



Case Report

Building the Business Platform by Modularization Strategies: Cases of Taiwan Social Networking Vendors

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Abstract: Firms achieve their competitive advantage quickly through the concept framework of open innovation by integrating external inspiration with internal endowment when facing hyper-competition in the digital era. This paper deploys open innovation into building platform blocks by modular operators. These eight modular operators are splitting, augmenting, deleting, substituting, inverting, porting, configuring, and integrating. By means of case studies of two Taiwan Internet vendors, the results depict the manipulation strategies between eight modular operators to fit seven functional requirements for weaving social media, which are presence, identity, sharing, reputation, groups, conversations, and relationship. Finally, this paper advances propositions about the deployment of modularization strategies to develop a competitive platform.

Keywords: e-commerce; innovation; modularization; platform; product design



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1. Introduction

Chesbrough [1] emphasized that the classical innovation process is like a funnel, taking time to scrutinize novel ideas that have usually gradually absorbed a bundle of resources toward a feasible and profitable conceptual target. One of the key tasks for such a closed loop innovation is to recruit large amounts of productive talent into the internal innovation funnel. However, the increasing costs of internal innovation limit the speed of new product launches when facing hyper-competition in the Internet era. Open innovation that leverages the outside, complementary resources and integrates the internal expertise emerges as an alternative. Firms in the software industry, such as open-source affiliation firms, have gotten used to utilizing the Internet as a bridge for aggregating a bundle of outsources to quickly meet the outsourcer's demands. For example, Google cooperated with 33 software vendors from the Open Handset Alliance in 2007 to promote the common Android smartphone operation system (OS), which finally outperformed the Symbian system sponsored by Nokia. Moreover, on this OS platform, there were more and more mobile Apps emerging collaboratively through accessible open application programming interfaces (APIs), such as Google Maps API, Facebook API, and YouTube API. Therefore, the open innovation process facilitates increasing returns of network externality due to the collective participation of users and producers so as to expand advantageously the size of the system's installed base. The maneuvering of the open innovation process is critical to startups for preemptive penetration as well as to incumbents for quick and agile transformation. The purpose of this paper is therefore to explore the logic of open innovation for the sake of not only creating the cooperative system ecosystem but also asserting innovation appropriability. The deployment mechanism of the open innovation process would be the research results.

2. Literature Review

2.1. Inevitability of Open Innovation

Open innovation becomes inevitable to firms, especially when facing unprecedentedly compressed time to market of products, high talent mobility, and prohibitively increasing

R&D expenditure [1]. Gassmann [2] emphasized that firms in certain industries with the characteristics of high technology, globalization, technological fusion, and new business models particularly desire open innovation, which could infuse them with novel ideas and opportunities from worldwide knowledge workers. In addition, open innovation invites global partners to share R&D costs so that the collaboration increases the possibility of a technological breakthrough. Particularly in the industry of information and communication technology (ICT), the market is no longer dominated by a single firm. Contrarily, the collective adoption by a conglomerate is indispensable to win a market-dominant design. Open innovation is critical for firms to be compatible with the emerging technology ecosystem and for preventing them from being locked out from the ICT standard definition and system competition. Cases such as the alliance of Vodafone–Swisscom, Sony–Ericsson, and Sony–BMG involved the mutual infusion of external, complementary knowledge into internal competence enhancement. Moreover, cross-industrial, cross-disciplinary technology fusion has blurred industry boundaries and promoted cooperation between firms, so that open innovation brings about new business models for providing a new generation of products and services [3]. The core competence of a firm is not only intellectual assets such as patents and experts but also the capability of leveraging, which facilitates the speed of knowledge creation, assimilation, absorption, and transformation. Beyond recruiting high-potential talents, a visionary entrepreneurial innovator should be a good intermediary and catalyst as well [4]. Open innovation is also a strategic choice for firms to organize corporate boundaries for searching for innovative solutions and breakthroughs for technology development with suppliers, users, and complementors [5]. Wang and Shu [6] asserted that open innovation is an efficient way to leverage resources internally and externally if it is possible through a well-designed modular product. Proper resource management mechanisms that corporations employ through open innovation strategies could lead to a win–win cooperative relationship with their partners. Bogers et al. [7] asserted that open innovation aligned with dynamic capabilities with an evolutionary view would be a better way to understand the core of strategic management in the current time-based hyper-competition. Finally, the culture of open innovation has been accumulated and emphasized to drive corporate innovation continuously and cyclically through three imperatives: entrepreneurship of novice entrepreneur, entrepreneurship of employees of an existing firm, and organizational entrepreneurship of a firm itself, toward keeping growth and building market power [8–10].

