A Comparative Study on the Impact of the Capabilities of Manufacturing and Service Firms on Export Performance: Focusing on the Interaction Effect of R&D

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This paper empirically examined the impact of firm capabilities and the interaction effect of R&D on the export performance of service firms in comparison with manufacturing firms. To this end, a total of 1,968 Korean firms were analyzed: 243 from service and 1,725 from manufacturing, and two-stage analysis was performed using multiple regression and hierarchical regression analysis. This research confirmed that network and customer capabilities played critical roles in the internationalization of service firms and R&D positively interacted with entrepreneurship and customer capabilities for export performance. These findings suggest valuable policy considerations for government trade policy and academic motivation for further research on the capabilities and R&D of service firms.

Keywords: Manufacturing firms, Service firms, Export performance, Firm capabilities, R&D, Interaction effect, Innovation

Introduction

Service economy refers to a phenomenon where the importance and the weight of services grow in the economy. The relationship between the growth of service industries and overall economic growth has become stronger in the past two decades as the contribution of services to GDP and value added has increased. The trade barriers for services in global markets have been dramatically reduced under the WTO regime. Consequently, the internationalization of service firms has increased in importance. The performance of the internationalization has been represented by export performance. Following the resource-based view (RBV) in 1991, The relationship between firm capabilities and export performance has been widely researched. The research to date has tended to focus on manufacturing firms rather than services firms. Meanwhile, with the rise of the Fourth Industrial Revolution and the globalization of markets, companies seek competitiveness through technology innovation. R&D capability was regarded as a dynamic capability that strengthens the industrial ability of acquiring and maintaining predominance in industrycompetition[1].A significant amount of research exists regarding the relationship between R&D and firm performance, focusing on manufacturing firms.

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However, not enough research has been done on service firms because service R & D has many non-technological elements associated with organizational and marketing innovation[2].On the other hand, the key feature of the fourth industrial revolution is the creation of new services based on data, which will increase the importance of services in economic development. In this context, this study sought to confirm the impact of capabilities and R&D of service firms on export performance in comparison with manufacturing firms. The theoretical model is shown in Figure 1.

Conceptual Framework and Hypothesis Development

Barney argued that firms are composed of resources and capabilities that are sources of competitive advantage[3]. Capabilities have since become the subject of many studies. Since Schumpeter put forward the important role of technology innovation in economic development in 1911[4], innovation has been widely considered the most important driver affecting firm performance. Thereafter, many studies have been done to test the hypothesis of Schumpeter. Researchers have tried to verify the relationship between innovation and firm performance. Recent empirical studies have emphasized the role of innovation and entrepreneurship as critical factors for firm performance[5].

However, service innovation has been perceived as facilitators, imitators, and passive reactors of

(1) 1st Phase Analysis (Multiple Regression)

(2) 2ndPhase Analysis (Hierarchical Regression for Interaction Effect Analysis)
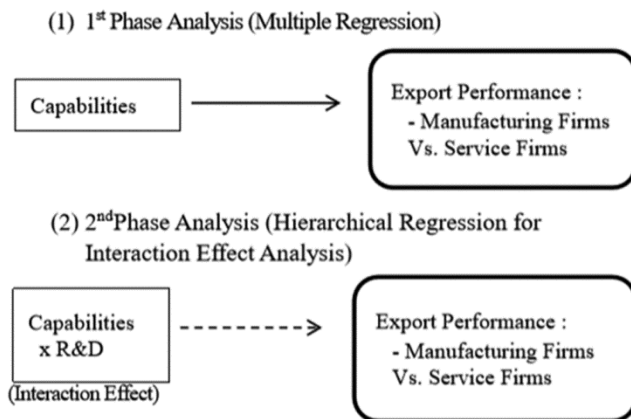

Fig. 1 — Theoretical Model of the Role of Capabilities and R&D on Export Performance of Service and Manufacturing Firm

manufacturing innovation[6].Yetthe service industries have become the largest elements in most developed countries, and the EU Expert Group on Innovation in Services noted that the potential for service innovation will be an important factor in future economic growth[7].Accordingly, the number of articles on service innovation has increased considerably in the past 25 years. They have dealt with various topics such as customer, organization, strategies, etc. Among them, customer involvement was recently claimed to be the most important element of service innovation[8]. In this study, we empirically examined the impact of firm capability on export performance and verified the role of R&D in the relationship between capabilities and performance in terms of interaction effect. Based on these analysis results, we compared manufacturing and service firms. The hypotheses were established as follows.

