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## **PLATFORM STRATEGY: AN EMPIRICAL STUDY ON THE DETERMINANTS OF PLATFORM SELECTION OF APPLICATION DEVELOPERS**

### **ABSTRACT**

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This paper is to prove empirically that the cooperative business structure and conflict control capability of a platform leader and that the complementarity of a platform will have positive impacts on whether complementors select specific platforms in 245 platform selection examples of 99 application developers. Past research has not been sufficient regarding platform selection, but has been similar to other research on ERP platforms. Therefore, it is very meaningful to make an empirical study on the platform selection of complementors, which has not yet been performed. As a result, it is important for platform leaders to establish their own cooperative business structures and secure the complementarity of their platforms. Therefore, platform leaders should create more transaction opportunities by helping complementors to develop more complements and making business ecosystems grow more and more.

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*Key Words: platform leader, complementor, cooperative business structure, conflict control, complementarity*

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## INTRODUCTION

Platforms have been extending more and more. The web platform is extending to mobile areas as it has been extended from a closed system to an open system. The new platform in the mobile market is developing into the integrated platform to be applicable to mobile terminals, cars, and electronics. Handset manufacturers, internet service providers, and computer manufacturers are expanding their businesses by specifying mobile platform strategies. Closed control with frequency and networks is centric for web 2.0 and platform strategy.

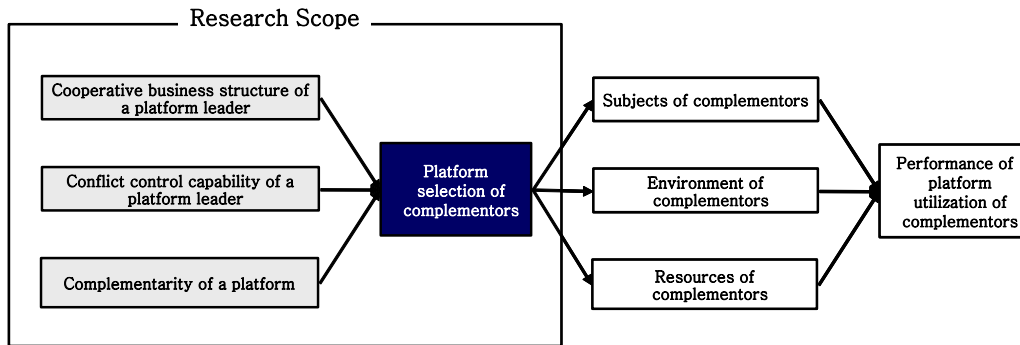
This paper aims to prove empirically that cooperative business structure and conflict control capabilities of a platform leader and platform complementarity will have positive impacts on whether complementors select specific platforms, using 245 platform selection examples of 99 application developers.

Past research has been insufficient regarding platform selection, but making similar research on ERP platforms. Therefore, it is very meaningful to make an empirical research on the platform selection of complementors, which has not yet been performed. Particularly, it takes into consideration size and age of complementors, platform life cycle, platform functional characteristics, reputation of platform leaders, and implementation. And this paper contributes on the research on platform leadership by considering differentiated variables from existing research.

The past research on the determinants of mobile platform selection has been particularly insufficient. Oliver (2009) performed the survey on the required platform characteristics of five major mobile platforms such as Android, RIM, OS X, Symbian and Windows Mobile. Therefore we studied the determinants of ERP platforms as a similar study on the determinants of the mobile platform selection of complementors.

The research on the platform can be divided into platform selection and platform utilization performance. This paper focuses on platform selection. Regarding platform selection, most research has been focusing on ERP selection. This paper can make up for the platform research from platform leadership (Cusumano and Gawer, 2002) including four major factors such as scope of the firm, external relationships with complementors, internal organization, and platform technology.

Figure 1: Research scope



## LITERATURE REVIEW

### Platform leadership

Cusumano and Gawer (2002) proposed scope of the firm, external relationships with the complementors, internal organization, and platform technology as the determinants of platform leadership. First, scope of the firm defined as the adjustment of internal jobs and jobs from external complementors. For this, it is important to build capabilities to create complements. Then, product platforms require complements to create more value and platform leaders should promote business ecosystems for platform leaders and complementors.

Second, customers, suppliers and business partners as external cooperative stakeholders can form competitive or cooperative relationships with platform leaders. Therefore platform leaders should build capabilities for the balance between cooperation and competition.

Third, internal organization of a platform leader is also important to resolve internal and external conflicts. Platform leaders should resolve conflicts by organizing internally, setting the goals of internal processes, and acquiring the agreements from external complementors. Their senior executives should arbitrate when conflicts arise among company units — and to foster an organizational culture that encourages debate and tolerates ambiguity. Their management should understand that platforms are complex systems calling for neutral industry brokers to oversee development of the system through external collaboration.

Three closely related issues particularly concerned with platform leadership. First, even successful platform leaders can fall prey to problems that arise from too much of a platform-centric mentality. There are other ways to compete. Second, platform leaders can become so tied to certain technologies that they find it difficult to evolve their platforms. Evolution is often important to long-term survival. And third, there may be some confusion as to whether market leadership is a necessary precondition for platform leadership.

Platform leadership can be interpreted in the perspectives of transaction costs and network externality. First, in the perspective of transaction cost theory, transaction efficiency from internalization would be decreased due to asset commonality by platform openness. More values would be created by high frequency of transactions and participation of complementors when a platform is open.