2.2. Execution of Open Innovation

Even though open innovation leads to a new lens for searching for innovation sources, the practical management processes of internal organizational alignment and cooperative mechanisms for dealing with the degree of openness make the point clear. Therefore, the success of executing open innovation depends on the foci of core, critical, and contextual capabilities [11]. Only after establishing an internal, distinctive core capability that is valuable enough to be attractive to outsiders should the resulting bargaining power of a firm safeguard the open innovation process from infringements. The deliberate delineation of complementary criticality between co-specialized partners enhances the possibility of open innovation for a win–win achievement. It is essential for maneuvering the contextual relationship with candidate cooperators to keep open innovation processes flexible and mobile enough for quick configuration on demand. Chesbrough [12] asserted that the open innovation process is a way of pursuing technological advances and is also a business model for developing an ecosystem and integrating the upstream, downstream, and horizontal complements. Evans and Schmalensee [4] recognized the firm with such a new business model as a catalyst business, which endeavors to create multi-sided relationships and a spontaneously chained reaction of business networks with high adaptation, compatibility, and low transaction costs [13]. Therefore, the network is as an aggregation platform wherein multiple vendors could easily dialogue and broker linkage for innovation swiftly. So, as long as a firm develops a platform-oriented business model, it may be efficient to

catalyze the business opportunities through open innovation. West [14] argued that a platform possessing standard, reusable, and complementary assets catalyzes firms within an ecosystem to complete a whole product, service, and system, such as the WINTEL system formed by Microsoft and Intel. Iansiti and Levien [15] also articulated that the platform-oriented ecosystem mutually nourishing tools, solutions, and business opportunities becomes a common resource pool. Chesbrough [3] further emphasized that a mutually adaptive platform business model is the best paradigm for executing open innovation. For example, Google, Facebook, and Yahoo all developed platforms to attract vendors to collectively create innovative applications and share profits. Gawer and Henderson [16] pointed out that the platform owner is usually positioned at the core of system value and controls the right of profit allocation and the path of technology evolution. Gawer and Cusumano [17] asserted that the platform owner sustained its platform leadership through open strategies, inviting outside vendors to participation for a new ecosystem, which is indeed a coopeitition relationship with an efficient mechanism of continuously locking participants in embracing the platform architecture and sharing profits. The semiconductor manufacturer TSMC developed an open innovation platform providing IC design tools, reusable intellectual property, and new fabrication technology under compatible interfaces so that TSMC could support clients to assemble the system chips faster than competitors. The platform-oriented business model facilitates TSMC's open innovation execution and, therefore, promotes its top position in the field of IC foundry to sustain the leadership of Taiwan-centered semiconductor ecosystem [17]. Along the technological evolution and product life cycle, the execution strategy of open innovation varies gradually. Ozman [18] argues that in the beginning of an industry life-cycle, open innovation policies usually serve the dual purpose of exploring distant knowledge sources and exploiting potential network effects to strengthen the installed base of a technology. However, in the later phases, especially after the emergence of a dominant design, open innovation incentives and effects depend largely on the product system architecture. If improper tuning between open and closed innovation process along the evolution and industry dynamics, negative feedbacks and degenerative interactions may offset the open innovation performance [19]. Almirall and Casadesus-Masanell [20] argue that open innovation is an approach allowing the firm to discover combinations of product features that would be hard to envision under integration. However, when partners have divergent goals, open innovation restricts the firm's ability to establish the product's technological trajectory. Therefore, the resolution of the trade off between the benefits of discovery and the costs of divergence determines the best blending of innovation modes. Undoubtedly, modularity at different parts of the product system is a critical dimension which influences the types of open innovation strategies implemented by firms and maneuvers the trade-off problem with the cooperative partners [18].