H1: The capabilities of *manufacturing firms* will have a positive effect on export performance.
- In hypothesis H1, capabilities include eight factors: Entrepreneurship, Marketing Capability, Network Capabilities, Customer Capability, Product Differentiation, Human Resources, Financial, and R&D.

H2: The capabilities of *service firms* will have a positive effect on export performance.
- In hypothesis H2, the capabilities are the same as in H1.

H3: R&D will positively interact with the capabilities of *manufacturing firms* for export performance.
- In hypothesis H3, the capabilities include the same factors as in H1, except R&D. R&D was used as interaction variable.

H4: R&D will positively interact with capabilities of *service firms* regarding export performance
- In this hypothesis, the same variables as in H3 were tested.

Method

To test our research hypotheses, we used Korea's High Growth Export Company data collected by KOTRA (Korea Trade & Investment Promotion Agency) in 2015. In total, data for 1,968 companies were analyzed, of which 243 belonged to the service sector and 1,725 to the manufacturing sector. In this report, KOTRA defined high-growth exporters as firms that have trading systems and export more than $1 million a year. The analysis was conducted in two stages. First, the impact of firm capability on export performance was observed using multiple regression analysis. At this stage, manufacturing firms and service firms were analyzed separately and compared with each other. Second, the interaction effects between R&D and other capabilities were tested with the hierarchical regression analysis method, and compared with each other as in the preceding stage.

As a dependent variable representing export performance, the export ratios (sales/exports) most commonly used in previous studies were established. Sousa confirmed that 36% of the empirical analysis research papers published by 2004 used export ratios as the indicator of export performance[9].The eight capabilities mentioned in H1 and H2 were set as independent variables. Firm age and size (number of employees) were used as control variables. In order to secure the stability of this regression analysis model, a multi collinearity test was performed between variables. Tolerance and Variation Inflation Factor (VIF) showed that there was no problem of multi collinearity. For hierarchical regression analysis, three models were tested in turn. Model 1, the basic model, was for analyzing the relationship between the seven capabilities except R&D and export performance, using multiple regression analysis. In model2, R&D was input as an additional independent variable, which made eight variables in total. Multiple regression analysis was also used in this model. In model 3, based on model 2, the interaction terms between the independent variables and R&D were created and analyzed simultaneously. The basic analysis equations are as follows.

$$y^{WOE} = \alpha + \beta_1 \text{ Ent} + \beta_2 \text{ Market} + \beta_3 \text{ Network} + \beta_4 \text{ Customer} + \beta_5 \text{ product} + \beta_6 \text{ Hr} + \beta_7 \text{ Fin} + \beta_8 \text{ R\&D} + \beta_9 \text{ Emp} + \beta_{10} \text{ Yr} + \beta_{11} \text{ EntX R\&D} + \beta_{12}$$

Market X R&D $+\beta_{13}$ Network X R&D $+\beta_{14}$ Customer X R&D $+ \beta_{15}$ Product X R&D $+ \beta_{16}$ FinX R&D $+$ β_{17} Emp X R&D $+ \beta_{18}$ YrX R&D $+ \in$

y^{WOE} (weight of export) : Export/Sales,

    Ent : Entrepreneurship,
    Market: Marketing Capability,
    Network : Network Capabilities,
    Customer : Customer capability,
    Product : Product Differentiation Capabilities,
    Hr : Human Resource Capabilities,
    Fin : Financial Capabilities,
    R&D : R&D, Emp : Number of Employees,
    Yr : Firm Age

Results and Discussions

As described above, three models were tested consecutively for the hierarchical regression analysis. Among them, it was analyzed that model 3's R^2 was the highest. Therefore, we will describe the results focusing on model 3. First, as presented in model 3 of table 1 (manufacturing firms), firm age, size(number of employees), marketing, product differentiation, human resources, and financial capability have significant effects on export performance. With regard to the interaction effect of R&D, entrepreneurship only interacted positively with R&D for export performance. The change of R^2 value and its significance in stepwise models was changed as follows. In model 1, the regression model was F = 21.497 and was significant at p <.001. R^2 was 31.8%. In model 2, which includes interaction variable R& D, the regression model was significant at p <.001 for F = 20.187, and R^2 was 32.5%, which was 0.7% higher than that of model 1. In model 3, the regression model was F = 13.240, which was significant at p <.001, and R^2 was 34.1%, which was 1.1% higher than that of model 2. Therefore, we presented <Table 1> as the result of the analysis for model 3.