Second, in the perspective of network externality (Cusumano and Gawer, 2002), closed software is standardized and monopolized by network effect. That is, it is monopolized due network externality and economies of scale. However, open software reduces customer lock-in effect and increases compatibility by source openness. Complementors pay more switching costs for maintenance, learning, and installing. This is opposite phenomenon that low lock-in effect drives low switching cost. Low lock-in effect makes complementors change the platform easily and reduces the interdependence between a platform leader and complementors. This reduces the importance of the balanced act of competition and cooperation. Also, the negative impact of conflicts would be eliminated.

### **Determinants of platform selection**

We performed literature reviews on the determinants of ERP platform selection as a similar research on mobile platform selection. Keil and Tiwana (2006) summarized cost, credibility, functionality, usability, flexibility, implementability, and reputation. Kumar et al. (2002, 2003) identified functionality, credibility, organizational fit with the mother company, best practices, module integration, technology application, vendor reputation, upgradability, compatibility, service and support infrastructure, customization, low purchase costs, and fit with business processes. Berchet and Habchi (2005) studied more about the implementation of ERP systems. New systems can improve organization

efficiency, drive transparency and real-time management, and encourage co-working among organizational units.

Wei et al. (2005) identified 6 factors for software itself and 3 factors for vendors: (1) total cost, (2) implementation time, (3) functionality, (4) user friendliness, (5) flexibility, (6) trustiness, (7) reputation, (8) technology capability, and (9) services. These factors are processed with weights in an analytic hierarchy process.

Ayagg and Özdemir (2007) used similar, but advanced AHP methodology. Related factors are system costs for licensing, maintenance and infrastructure, vendor support about reputation, consulting performance, R&D competences, and technology support capability, flexibility for upgrade, integration and internal development, functionality for module completion, functional fitness and complementary level, credibility, usability, and technology advance.

Bueno and Salmeron (2008) identified 27 factors for ERP evaluation: (1) applicability to solution by industry, (2) system credibility, (3) integration with existing IT systems, (4) trustiness on ERP systems, (5) modulization, (6) implementability of required functions of existing systems, (7) on-time delivery capabilities of required information, (8) intuitive problem solving for ERP systems, (9) software costs, (10) consulting fees, (11) maintenance costs, (12) hardware requirements, (13) expert team, (14) high average implementation time, (15) complexity of measurement, (16) project planning, (17) objective concept definition, (18) employee training, (19) average age of employees, (20) continuous training for decision makers, (21) recommendations for users, (22) traditional organization culture, (23) complexity of organization structure, (24) high performance, (25) employees and firm size, (26) traditional organization strategy, and (27) complexity of processes.

Han (2004) proposed the determinants of ERP selection on vendors, functionality, expandability, and technology. Nah and Delgado (2006) studied the implementation and the upgrade of ERP systems. They recognized ERP implementation as the most important stage for ERP selection.

Verville and Halington (2003) mentioned the factors on systems such as improvement for existing systems, customization, user interfaces, compatibility, integration with existing infrastructure, solution architecture, system expansion, training performance, security, and implementation, and the factors on vendors such as implementation support, connection with partners, vision, financial status, market shares, customer support, product awareness,

product scope, references, reputation, vendor's strategic status, qualification, experiences, success history, proposal quality, implementation plan, implementation service, implementation strategy, and support services.

Umble et al. (2003) discussed pricing, supplier support, implementability, appropriateness, flexibility, technology risks, and corporate valuation.

Rao (2000) presented the determinants of ERP selection of Indian small and medium enterprises such as receptiveness, knowledge provision, local support, technical upgrade, and latest technologies.

Fisher et al. (2004) evaluated ERP packages by performing data envelopment analysis (DEA). The evaluating factors were service and support, training, extensibility, implementation flexibility, integration, and implementation time.

Bernroider and Stix (2006) proposed accounting, logistics, purchasing, local needs, service and engineering, sales, and project management by performing utility ranking method and data envelopment analysis.

Yang et al. (2007) proposed the determinants of ERP selection such as system technology, database, development tool, compatibility, efficiency, completeness, quality of consulting service, system training, hardware requirements, upgradability, module fitness, extensibility, flexibility, usability, implementation plan management, maintenance, hardware costs, consulting fees, training fees, quality of customer service, technical support, and performance.