2.3. Modularization and Open Innovation

Gawer and Cusumano [17] argued that the platform owner could sustain the industry power only when it maintains the evolutionary path of system architecture efficiently to support participants' innovation on product generations. The modular design is the key to implement the platform-oriented business model for open innovation. Ulrich [21] defined the modular design as a conceptual one-to-one mapping schema between physical chunks and corresponding functions. De-coupling relations between components (physical chunks) simplify the integration interfaces and keep each chunk as independent as possible, having no complicated adjustment if one certain component changes. Such a modular way facilitates manufacturers to quickly configure differentiated products and speeds up the time to market by efficiently plugging or removing independent components. O'Grady [22] asserted that modularization enhances the product differentiation from composition of reusable modules via the predefined clear-cut interfaces. Moreover, the mass production of common, reusable, standard modules benefits from the economy of scale, while ease of composition promotes customization. Even though the modularity design thinking prevails

in many cases of product development and platform building, the applying modularity policy in the business strategy still needs thorough consideration. Over-refined modularization may blind the designer to potentially important interactions between decision choices and result in excessive levels of testing and integration [23]. Moreover, the modular product design, which usually leads to modular organization for autonomy, may result in the high intensity of interactions to maintain the product and organizational architecture when the system complexity increases too much [24–26]. The proper modular design may be the way to achieve cost leadership and a differentiation advantage simultaneously. Baldwin and Clark [27] studied the development process of IBM system/360 and asserted six strategic modular operators—splitting, substituting, augmenting, excluding, inverting, and porting—which had promoted IBM to be the dominant position of mainframe computer industry, outperforming its European competitors [28]. Splitting is separating systems into components which interact across defined interfaces, such as interchangeable drives, keyboards, mice, monitors, and printers to PC. Substituting is switching between components which perform the same function, such as replacing a Pentium CPU with a Centrino CPU. Augmenting is adding a module to increase the functions of a system, such as attaching a Web camera to PC. Excluding is removing a module to reduce the functions the system can perform, such as removing a floppy disk drive from PC [29]. The operators of augmenting and excluding are mutually complementary and independent, so the system manufacturer can reconfigure the system functionalities to increase production differentiation for meeting the users' heterogeneous demand. Inverting is the reverse direction of splitting and making an imbedded function into a stand-alone module and setting the module's interfaces, such as separating the operating system from DEC's system to create UNIX. This kind of modular operator makes the internal structure of a stand-alone module invisible to others except for released interfaces. Therefore, the manufacturer can sustain the module advantage by stopping the system design from transparent details to prevent the module secrets from leaking out [30]. However, IBM made the mistake of manipulating the inverting modular operator later on in the PC industry. The BIOS module of the PC was inversed without enough translucence to PC clone competitors. Gradually, Compaq imitated and created a new BIOS module for new generation of the PC, and, therefore, weakened the dominant power of IBM in the PC industry evolution [31]. To gain a competitive advantage and value appropriation through manipulating modular design, Henkel et al. [32] also assert that the degree of controlling the critical IP (intellectual property) module is necessary as well as avoiding of IP leakage after enabling the distributed innovation in a larger ecosystem and exploiting surrounding resources for the dominant position in the beginning stage. Porting is moving a module from one system to another, such as using a Mac printer on a PC network by adding a translator or converter [29]. This modular operator is used to extend the original system's life cycle, broaden the market opportunities, and extract the surplus of technology investment by leveraging the potential of another platform. Currently, the mobile systems often use the porting operator strategically to migrate to advanced broadband systems. For example, the 2G GSM system ported to GPRS and EDGE, while 3G WCDMA system ported to 4G LTE [33,34].