Second, as shown in model 3 in table 2 (service firms), firm age, network, customer, financial, entrepreneurship, and R&D have a significant effect on export performance. The interaction effects of R&D on export performance were significant with customer capability and entrepreneurship. Regarding the change of R^2 value and its significance, the regression model of model 1 was F = 11.375, p <.001, and R^2 was 30.5%. In model 2, which includes interaction variable, R&D capability, the regression model was significant

Table 1 — Capabilities of Manufacturing Firm and Export Performance (N=1725)

Items	B	t
	Model 3 : Manufacturing Firms	
(Constant)	125.849	4.991***
Yr	.297	4.759***
Emp	.010	2.506*
Ent(A)	-.075	-.703
Market(B)	.416	4.481***
Network(C)	.163	1.539
Customer(D)	-.088	-.685
Product(E)	.176	2.196*
Hr(F)	.334	3.823***
Fin(G)	.512	5.581***
R&D(H)	.105	.745
B × H	-.003	-.529
C × H	.000	.041
D × H	-.011	-1.490
E × H	-.009	-1.790
F × H	.009	1.916
G × H	.004	.839
A × H	.013	2.036*
F	13.240***	
R2	.341	
Adjusted R2	.116	
R Square Change	.011**	

*p<.05 **p<.01 ***p<.001

Table 2 — Capabilities of Service Firm and Export Performance (N=243)

Items	B	t
	Model 3 : Service Firms	
(Constant)	4.387	.042
Yr	2.401	6.556***
Emp	.002	.246
Ent(A)	2.751	4.781***
Market(B)	.037	.062
Network(C)	1.736	2.157*
Customer(D)	2.500	5.321***
Product(E)	-.067	-.273
Hr(F)	-.254	-1.045
Fin(G)	1.730	3.434**
R&D(H)	1.324	2.247*
B × H	-.120	-2.583
C × H	.011	.212
D × H	.128	5.439***
E × H	-.010	-.702
F × H	.012	.620
G × H	-.039	-1.827
A × H	.159	4.459***
F	38.294***	
R2	.543	
Adjusted R2	.524	
R Square Change	.097***	

*p<.05 **p<.01 ***p<.001

at F <.001 for F = 27.914, and R^2 was 44.6%, which was 24.1% higher than that of model 1. Finally, in model 3, where interaction variables were tested,the regression model was significant at F = .02, p <.001, and R^2 was 54.3%, which was 9.7% higher than model 2. <Table 2> shows the results of the test ofmodel 3 for service firms.

Conclusion

The findings from this research have implications for the difference in capabilities and R&D roles of service and manufacturing firms for export. They can be summarized as follows. First, this study confirmed that in the global market, service firms are required to have different capabilities than manufacturing firms. The results indicated that entrepreneurship, network, customer and R&D capabilities were important for service firms while marketing, products, human resources and financial capabilities were important for manufacturing firms. But one interesting result of this research was that in the case of manufacturing firms, entrepreneurship did not have a significant impact on performance. This differed from the conclusions of prior studies. Most researchers have reported a positive relationship between them[10,11,12]. The reason for this result can be attributed to the characteristics of the data. This test used data from a list of Korean export firms that were in a growth phase in the global markets. Therefore, it can be reasoned that entrepreneurship influenced performance differently depending on the phase of growth. Second, this study demonstrated that the R&D effect of manufacturing firms on export performance was not significant. This is consistent with the conclusions of some previous studies[13,14]. Contrarily, for service firms, R&D had a positively significant effect on export performance. As for the interaction effect of R&D, it was significant with entrepreneurship for both manufacturing and service firms. However, for service firms, R&D has interaction effects with customer capability as well. In conclusion, this study confirmed the strategic importance of customer-based R&D, network-related marketing and entrepreneurship for the successful internationalization of service firms. For service firms, network capabilities have been identified as playing an important role in export marketing. This is because, due to the nature of the service, responding to changes in local market demand is a source of competitive advantage for them[15].From a governmental policy standpoint, these findings indicate that trade policies related to service firms should be planned and implemented within an overseas investment policy framework because customer involvement and network abilities can be acquired through firm localization. Academically, this research can contribute to the expansion of research scope into comparative studies and motivate further studies on the capabilities and R&D of service firms. However, the limitations of this study are that variables from manufacturing-based export literature were applied for comparison. In this regard, there is a need for further study to explore new capabilities suitable for service firms.

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