## **HYPOTHESES**

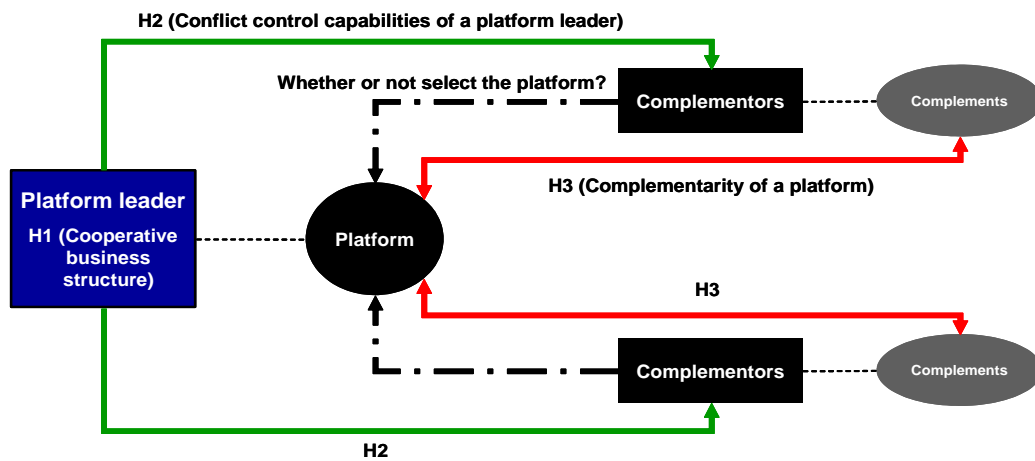
This case study on the Korean ubiquitous applied solution developer, which was established in 1997 and raised 38 million won in 2007 is to identify the determinants and processes of platform selection of a mobile application developer. This is one of the logical axes in establishing hypotheses.

When the determinants of the platform selection of the company are compared with those of existing research, most factors on the platform itself, platform leaders, and implementation projects are redundant. Therefore we will analyze these new criteria in the perspective of platform leadership expressing scope of the firm, external relationship with complementors, internal organization and platform technology.

The hypothesis structure in this paper is as follows. Hypothesis 1 is related to the cooperative business structure of a platform leader compared to those of complementors.

Hypothesis 2 is related to the conflict control capabilities of a platform leader. Hypothesis 3 is related to the characteristics of a platform itself, the complementarity between a platform and complements.

Figure 2: Structure of hypotheses



### Cooperative business structure of a platform leader

Establishing optimal core businesses of a platform leader is a key success factor in platform leadership (Cusumano and Gawer, 2002). The determinants of platform success are the opportunity seeking capabilities of a platform leader and the non-contractual relationship with complementors (Olleros, 2007). Collaborative relationship means that more than two companies participate directly in product development, production and marketing. On the other hand, cooperative relationship means that more than two companies have formal and informal networking for information sharing, training and market information provision. This paper defines the relationship between a platform leader and complementors as cooperative relationship. Market expansion through the increased participation of complementors requires the cooperative business structure of a platform leader to maximize the values of complementary markets (Cusumano and Gawer, 2002). The cooperative relationship would be maintained with the range as controlled by formal contracts between a platform leader and complementors in the closed platform environment in the traditional PC and communications industries. However, as platforms become open, more complementary and cooperative business structure are required. For

example, Micros intended to create business opportunities by maximizing the platform utilization opportunities of GPS applied application developers using Windows Mobiles. Palm encouraged external firms to develop about 8,500 applied applications, and NTT DoCoMo opened 40,000 websites for contents provision.

In platform leadership, scope of the firm means the business participation of complementors and the business structure of a platform leader. Platform leaders should drive complementary market expansion (Cusumano and Gawer, 2002). If a platform is open, a platform leader can make complementors participate in the market more aggressively and create more transaction opportunities.

For example, Nokia had retained the effective business model in handset manufacturing, contents provision, and platform development. Nokia could maximize their business performance by fostering complementary markets using Symbian. If Nokia changes Symbian to the closed platform, Nokia may form their business structure to incorporate vertical integrated to solve the issues of opportunism and information asymmetry. However, this does not fit the industry environment and strategic resource management.

The mandatory policy of 'WIPI' which is the Korean wireless internet software became de facto abolished. Due to this political change, global handset brands such as iPhone and Nokia phones would have the flexibility to be launched in the Korean market.

If global mobile platforms such as Symbian, OS X and Android open source codes, complementors do not have to pay licensing fees and can raise more revenues and transaction opportunities in the expanding ecosystems.

As the relationship between a platform leader and complementors is formal and contractual, cost competitiveness in technology patent and sourcing is very critical. While, as the industry is converged and the platform is open, the relationship between a platform leader and complementors becomes both formal and informal. Therefore, establishing cooperative business structure is critical to secure platform leadership through activating complement development.

*Hypothesis 1: The cooperative business structure of a platform leader is positively related to the platform selection of complementors.*



### **Conflict control capability of a platform leader**

Social Exchange Theory (Das and Teng, 2002; Druckman, 1998) was initially developed to examine interpersonal exchanges that are not purely economic. The organization has to enable social and economic outcomes in the exchange between a platform leader and complementors such that these outcomes outperform those obtainable in alternative exchange. Positive economic and social outcomes over time increase the platform leader and complementors' trust of each other and commitment to maintaining the exchange relationship. Commitment is important, as it is an exchange belief that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it.

Stakeholder Theory (Lacity and Wilcocks, 2000) could be applied when a platform leader must create efficient and effective communication with and between complementors to secure continued support from all platform leaders, to balance their interests and to make the complementary arrangement so that all complementors achieve their goals.

Contractual Theory (Lee, 1996) means that all contractual relationships bring transactions, prevent opportunism, reduce moral hazard, and protect the proprietary assets. All stakeholders should consider the appropriate management environment to reduce opportunistic behaviors and information asymmetry in efficient collaborative environment between platform leaders and complementors.

Formal Control Mechanism (Li et al., 2008; Grant and Baden-Fuller, 2004) mentioned that internal processes, internal policies and communication system would be established to acquire agreements from complementors regarding specification and standard.