Beyond six modular operators by Baldwin and Clark [27], Chou and Hung [29] also proposed an additional two operators for studying the case of NTT DoCoMo's i-mode mobile service: integrating and configuring. The integrating modular operator from the lesson of NTT DoCoMo means closely collaborating with manufacturers in designing handsets so the mobile operator can seamlessly promote advanced mobile services and M-commerce. The configuring modular operator is used to invite users to bookmark their favorite sites and design their own mobile homepages; more stickiness resulting from user involvement increases the users' lock-in effects and network externality to deter competitors. These additional modular operators emphasize completion of a whole system through "integrating" the complementary assets by means of technological assistance and economic incentives. NTT DoCoMo with the advanced mobile technology actively supported Japanese manufacturers to develop new Internet mobile phones and

cooperated with Internet application vendors for designing mobile homepages and service by using the CHTML page format. The collaboration power to create a new ecosystem by integrating a cluster of complements around a common system architecture for the speed of launching a whole product to users is critical to system competition [29,33]. NTT DoCoMo increased the users' options for making the starting menu when using the handset. The augmenting and excluding operators by Baldwin and Clark [27] emphasized the reconfiguration of physical components, while the configuring one by Chou and Hung [29] focused on the user participation that von Hippel [35] articulated for searching sources of innovation from lead users who usually reveal effective and profitable market demands. Therefore, if there are innovative toolkits supported by manufacturers, the propensity of user innovation customizing user requirements correctly will be increased [36]. According to Kietzmann et al. [37], social media as platforms increase user engagement with firms, interactions between users and significantly impact on a firm's reputation, sales, and even survival. Thus, user-centric platforms could be built by seven functional blocks—identity, conversations, sharing, presence, relationships, reputation, and groups—with different extents, respectively, to which and when they focus. The self-fulfillment by users will enhance user satisfaction, lock up users on the system evolution, and finally sustain the platform advantage [38].

3. Case Study

This study investigated two Internet-based businesses to examine their strategies of manipulating modular operators for developing the sustainable service platform. One has been established before 2000, Youthwant.com (accessed on 2 May 2017), while the other a relatively young online music content provider built at the end of 2004, KKBOX (accessed on 2 May 2017). Both are Taiwan-based websites. The former is a social networking platform focusing on novel composition and picture/video sharing. This website was once one of the stickiest and busiest websites in Taiwan, with eight million daily page views in 2007. Youthwant continuously grows to cover the business of electronic commerce, focusing on shopping guide and price comparison. Finally, it was successful enough to be acquired by LINE, the Japan's largest social networking app provider on electronic devices, particularly smartphones, in the end of 2017. KKBOX, providing online streaming services, has become the largest vendor of music on demand in Taiwan. KKBOX was also acquired by Japan's second-largest mobile operator, KDDI, with a 76% share. This research aims to adopt eight modular operators—splitting, substituting, augmenting, excluding, inverting, porting, integrating, and configuring—to elaborate the platform development strategy by these two Taiwan-based cases. The research data were mostly collected from the second-sourced archives and the public press that had been posted officially on each corporate website, while some supplementary data were interviewed from corporate respondents (engineers and managers) from December 2016 to May 2017. After collecting the archive data and interviewing opinions, the author, based upon the analytical framework of modular operators, applied the "content analysis" method under the characteristics of each modular operator to delineate the modularity principle behind key product/service strategies of these two vendors.

3.1. Youthwant Platform of Social Community

The Youthwant.com website targets college students and provides services around a lot of things that most of college students want: learning, love, and participation in social activities. As the vice president pointed out, the community platform of Youthwant evolves like building blocks from basic functions of chatting, romantic novel composition, storytelling, and sharing lovely or fantastic picture/photo to designing personal cards, exchanging shopping experience, and advanced backup and quick search services of historical Facebook browsing logs.

