

THE FIT BETWEEN MODULARIZATION STRATEGY AND PLATFORM LEADERSHIP

ABSTRACT

In the pursuit of platform leadership, ambitious wannabe companies constantly modularize and de-modularize their products, technologies, services, and even organizational resources for long-term development. This study is to find an association between modularization strategy and platform leadership. By designing an empirical research on the Internet-related companies through operationalizing measurement scales for modular operators and platform leadership imperatives respectively, this paper validates the linkage between modularization strategies and capabilities of platform leadership.

Key words: Open innovation; Platform; Modularization strategy; Platform Leadership

INTRODUCTION

In the era of open innovation (Chesbrough, 2010), companies must understand the cost and value of using external resources. Those who can provide industry core modules, i.e. platforms, and successfully direct external complement innovations enjoy tremendous advantage (Cabigiosu, Zirpoli and Camuffo, 2013 and Claussen, Essling and Kretschmer, 2015). Platforms must be built through system modularization (Baldwin and Henkel, 2014), and modular systems would foster collaboration across organizational boundaries so that support open innovation (Bouncken, Pesch and Gudergan, 2015). Modularization strategy is the foundation of platform strategy. How companies modularize their products or services would affect their organizational abilities to pursuit platform leadership. Currently, literature about platform strategy is mostly on explaining why a platform succeeds (e.g. Nambisan and Sawhney, 2011, etc.), but few on how to build a platform. Especially when taking company vintage into account, startups of platform leader wannabes may not be proper to apply platform strategy in their early stage of development. They need modularization strategy for pursuing platform leadership. This paper is aiming at exploring the relationship between modularization strategy and platform leadership, considering the difference between startups and incumbents.

LITERATURE REVIEW

Baldwin and Clark (2000) have identified six modular operators that characterize modularization. These operators are splitting, substitution, augmenting, excluding, inverting, and porting. Definitions of these operators are given in Table 1.

Table 1. Definitions of Modular Operators

Operator	Definition	Example
Splitting	Separating systems into components which interact across defined interfaces	Interchangeable drives, keyboards and mice
Substitution	Switching between components which perform the same function	Replacing a i5 CPU with a i7 CPU
Augmenting	Adding a module to increase the functions of a system	Attaching an smart card reader
Excluding	Removing a module to reduce the functions the system can perform	Removing a floppy disk drive
Inverting	Making an imbedded function into a standalone module and setting the module's interfaces	Separating the operating system from DEC's system to create Unix
Porting	Moving a module from one system to another	Using a Mac printer on a PC network by adding a translator

Source: Summarized and revised from Baldwin and Clark (2000)

These modular operators could represent facets of modularization strategy which is a technological strategy that wannabe platform leaders apply. In order to become a platform leader, a company must make its module an industry core module and set interface rules for complement modules to follow. With this notion, Chou and Hung (2008) examined a case of how NTT DoCoMo i-Mode achieved its platform leadership, and found two more operators must be added: integrating and configuring. Integrating means incorporate other vendor's module into the company's own system, and configuring means enabling users to adjust subsystem's functions within the incumbent system architecture. For measuring how the companies apply modularization strategy, we designed a scale as shown in Table 2.

Table 2. Question Items of Modularization Strategy

Facet	Question Item
Splitting	<ol style="list-style-type: none"> 1. When you design a product or service, would you divide the system into subsystems or modules? 2. When you design subsystems or modules, would you strive to keep independence among them? 3. When you maintain subsystems or modules, would you place importance on compatibility among them and across time? 4. Do you design your product or service in form of independent and compatible subsystems or modules in the early stage of system development?
Substitution	<ol style="list-style-type: none"> 1. When you design a product or service, would you place importance on standardized interfaces for subsystems or modules? 2. Do you benefit from sourcing outside modules or collaborating with other module vendors because of standardized interfaces? 3. Do you place importance on standardized interfaces in the early stage of system development?