Social Control Mechanism (Cusumano and Gawer, 2002; Li Y. et al., 2008) mentioned that trust with external stakeholders should be established by role separation of the organizational unit. We should perform detailed processes and evaluate internal and external conflicts to establish strategy and business goals. Top management should encourage effective debate and build organizational culture by accepting the different goal of another organization. According to customer management (Kotler and Keller, 2005; Ravald and Gronroos, 1996), customer value can be defined as customer perceived value which is the difference between all costs and benefits base on customer evaluation and outgoings of perceived alternatives. Customer value management is the customer centric

management which focuses on customer impression over the meaning of customer satisfaction.

The reason that Apple's iPod became the market leader, leading Korean MP3 player manufacturers as early movers is not only because they can provide MP3 players but also because they can develop more diverse designs and colors for the MP3 players and provide ubiquitous user interfaces.

A platform leader should acquire and retain handset manufacturers and applied application developers in customer management.

Hypotheses 2 and 3 are related to external relationships with complementors and internal organization of a platform leader in platform leadership (Cusumano and Gawer, 2002). Internal organization means organization structure, internal processes, organization culture, and conflict control capability.

First of all, regarding conflict control, a platform leader should acquire complementors' agreements on technical specification and standard, and maintain major designs to coordinate between core products and complements. Regarding conflict control capability, platform leaders and complementors should build trust through clear role definition. Especially, a platform leader should perform detailed processes for strategy and business objectives and evaluate and resolve conflicts. The CEO of a platform leader should build an organization culture which encourages reasonable debates.

Closed software is standardized and monopolized by the network effect. That is to say, it is monopolized due to network externality and economies of scale. However, open software reduces customer lock-in effect and increases compatibility by source openness. Complementors pay more switching costs for maintenance, learning, and installing. This is an opposite phenomenon that low lock-in effect drives low switching cost. Low lock-in effect makes complementors change platforms easily and reduces the interdependence between a platform leader and complementors. This reduces the importance of the balanced act of competition and cooperation. Also, the negative impact of conflicts would be eliminated.

In the case of Nokia, regarding the balanced act of competition and complementarity and conflict control capability, Nokia cannot expect benefits from network externality, because Maemo and Linux already entered the market.

In the traditional industries, since the relationship between a platform leader and complementors is based on formal contracts, a platform leader might resolve conflicts

aggressively. While, in the information and communications industry, the relationship between both of them is based on informal networks. Therefore, in this case, the importance of conflict control capability is reduced, since a platform leader might make less effort to resolve the conflicts.

*Hypothesis 2: Conflict control capability for complementors is positively related to the platform selection of complementors.*

### **Complementarity of a platform**

Compatibility means the inter-function among products in technology. On the other hand, complementarity means doing a complementary role in inter-functions among products. When the complementarity is increased, the ecosystem and the transaction opportunities are growing.

In the past, compatibility is important for product flexibility and interaction among products. In ERP platform, compatibility among modules and systems is the most important. This is related to flexibility and interoperability for the determinants of ERP platform selection. However, as many complements such as applications and contents are developed by using platforms, complementarity except compatibility becomes very important.

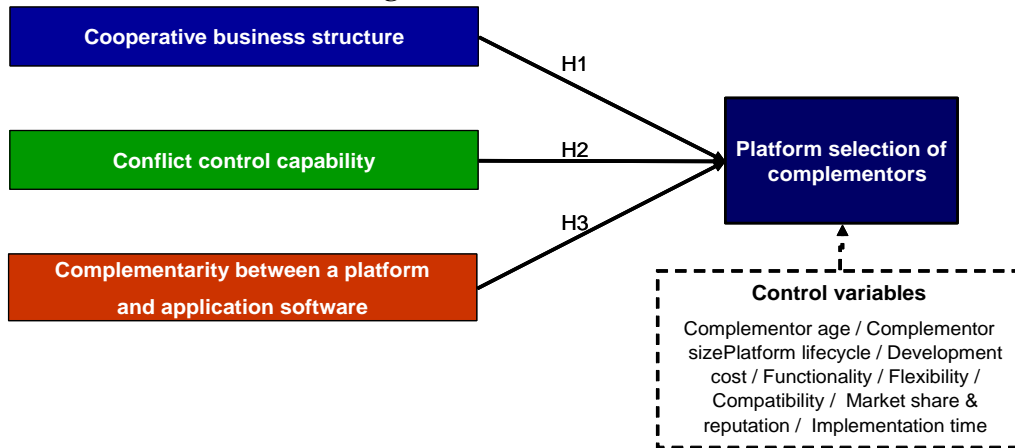
Complementors need to know how the platform fits their businesses. Utilizing a platform complements are complementary activities (Pisano, 1990). The complementary activities lower internal transaction costs (Oxley, 1997) and increase revenues. Complementors can get the benefit of cost reduction with the trend of platform openness. Platform leaders can utilize market opportunities created by the development of diverse applications.

Also, complementarity makes complementors improve the diversity and functions of complements. For example, saying that Symbian has complementarity, is saying complementors using it can develop more applications.

Compatibility has been more important in the past. For example, compatibility with existing processes and systems is the most important in ERP platform. While, as complements such as applications and contents are developed in the information and communications industry, complementarity becomes more important than compatibility.