After reviewing the evolutionary process of Youthwant, its building block concept is like the modularization of product development platform. The decomposition of the

complicated campus lives of college students into several basic services involves implementing the splitting modular operator. The splitting modularization in the beginning stage of platform development keeps the platform extensible as market demands grow gradually. Thus, augmenting new services together on the Youthwant platform is possible later on. More importantly, surfing on the wave of web 2.0, Youthwant directed the heavy duty of providing contents that used to be performed by a single vendor in the earlier Internet era into the simple, spontaneous process of user-generated, up-to-date content. In 2001, Youthwant launched the composition board of “childhood love stories”, which engaged with the great volume of customers for utilizing the creativity of diverse users and chatting stories each other such as playing a fan-tan game. The strategic expansion entails functional blocks, sharing, conversation, and presence, proposed by Kietzmann et al. [37]. Additionally, Youthwant issued a video/picture sharing channel, communism of files, to augment to the text-based composition of childhood love stories after the year 2006. Consequently, Youthwant achieved the stickiest website in Taiwan as a result of aggressive savoring, sharing, and commentary among college students in 2007. Thus, the clear APIs resulted from the splitting modular operator creating a smooth way of conducting the substituting modular operator on content provision from a few vendors to a crowd of innovative users. Therefore, there are prospering contents composed or configured by users to exactly match the interests of diversified young groups. According to the network effects, the positive feedback loop is likely resulted from thick two-sided markets, that is, more and more content providers and demanders [39].

Beyond sharing with fun and joy, Youthwant further issued customizable “personal cards” for social networking among college students in 2007. This is a functional block of identity [37]. This service turned users to be producers or co-producers by means of some simple, user-friendly toolkits. Such a product innovation strategy is undoubtedly conducting the configuring modular operator. Therefore, there are not only user-generated personal cards but also the templates of personal card sharing with each other so that the increasing number of sharing templates supports augmenting and substituting modular strategies to expand customer choice options and thus satisfy the varied demands, broadening the size of the customer base.

For the successful promotion of new issued services on the Youthwant platform, there are complementary incentive programs in return to encourage users’ adoption of the firm’s modularization strategies. Users of Youthwant are likely to be listed in the hit parade whenever they are popular enough to receive many good guy messages from others, or to be tagged as best friends by many others because of contributions to the community through solving problems of others or sharing ideas, files, and web templates. This is a function of promoting users’ reputation in the network society [37]. Therefore, the users on the top-hit parade list are bound to obtain beneficial returns such as coupons, access privilege, and member fee premiums.

For the purpose of continual proliferation of services for college students, in 2007, Youthwant launched a service related to daily lives, Wi-Fi sharing services. Surfing on the Internet is an important thing for college lives through a high-speed network. Before 4G penetration, Wi-Fi hotspots are the critical access points for college students to networking. In 2006, a Spain-based firm, Fon, started out by building its Wi-Fi network through devices called “foneras”. Members of Fon agreed to share a part of their bandwidth as a Wi-Fi signal, so that they could connect to other members’ hotspots. Youthwant found that most Taiwan college students usually study in unfamiliar places away from their hometowns. Thus, students leaving homes could share their residual Wi-Fi bandwidth installed at homes with those who move from other places, and vice versa. So, Youthwant expanded the corporate boundary by cooperating with Fon and Pchome, the largest vendor of electronic commerce in Taiwan, and promoting members of Youthwant to adopt wireless devices, Foneras. Youthwant reckoned with all the integrating businesses with Fon and reputation leverage with Pchome to fulfill the whole wireless services. Therefore, members of Youthwant have the premium access to the wireless broadband nationwide among members far apart from

each other before ubiquitous networking. Moreover, in 2013, Youthwant augmented a new service, iguang.tw, which is a site of sharing shopping experience and, especially, focusing the price comparison between major online vendors. Beyond the prosperous information sharing like services of childhood love stories, communism of files, and personal cards within the community members, Youthwant collaboratively integrated with other online and offline vendors such as EasyStore, a virtual platform cooperated with retailers like Yahoo!, Books.com (the largest online bookstore in Taiwan), B&Q, and so on to effectively direct users to select fitted products, matching their diverse demands. The collaboration with outside vendors indeed needs the integration power and capability to smooth away any obstacle when interfacing between entities. In other words, the growth strategies linking to other platforms adopted by Youthwant is like the functional block of relationship proposed by Kietzmann et al. [37], which is used to enhance the user flow among members.