Table 2. Question Items of Modularization Strategy (continued)

Facet	Question Item
Augmenting	<ol style="list-style-type: none"> 1. When you maintain subsystems or modules, do you consider diversifying their functions? 2. When you maintain subsystems or modules, do you consider system expansibility? 3. Do you place importance on system expansibility and function diversification in the early stage of system development?
Excluding	<ol style="list-style-type: none"> 1. When you design a product or service, are you aware of different needs of market segments? 2. Knowing different needs of market segments, do you consider simplifying the system design for certain market segments? 3. Do you place importance on the option of simplifying the product or service in the early stage of system development?
Inverting	<ol style="list-style-type: none"> 1. When you maintain subsystems or modules, would you strategically hide your technology so to avoid imitation? 2. When you maintain subsystems or modules, would you avoid overly dependent on modules from other vendors? 3. Would you strategically hide proprietary technology and avoid overly dependent on modules from other vendors in the early stage of system development?
Porting	<ol style="list-style-type: none"> 1. When you maintain subsystems or modules are you aware of the sales growth of your product or service? 2. When you maintain subsystems or modules, did you cooperate with other platforms to deliver your product or service? 3. When you maintain subsystems or modules, did you often adjust their compatibility so to enable them to function on other platforms? 4. Did you consider designing your product or service to be cross-platform for sustaining the sales growth in the early stage of system development?
Integrating	<ol style="list-style-type: none"> 1. When you develop your product or service, can you lead or channel outside innovations of other module vendors? 2. When you develop your product or service, have you built effective negotiation mechanisms with other module vendors? 3. Do you consider building mechanisms of cooperating with or leading other module vendors in the early stage of system development?
Configuring	<ol style="list-style-type: none"> 1. When you keep innovating the product or service, do you place importance on user interface allowing user choose system functions or function levels according to their preferences? 2. When you keep improving the product or service, do you encourage users to participate in innovation? 3. Do you consider incorporating ideas and innovations from users in the early stage of system development?

To achieve platform leadership, the company needs several capabilities of making its module an industry core module that sets interface and compatibility rules. Summarizing from Gawer and Cusumano (2002), Gawer and Cusumano (2007), and Boudreau and Lakhani (2012), we designed a scale for measuring the capabilities of platform leadership as shown in Table 3.

Table 3. Question Items of Platform Leadership

Facet	Question Item
Boundary Adjusting	<ol style="list-style-type: none"> 1. When you develop your product or service, do you strategically decide which tasks should be done internally or externally? 2. Could you identify core module and develop it internally? 3. Could you identify complement module and develop it externally?
Platform Architecturing	<ol style="list-style-type: none"> 1. When you develop your product or service, can you clearly picture the technological architecture and roadmap so to attract complement module developers? 2. When you develop your product or service, can you adjust the technological architecture and roadmap responsively if the market changes? 3. When you develop your product or service, can you attract complement developers with the technological architecture and roadmap?
External Relationship Leveraging	<ol style="list-style-type: none"> 1. When you develop your product or service, do your mechanisms for cooperating and competing with complement developers facilitate the fulfillment of contracts? 2. When you develop your product or service, can your mechanisms protect your core module and sanction the complement developers for the default or betrayal behavior?
Core Module Internalizing	<ol style="list-style-type: none"> 1. Can your organizational capability support your proprietary module become an industry core module? 2. Can your organizational capability support your proprietary module be adopted by killer applications?

RESEARCH METHOD

After a pre-test with professors in the field of strategic management and Internet related industry experts who have confirmed the content validity of scales, we conducted a formal investigation. The samples were collected from lists of Taipei Computer Association, Taichung Computer Association, winners of two government sponsored industry awards, and the watching list of AppWorks, a leading accelerator of Internet startups. 266 Internet related companies were requested to answer the questionnaire by mail or e-mail. 81 companies responded, and 48 of them have established over 5 years and 33 of them under 5. Because according to Taiwan's statistics of Ministry of Economic Affairs, among the first 5 years the survival rate of startups drops rapidly and goes steady after that, we group the companies older than 5 years as a sample of incumbents and the rest a sample of startups. We conducted Canonical Analysis for the two samples respectively.

RESEARCH RESULTS

The content validity of constructs in this paper is ensured because the items were adapted from literature and confirmed by college professors and industry experts. The internal consistency of constructs is ensured with values of Cronbach's α ranging from 0.513 to 0.870, which are listed in Table 4.

