-341, 1975.

APPENDIX 1

PLANT AND CONSTRUCTION EXPORTS QUESTIONNAIRE

In answering the questions, please answer in the way that matters to yourself as a project manager or employer. A total of four questions are included in this questionnaire, which will take about ten minutes to complete.

Please answer the questions with the information requested or by ticking the appropriate box.

1. a) Name of the firm: .....

b) Export activity

1) plant ☐

2) overseas construction ☐

3) both 1) and 2) ☐

c) What is the nature of your firm's operation?

1) industrial plant exports as a registered firm ☐

2) overseas construction company ☐

If you answered " c 1)", please go on to question "1 d)".
If not, go to question 2.

d) In which industrial sector is your firm represented? (Tick one).

1) machinery manufacturing industry ☐

2) general manufacturing industry ☐

3) engineering ☐

4) trade ☐

2. What is the size of your firm in terms of

a) number of employees .....

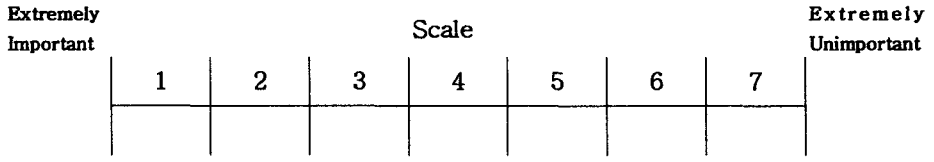
b) issued share capital (US$) .....

c) sales volume in 1986 (US$) .....

d) export volume in 1986 (US$) .....

e) the ratio of R & D expenditure to sale (%) .....

3. For each of the possible factors, shown below, for <u>successful bids (tenders) in plant/construction exports,</u> if you feel the factor is extremely important, pick a number from the far left side of the scale and write in the box. If you feel it is extremely unimportant, pick a number from the far right, and if you feel the importance is between these extremes, pick a number from some place in the middle of the scale to show your opinion.



<u>Sucess factors</u>

a) technological attributes ☐

b) competitive price ☐

c) attractive bid package ☐
(e. g. technology, installation, construction, funds)

d) delivery date ☐

e) reputation and past record ☐

f) competent knowledge of the overseas plant and construction markets ☐

g) experience of tender process ☐

h) after-sales service ☐

i) competitive payment conditions ☐

j) high ratio of local (on-the-spot) procurement (manpower, installation, machinery and tools) ☐

k) close political and diplomatic relations between countries ☐

l) traditional cultural link ☐

m) mutual economic co-operation (trade, joint-ventures, loans and technology supply) ☐

n) mutual co-operative arrangements, with a consulting firm taking charge of feasibility study ☐

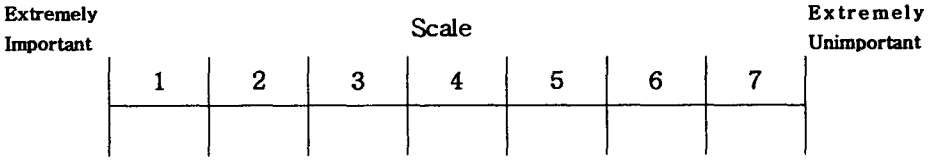
o) member of international consortium ☐

p) negotiating ability with foreign government officials ☐

q) quality guarantee of products exported ☐

r) fund arrangements ☐

4. In the same manner, give your opinions of the following possible reasons for <u>bid failure</u> in the plant and construction exports?



a) price disadvantage ☐

b) low technology ☐

c) weak package (e. g. technology, installation, construction and funds) ☐

d) date of delivery ☐

e) poor reputation and past record ☐

f) inadequate knowledge of the overseas plant and construction markets ☐

g) lack of bid experience ☐

h) poor after-sales service ☐

i) unsatisfactory payment conditions ☐

j) excessive competition among native firms ☐

k) low ratio of local (on-the-spot) procurement (manpower, installation, machinery and tools) ☐

l) weak political and diplomatic relation between countries ☐

m) lack of traditional cultural link ☐

n) lack of mutual economic co-operation ☐

o) inadequate mutual co-operative relations with a consulting firm taking charge of feasibility study ☐

p) non-member of international consortium ☐

q) lack of negotiating ability with foreign government officials ☐

r) lack of guarantee of products exported ☐

s) inability to offer acceptance funding arrangements ☐

APPENDIX 2

THE 20 NON-KOREAN INTERNATIONAL CONTRACTORS SELECTED (AMONG THE TOP 160 FROM EXPORTING COUNTRIES)

U.S.A (5)
Brown & Root Inc.
Foster Wheeler Corp.
Morrison-Knudsen Corp.
The parsons Corp.
An Anonymous Co.

Japan (3)
Chiyoda Chemical Engrg. & Const. Co., Ltd.
Kajima Corp.
Nishinatsu Const. Co., Ltd.

Italy (3)
Italimpianti SpA
Saipem SpA
Snamprogetti SpA

Germany (2)
Krupp-Polysius AG
Coutinho, Cargo & Co. AG

United Kingdom (1)
Lilley Construction Ltd

France (1)
DUMEZ

Belgium (1)
S.B.B.M. & Six Construct SA, Les Entreprises

Turkey (1)
Enka Construction & Industry Co., Ltd

Sweden (1)
Skanska AB

Taiwan (1)
Ret-Ser Engineering Agency

Singapore (1)
Boskalis International BV

Source: Engineering News-Record, July 17, 1986

THE SELECTED 42 KOREAN INTERNATIONAL CONTRACTORS

Plant Exporters (23)	Construction Firms (19)
Daelim Engineering Co., Ltd.	Daelim Industrial Co., Ltd.
Daewoo Corporation	Daewoo Corporation
Daewoo Engineering Co., Ltd.	Dong Ah Const. Industrial Co. Ltd.
Daewoo Heavy Industries, Ltd.	Dongsan Construction Co., Ltd.
Daewoo Shipbuilding and Heavy Machinery Ltd.	Hanbo Construction Co., Ltd.
Golden Bell Trading Co., Ltd.	Hanil Development Co., Ltd.
Hyosung Corporation	Hyundai Engrg. & Constrn Co., Ltd.
Hyosung Industries Co., Ltd.	Hyundai Industrial Co., Ltd.
Hyundai Corporation (2)	Korea Heavy Industries and Construction Co., Ltd.
Hyundai Engineering Co., Ltd.	Kuk Dong Const. Co., Ltd.
Hyundai Heavy Industries, Ltd.	Lucky Development Co., Ltd.
Kolon Engineering INC.	Miryung Construction Co., Ltd.
Kolon International Corp.	Poong Lim Industrial Co., Ltd.
Kukje ICC Corporation	Samsung Construction Co., Ltd.
Kukje Machinery Co., Ltd.	Samwhan Corporation
Lotte Engrg. & Machinery MFG. Co., Ltd.	Shinsung Corporation
Lucky-Goldstar International Corp.	Shinwha Engineering and Constrn Co., Ltd.
Lucky Engineering Co., Ltd.	Ssangyong Construction Co., Ltd.
Samsung Co., Ltd.	You One Construction Co., Ltd.
Samsung Shipbuilding and Heavy Industries Co., Ltd.	
SSangyong Corporation	
Sunkyong Ltd.	