*Hypothesis 3: Complementarity of a platform is positively related to the platform selection of complementors.*

Figure 3: Research model



## RESEARCH METHODOLOGY

### Data collection and sample

We collected 269 survey responses as platform selection cases from 99 application developers belonging to the Korea SW Industry Promotion Agency, especially in the SW areas such as system, developing, information protection, groupware, corporate portal, CRM, and GIS. Out of these 269 responses, 245 are selected as statistical samples.

### Variables and Measurement

#### *Dependent variable*

In this statistical study, whether or not to select the specific platform is used as a dependent variable. It can be measured by asking the question: 'Are you applying or planning to apply to the specific platform you mentioned?' For this question, yes is 1 and no is 0.

#### *Independent Variables*

In this statistical study, three independent variables are used. They are cooperative business structure and conflict control capability of platform leaders and complementarity of platforms. Two survey questions for the first independent variable, cooperative business structure of a platform leader. These two questions are business portfolio

considering complementors and business opportunities for complementors by a platform leader's businesses.

The second independent variable is related to conflict control capability of a platform leader. 5 survey questions are used for this variable - monitoring of complementors' platform utilizing activities, internal policies for complementors, management participation for conflict resolution, and organization culture and communications.

The third variable is related to complementarity of a platform. This is to identify the fitness of the platform into complementors' businesses. 6 survey questions are used for this variable - the platform leader's strategic and technological consideration on the environment changes, product and complement development with the platform, cost reduction, and revenue enhancement.

#### *Control variables*

There are other factors impacting the platform selection of complementors beside exploratory variables. These factors should be controlled for the statistical study.

First of all, age and company size of a complementor can have impacts on the platform selection. Company size can be measured with revenues in fiscal year 2007.

Second, the characteristics of a platform can be identified by comparing with ERP platforms. The characteristics are operation, transition and strategic fitness of a platform. Platform operation means functionality, usability, integration, credibility, and efficiency. Platform transition means portability, reusability and interoperability, and strategic fitness means the correspondence of objectives and vision with market environments.

On the other hand, decentralization is to break up knowledge, experiences and entrepreneurship, as well as benefits from specialization (Hayek, 1945). Decentralized market is recognized as superior innovative system creating transaction opportunities, distributing existing knowledge, and generating new ideas (Vanberg, 1991; Potts, 2001; Baumol, 2004). Timing is important to select centralization and decentralization (Olleros, 2008). Centralized processes bring optimal outcomes in the short-term. Decentralized processes are beneficial in the long-term, but rapidly growing once decentralized. Therefore, the degree of decentralization depends on platform life cycle. In the early stage of its life cycle, a platform is closed, integrated and centralized. After then, according to reduced uncertainty and increased stability, complementary markets are developing. Complementary markets prefer to decentralization and platform openness to secure the

diversity and low costs of complements (Christensen and Raynor, 2003; Chesbrough, 2004). Therefore, platform life cycle should be controlled.

Third, regarding issues on ERP platform selection, the factors on platform leaders are similar to the characteristics of ERP vendors. According to existing literature, the factors on platform leaders include market share and reputation, legitimacy of industry information, service and support for complementors, and implementation capabilities.

Fourth, the factors on project implementation are also important. These factors include total costs and time to implement.

## **BINARY LOGISTIC REGRESSION ANALYSIS**

We built the 245 samples of the platform selection cases for 99 application developers belonging to Korea SW Industry Promotion Agency. The complete survey, complete coefficient method is compared with the sample survey. It cannot be really inspected due to the high requirement of time and expenses.

Nevertheless, the complete survey is performed because of high credibility by surveying application developers belonging to Korean SW Industry Promotion Agency. It is performed for the sample companies with the PC OS platforms, web platforms and mobile platforms in the application areas of systems, developing, information protection, groupware, corporate portal, CRM, and GIS.

Cooperative business structure of a platform leader would be a dependent variable in this statistical study. We applied binary logistic regression analysis for the platform selection. Logistic regression is used to predict a categorical (usually dichotomous) variable from a set of predictor variables. With a categorical dependent variable, discriminant function analysis is usually employed if all of the predictors are continuous and evenly distributed; logistic analysis is usually employed if all of the predictors are categorical; and logistic regression is often chosen if the predictor variables are a mix of/continuous and categorical variables and/or if they are not nicely distributed (logistic regression makes no assumptions about the distributions of the predictor variables).

We proved the empirical research model for the platform selection of complementors by cooperative business structure and conflict control capability of a platform leader and complementarity of a platform by analyzing binary logistic regression with the data from applied application developers who have experiences on platform selection.

## RESULT

According to the descriptive statistics shown as Table 1, the importance of application development costs using the platform is 3.5184. The lowest is 1.8327 of complementor age. Especially, the platform selection of complementors is 0.7510 which means 75.1% of platform selection cases might be decided to use.

This statistical study controlled the factors which are redundant with the determinants of the platform selection of complementors. As a result of correlation analysis, all independent variables except complement diversity and organization culture of a platform leader for conflict control have positive correlations with the platform selection of complementors. And, all control variables except complementor age and size have positive correlations with the platform selection of complementors. This means most factors on platform leadership have positive impacts on the platform selection of complementors.

Under base model summary, we see that the -2 Log Likelihood statistic is 126.673. While, under research model, the -2 Log Likelihood statistic is 101.057. This statistic measures how poorly the model predicts the decisions - the smaller the statistic, the better the model. Therefore, the research model fits.