Table 4: Construct Reliability Summary

Scale Name	Facet	Cronbach's α
Modularization Strategy	Splitting (M1)	0.798
	Substitution (M2)	0.627
	Augmenting (M3)	0.513
	Excluding (M4)	0.687
	Inverting (M5)	0.656
	Porting (M6)	0.718
	Integrating (M7)	0.712
	Configuring (M8)	0.870
Platform Leadership	Boundary Adjusting (P1)	0.562
	Platform Architecturing (P2)	0.656
	External Relationship Leveraging (P3)	0.667
	Core Module Internalizing (P4)	0.653

From the incumbent sample, two canonical functions are identified with the significance level of 0.05. The correlation coefficients between two pairs of canonical variates are 0.805 and 0.671. For the first pair of linear combinations, variables with absolute value of canonical loadings exceeding 0.5 are M2 (0.732), M7 (0.760), P2 (0.915) and P3 (0.553). For the second pair of linear combinations, variables with absolute value of canonical loadings exceeding 0.5 are M1 (-0.504), M5 (-0.509), M6 (-0.565), M8 (-0.732), P1 (-0.560), P3 (-0.755) and P4 (-0.804). The coefficients are summarized in Table 5 and Table 6, and the path analysis is illustrated in Figure 1.

Table 5: Model Fit for Canonical Correlation Analysis for Incumbents

Canonical Function	Wilk's λ	χ^2	d.f.	p-value	Canonical Correlation
1	0.127	83.490	32	0.000***	0.805
2	0.362	41.174	21	0.005**	0.671
3	0.659	16.904	12	0.153	0.504
4	0.884	5.011	5	0.415	0.341

*p < 0.1 **p < 0.05 ***p < 0.01

Table 6: Canonical Loadings of Incumbents

Modularization Strategy	Canonical Variate		Platform Leadership	Canonical Variate	
	X1	X2		Y1	Y2
M1	0.146	-0.504	P1	0.437	-0.560
M2	0.732	-0.092	P2	0.915	-0.251
M3	0.490	-0.350	P3	0.553	-0.755
M4	0.486	-0.276	P4	0.167	-0.804
M5	0.023	-0.509			
M6	0.072	-0.565			
M7	0.760	-0.433			
M8	-0.077	-0.732			
Var. Explained	0.203	0.220	Var. Explained	0.340	0.398
Redundancy	0.131	0.099	Redundancy	0.221	0.279
Canonical Correlation	0.805***	0.671**			