Hypothesis 1 predicts that the cooperative business structure of a platform leader is positively related to the platform selection of complementors. Hypothesis 2 predicts that the conflict control capability for complementors is positively related to the platform selection of complementors. Also, hypothesis 3 predicts that the complementarity of a platform is positively related to the platform selection of complementors.

As a result, the regression coefficient (B) and the standard error (s.e.) of cooperative business structure of a platform leader are respectively 1.076, and 0.330. And, the regression coefficient (B) and the standard error (s.e.) of complementarity between a platform and complements are 0.785 and 0.344. Therefore, the hypothesis 1 and 3 are statistically significant, but the hypothesis 2 is not statistically significant. It is important for platform leaders to establish their own cooperative business structures and secure the complementarity of their platforms for complementors.

PLATFORM STRATEGY: AN EMPIRICAL STUDY ON THE DETERMINANTS OF PLATFORM SELECTION OF APPLICATION DEVELOPERS

Table 1. Descriptive statistics and correlation

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Complementor age	1.833	0.941	1																						
2. Complementor size	2.261	1.14	.323	1																					
3. Platform life cycle	3.494	0.99	0.023	0.045	1																				
4. Development cost	3.518	1.096	0.017	-0.128	.375	1																			
5. Functionality	3.298	1.104	0.025	-0.08	.311	.421	1																		
6. Flexibility	3.453	1.157	-0.04	-0.07	.369	.425	.398	1																	
7. Compatibility	3.278	1.151	0.005	-0.07	.419	.344	.428	.502	1																
8. Market share and reputation	3.429	1.094	-0.01	-0.11	.447	.480	.379	.442	.446	1															
9. Implementation time	3.184	1.099	0.002	-0.04	.191	.169	.215	.150	.154	.224	1														
10. Business portfolio of a platform leader	3.327	1.194	-0.137	-0.262	.269	.387	.343	.305	.390	.310	.170	1													
11. Possibility of business opportunity	3.216	1.141	-0.04	-0.08	.152	.290	.242	.177	.288	.283	-0.03	.303	1												
12. Monitoring of complementors	2.955	1.188	0.074	-0.01	-0.02	0.034	-0.07	0.039	-0.07	.141	-0.14	-0.1	0.007	1											
13. Internal policies of a platform leader	3.38	1.18	-0.05	-0.147	.435	.421	.224	.309	.342	.416	.256	.339	.195	0.006	1										
14. Participation of management in conflict control	3.616	1.245	-0.06	-0.07	.437	.504	.349	.363	.321	.464	.181	.278	.174	0.058	.460	1									
15. Organization culture for conflict control	2.918	1.209	0.013	0.007	-0.01	-0.06	-0.06	0.006	-0.06	-0.08	-0.12	-0.04	0.007	0.077	-0.05	-0.07	1								
16. Communications	3.196	1.132	0.073	-0.01	.279	.268	.278	.273	.285	.230	.155	.241	.183	0.004	.331	.152	0.042	1							
17. Strategic complementarity	3.041	1.197	0.021	-0.04	0.031	-0.01	.149	0.04	-0.02	0.03	0.032	0.034	-0	0.021	0.03	-0.06	0.028	0.067	1						
18. Technology complementarity	3.425	1.086	0.046	0.029	.441	.434	.263	.358	.486	.408	.195	.332	.237	0.008	.427	.451	0.08	.195	0.006	1					
19. Complementarity for quality	3.457	1.147	-0.02	-0.04	.436	.522	.442	.393	.453	.461	.135	.352	.385	0.015	.407	.454	-0.06	.284	0.007	.475	1				
20. Complementarity of complements	2.922	1.204	0.021	-0.03	-0.02	-0.02	0.073	-0.02	-0.04	0.01	0.017	0.046	0.024	0.075	0.027	-0.04	0.007	-0	-0.02	0.1	-0.02	1			
21. Complementarity for cost reduction	3.457	1.164	-0.04	-0.189	.454	.437	.346	.460	.449	.396	.174	.346	.209	0.05	.470	.447	-0.06	.314	.166	.413	.398	-0.07	1		
22. Complementarity for revenue enhancement	3.363	1.053	-0.07	-0.03	.354	.475	.390	.463	.414	.405	0.055	.345	.255	-0.02	.350	.429	-0.03	.201	0.021	.499	.463	-0	.422	1	
23. Platform selection of complementors	0.751	0.433	-0.07	-0.191	.507	.566	.421	.504	.550	.529	.217	.514	.317	0.002	.506	.453	-0.09	.284	0.051	.487	.519	-0.08	.584	.522	1



**Table 2. Result of factor analyses**

	<b>(a) Rotated Component Matrix <sup>a</sup></b>			<b>(b) Rotated Component Matrix <sup>b</sup></b>		
	<b>Component</b>			<b>Component</b>		
	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>
Complementarity for quality	<b>.753</b>	.014	-.034	<b>.784</b>	-.020	.036
Technical complementarity	<b>.734</b>	.121	-.039	<b>.725</b>	.148	-.016
Complementarity for revenue enhancement	<b>.716</b>	-.044	-.013	<b>.695</b>	.163	.034
Complementarity for cost reduction	<b>.711</b>	.043	.292	<b>.690</b>	.297	-.011
Management participation	<b>.707</b>	.105	-.130	<b>.678</b>	.234	-.078
Internal policy	<b>.698</b>	.076	.019	<b>.657</b>	.333	.114
Business portfolio	<b>.617</b>	-.236	.021	.245	<b>.622</b>	-.052
Business opportunity	<b>.487</b>	-.114	-.076	.434	<b>.520</b>	-.214
Communication	<b>.481</b>	-.012	.162	.336	<b>.439</b>	.021
Monitoring	.037	<b>.770</b>	-.073	.222	-.352	<b>.712</b>
Organization culture	-.036	<b>.534</b>	.276	-.238	.502	<b>.652</b>
Variety of complements	-.001	.396	-.362	-.001	-.008	<b>.372</b>
Strategic complementarity	.013	.086	<b>.860</b>	<b>H3</b>	<b>H1</b>	<b>H2</b>

a. Rotation converged in 4 iterations.

b. Rotation converged in 7 iterations.

**Table 3: Result of binary logistic regression analysis**

	<b>Base Model</b>				<b>Research Model</b>			
	<b>B</b>	<b>s.e.</b>	<b>Wald</b>	<b>Exp(B)</b>	<b>B</b>	<b>s.e.</b>	<b>Wald</b>	<b>Exp(B)</b>
Complementor age	-.232	.263	.780	.793	-.141	.269	.276	.868
Complementor size	-.460*	.214	4.619	.631	-.503	.273	3.403	.605
Platform life cycle	.655*	.262	6.252	1.924	.527	.289	3.330	1.694
Development cost	.804***	.247	10.607	2.234	.329	.265	1.538	1.389
Functionality of a platform	.144	.227	.402	1.155	.056	.237	.056	1.058
Flexibility of a platform	.235	.203	1.335	1.266	.149	.240	.389	1.161
Compatibility	.717**	.245	8.533	2.048	.414	.276	2.259	1.513
Market share and reputation	.344	.218	2.497	1.411	.255	.247	1.064	1.290
Implementation time	.208	.219	.902	1.232	.236	.280	.712	1.266
Cooperative business structure of a platform leader					1.076***	.330	10.612	2.932
Conflict control capabilities					-.076	.314	.137	.929
Complementarity					.785**	.344	5.181	2.383
-2log likelihood			126.673				101.057	
$\Delta x^2$							25.616	

(differences from base model)

\*p&lt;.05, \*\*p&lt;.01, \*\*\*p&lt;.001

## CONCLUSION

In order to maximize the performance of platform utilization of complementors, platform leaders should build cooperative business structure and conflict control capabilities and platforms should be complementary.

This paper is to identify the different determinants of platform selection from those of ERP platform selection in existing literatures. As a result, this statistical study makes the following theoretical and practical contributions. Compared to the past research on ERP platform, this paper analyzed cooperative business structure, conflict control capability, and complementarity as new determinants of platform selection.

The theoretical contribution in this paper is to clarify whether securing the cooperative scope of the firm and the complementarity would decide the competitive advantage to maximize the values through business ecosystems in the perspective of platform leadership.

The practical contributions in this paper are divided into three things according to the stakeholders such as platform leaders, complementors and wireless carriers. First of all, for the platform leaders, they should decide business targeting and capability building by considering the businesses of complementors and the relevant ecosystems in the network information technology value chain for their strategic planning. For complementors, handset manufacturers should revise their business strategies in the long term perspective. Because cost leadership through patent management and procurement becomes less important and complements becomes more important through the participation of the third party. If complementors can not change their business strategies, platform leaders will take the value creation leadership in the long term. For wireless carriers, the walled garden would have been destroyed in recent times. Therefore they should establish the platform duality strategies such as developing their own platforms and doing complement businesses by utilizing leading platforms.

The example explaining the maximization of transaction opportunities under the ecosystem is the 'App Store'. The App Store war started in the global information and communications industry. The competition in the mobile market is expanding into the content and software markets because of smartphone popularity. While Apple's App Store is for the operating system, the App Stores of late movers put together diverse operating systems and cling to open their platforms. These App Stores would sell all kinds of contents such as games, e-books, films, and so on. For this, platform leaders distribute

software development kits (SDK) for free and promote aggressively to secure superior content. The convergence of hardware and software builds potential big marketplaces, but more the important issue is how to obtain more attractive content.

In short, since platform leaders, complementors, and wireless carriers, respectively cannot go it alone, they should maximize transaction opportunities under a complementary ecosystem. In other words, flowers (platform leaders) should produce more qualified honey (platforms) so that their platforms attract more honey bees (complementors). Which will in turn, bear more fruit. This makes an ecosystem more sustainable and flowers as platform leaders and honey bees as complementors coexist. In short, platform leaders should create more transaction opportunities by helping complementors to develop more complements and making business ecosystem grow ever more and more.

Regarding the limitation of this paper, 245 cases of platform selection are not equally distributed to 6 mobile platforms of Symbian, Windows Mobile, OS X, Palm Pre, WIPI, and RIM. This is due to the policy on WIPI in Korea, and due to the market status of the platform leaders like Symbian not changing.