*p < 0.1 **p < 0.05 ***p < 0.01

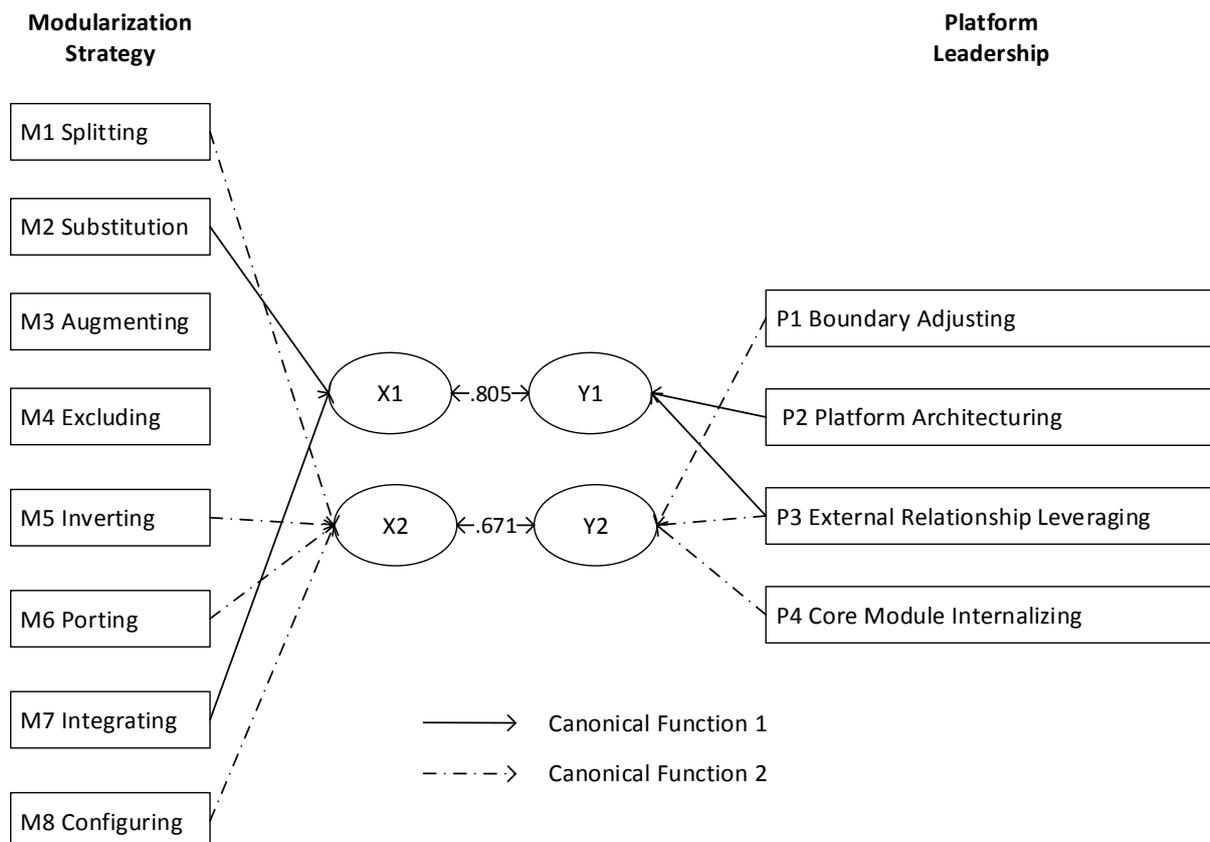


Figure 1: Path Analysis of Incumbents

From the startup sample, one canonical function is identified with the significance level of 0.05. The correlation coefficient between the pair of canonical variates is 0.884. For the pair of linear combinations, variables with absolute value of canonical loadings exceeding 0.5 are M1 (-0.730), M2 (-0.546), M4 (-0.582), M5 (-0.741), M7 (-0.766), P2 (-0.690), P3 (-0.538) and P4 (-0.957). The coefficients are summarized in Table 7 and Table 8, and the path analysis is illustrated in Figure 2.

Table 7: Model Fit for Canonical Correlation Analysis for Startups

Canonical Function	Wilk's λ	χ^2	d.f.	p-value	Canonical Correlation
1	0.065	66.890	32	0.000***	0.884
2	0.295	31.159	21	0.071*	0.752
3	0.677	9.947	12	0.621	0.520
4	0.928	1.917	5	0.861	0.269

*p < 0.1 **p < 0.05 ***p < 0.01

Table 8: Canonical Loadings of Startups

Modularization Strategy	Canonical Variate		Platform Leadership	Canonical Variate	
	X1	X2		Y1	Y2
M1	-0.730	-0.354	P1	-0.393	0.715
M2	-0.546	0.376	P2	-0.690	0.469
M3	-0.394	0.554	P3	-0.538	-0.185
M4	-0.582	-0.187	P4	-0.957	-0.178
M5	-0.741	-0.024			
M6	-0.178	0.330			
M7	-0.766	0.065			
M8	-0.287	0.516			
Var. Explained	0.322	0.123	Var. Explained	0.459	0.199
Redundancy	0.251	0.070	Redundancy	0.359	0.112
Canonical Correlation	0.884***	0.752*			