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## **REFERENCES**

- Ayagg, Z. and R. G. Özdemir. 2007. An intelligent approach to ERP software selection through fuzzy ANP. *International Journal of Production Research* 45 (10): 2169-2194.
- Baumol, W. 2004. *Technology dissemination and adaptation: Growth via imitative innovation*. Information Commercial Espanola-Monthly Edition.
- Berchet, C. and G. Habchi. 2005. The implementation and deployment of an ERP system: An industrial case study. *Computers in Industry* 56 (6): 588-605.
- Bernroider, E. and V. Stix. 2006. Profile distance method: A multi-attribute decision making approach for information system investments. *Decision Support Systems* 42 (2): 988-998.
- Bueno, S. and J. L. Salmeron. 2008. Fuzzy modeling enterprise resource planning tool selection. *Computer Standards & Interfaces* 30: 137-147.
- Chesbrough, H. 2004. Managing open innovation: Chess and poker. *Research-Technology Management* 47 (1): 23-26.
- Christensen, C. M. and M. E. Raynor. 2003. *The innovator's solution: Creating and sustaining successful growth*. Boston, MA: Harvard Business Press.

- Cusumano, M. and A. Gawer. 2002. The elements of platform leadership. *MIT Sloan Management Review* 43 (3): 51-58.
- Das, T. and Teng, B. 2002. Alliance constellations: A social exchange perspective. *Academy of Management Review* 27 (3): 445-456.
- Druckman, D. 1998. Social exchange theory: Promises and prospects. *International Negotiation* 3: 253-266.
- Fisher, D. M., S. A. Fisher, and M. Y. Kiang. 2004. Evaluating mid-level ERP software. *Journal of Computer Information Systems* 45 (1): 38-46.
- Grant, R. M. and C. Baden-Fuller. 2004. A knowledge accessing theory of strategic alliances. *Journal of Management Studies* 41 (1): 61-84.
- Han S. W. 2004. ERP-Enterprise resource planning: A cost-based business case and implementation assessment. *Human Factors and Ergonomics in Manufacturing* 14 (3): 239-256.
- Hayek, F. 1945. The use of knowledge of society. *The American Economic Review* 35 (5): 519-530.
- Keil, M. and A. Tiwana, 2006. Relative importance of evaluation criteria for enterprise systems: A conjoint study. *Information Systems Journal* 16 (3): 237-262.
- Kotler, P. and K. L. Keller. 2005. *Marketing management*. Englewood Cliffs, NJ, Prentice-Hall.
- Kumar V., B. Maheshwari, and U. Kumar. 2002. Enterprise resource planning systems adoption process: A survey of Canadian organizations. *International Journal of Production Research* 40 (3): 509-523.
- Kumar V., B. Maheshwari, and U. Kumar. 2003. An investigation of critical management issues in ERP implementation: Empirical evidence from Canadian organizations. *Technovation* 23 (10): 793-807.
- Lacity, M. and L. Wilcocks. 2000. *Global IT outsourcing: In search of business advantage*. New York, John Wiley and Sons.
- Lee, M. K. O. 1996. IT outsourcing contracts: Practical issues for management. *Industrial Management and Data Systems* 96 (1): 15-20.
- Li, Y., Y. Liu, M. F. Li, and H. B. Wu. 2008. Transformational offshore outsourcing: Empirical evidence from alliances in China. *Journal of Operations Management* 26 (2): 257-274.
- Nah, F. F. H. and S. Delgado. 2006. Critical success factors for enterprise resource planning implementation and upgrade. *Journal of Computer Information Systems* 46: 99-113.
- Oliver E. 2009. A survey of platforms for mobile networks research. *Mobile Computing and Communications Review* 12 (4): 38-87.
- Olleros, X. 2007. The lean core in digital platforms. *Technovation* 28 (5): 266-276.
- Oxley, J. E. 1997. Appropriability hazards and governance in strategic alliances: A transaction cost approach. *Journal of Economics and Organization* 13: 387-388.
- Pisano, G. P. 1990. The R&D boundaries of the firm: An empirical analysis. *Administrative Science Quarterly* 35 (1): 153-176.
- Potts, J. 2001. Knowledge and markets. *Journal of Evolutionary Economics* 11 (4): 414-431.
- Rao, S. S. 2000. Enterprise resource planning: Business needs and technologies. *Industrial Management and Data Systems* 100 (1-2): 81-88.

- Ravald, A. and C. Grönroos. 1996. The value concept and relationship marketing. *European Journal of Marketing* 30 (2): 19-30.
- Umble, E. J., R. R. Haft, and M. M. Umble. 2003. Enterprise resource planning: Implementation procedures and critical success factors. *European Journal of Operational Research* 146 (2): 241-257.
- Vanberg, V. J. 1991. Constitutional choice, rational ignorance and the limits of reason. *Jahrbuch für Neue Politische Ökonomie* 10: 61-78.
- Verville, J. and A. Haltingen. 2003. A six-stage model of the buying process for ERP software. *Industrial Marketing Management* 32 (7): 585-594.
- Wei, C. C., C. F. Chien, and M. J. J. Wang. 2005. An AHP-based approach to ERP system selection. *International Journal of Production Economics* 96 (1): 47-62.
- Yang, J.B., C. T. Wu, and C. H. Tsai. 2007. Selection of an ERP system for a construction firm in Taiwan: A case study. *Automation in Construction* 16 (6): 787-796.