*p < 0.1 **p < 0.05 ***p < 0.01

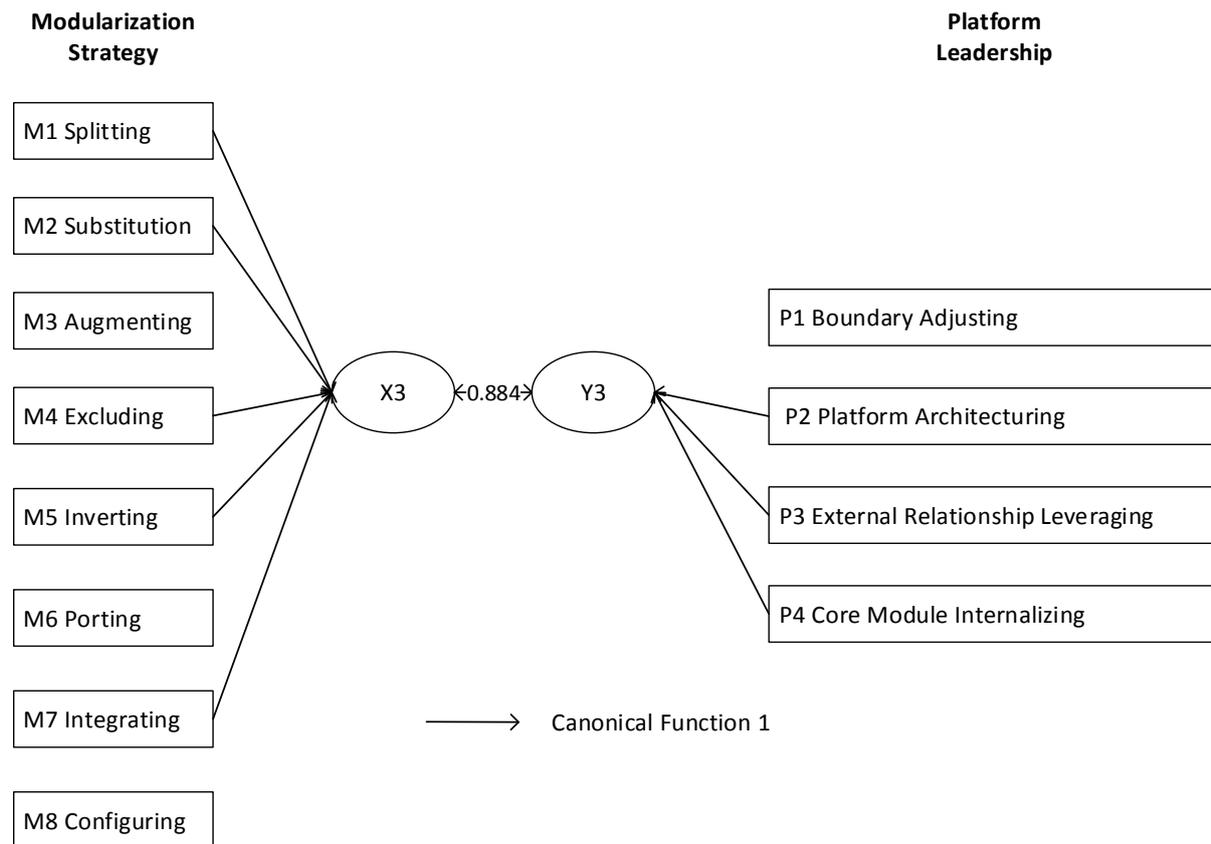


Figure 2: Path Analysis of Startups

Three strategic fits were found in the above analysis. For the incumbent group, strategy integrating (M7) and substitution (M2) are associated with the capability of platform architecturing (P2) and external relationship leveraging (P3), while strategy configuring (M8), porting (M6), inverting (M5) and splitting (M1) are associated with the capability of core module internalizing (P4), external relationship leveraging (P3) and boundary adjusting (P1). For the startup group, strategy integrating (M7), inverting (M5), splitting (M1), excluding (M4) and substitution (M2) are associated with the ability of core module internalizing (P4), platform architecturing (P2) and external relationship leveraging (P3).

CONCLUSION

This paper validates the linkage between modularization strategies and capabilities of platform leadership by designing an empirical research on the Internet-related companies through operationalizing measurement scales for modular operators and platform leadership imperatives respectively. For incumbent platform players, the capability of platform architecturing and external relationship leveraging are fortified by technological strategy of module substitution and integrating. This finding is consistent with the well-known history of Microsoft Windows operation system and

Intel processor which had frequent releases of generations of products with better performance and integrated additional new functions to substitute their previous products. The capability of core module internalizing must be supported by technological strategy of configuring, porting, inverting and splitting. This means for incumbents to ensure their appropriability or increase their profit share, they need to continually configure modules within the current architecture to add new value, or link with other platforms and seek opportunities on the new value landscape by splitting and inverting modules. For example, once a module of eBay system, PayPal has been split from eBay, made compatible with other online shopping systems, and strived to become a core module of the industry. For startups, they need to master almost all kinds of strategies, but the strategy of augmenting and porting are not suggested for gaining platform leadership because augmenting and porting are usually moves of rule followers. This paper operationalizes the concept of modularization strategy and platform leadership, and thus helps future empirical studies in this field. The research results can help incumbents, as well as startups, deploy their modularization strategies according to the capabilities they require when facing different situations.

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