Along with the growth of other platforms, severe competition between firms may result in succession. Porting to the advantageous platforms with a high growth rate is a way to prevent from obsoleting or having difficulties of a winner-takes-all situation. Beyond the PC version, it is necessary for Youthwant to develop the version of mobile smartphone to accommodate to the wide spreading mobile users. Additionally, Facebook is an emerging but highly growing social networking website, especially, after 2008. Youthwant adopted the APIs released by Facebook to invite Facebook users to logon by means of their Facebook account. Thus, Youthwant could not only embrace the large size of Facebook users but also migrate existed Youthwant users to a large networking base with greater network effects. Furthermore, Youthwant thought highly of the large volume of browsing logs of Facebook's users. Thus, it must be useful and valuable for a user to search for some particular messages that he/she left before or friends did before. However, Facebook never supported the searching function from historical browsing log. In 2014, Youthwant adopted the APIs released by Facebook to back up the personal Facebook browsing log on the Youthwant platform so that the Youthwant user can have a quick search from his/her Facebook browsing log. For the extension of the product life cycle, firms must look for leveraging a powerful cornerstone to escape from difficulties. Applying the porting modular operator to migrate an extensible platform is especially important to a new entrant or a local incumbent because of possessing limited resources. If it is impossible to deter the growing competitors, embracing and expanding is an indispensable strategy as long as the immigrants could keep something inimitable. Even though the irresistible competitive tide floods from Facebook, the incumbent social networking website such as Youthwant still manipulated the fitted porting modular operator to leverage for survival.

Table 1 shows how Youthwant managed the modularization strategies to develop her own platform of social community. The dynamics depict the art of manipulation between modular operators to fulfill the functional requirements of building social media.

Table 1. Youthwant builds the platform of functional blocks by manipulating modular operators.

Year	Issued Services	Functional Blocks	Modular Operators
2001	Childhood love stories	Presence, sharing and conversation	Splitting and augmenting
2006	Communism of video/picture files	Sharing and conversation	Augmenting and substituting
2007	Personal cards	Identity, sharing and reputation	Configuring, augmenting and substituting
2007	Top hit parade	Reputation and group	Augmenting
2007	Wi-Fi foneras	Sharing and relationship	Integrating and augmenting
2008	Logon by Facebook	Relationship	Porting
2013	Shopping at iguang.tw	Sharing and relationship	Integrating and augmenting
2014	Backup Facebook browsing logs	Relationship	Porting, integration, and augmenting

3.2. KKBOX Platform of Entertainment Community

KKBOX is an online entertainment provider focusing on streamlining music services in Taiwan since October of 2004. KKBOX emphasized that all the music on the platform has licensed the copyright from entertainment corporations, which is a business model like Apple's iTunes, different from peer-to-peer illegal file sharing. As the splitting modular operator adopted by Youthwant for building college life content blocks to users, KKBOX issued music provision by categorizing music genres. At first, KKBOX developed the LOHAS music museum, a collection of light music and classic music, focusing on Chinese folk songs and campus ballads. After installing a visualized, user-friendly music-playing software on PCs, KKBOX users can listen online to the selected streaming music or conditional, limited downloading of offline music.

Beyond augmenting the different music genres chronically to the music platform by KKBOX, in 2007, it also reoriented to the spirit of web 2.0. KKBOX invited users to configure personal favorites to create Blogmusic. In addition, there are many options for users to decorate their own blogs such as background color, ambiance, and repertoires that customers could choose not only to preview but also to restore anytime after setting up. Consequently, the personal Blogmusic reveals the customer preference so that KKBOX could further adjust the portfolio of licensed music and design the appealing promotion program. It is now launching the functional blocks of identity, sharing, and reputation in the social media society [37]. So, KKBOX used the configuration modular operator facilitated by simple drag-and-drop toolkits to release users' creativities, which help the online vendor achieve the product/service differentiation to match diversified customer demands. However, the personal collections may cause the concerning of copyright infringement. Considering the website reputation, after 2010, KKBOX removed the function of Blogmusic by means of a seamless deletion modular operator without any influence on the whole platform.

In 2011, KKBOX launched a new music service, Listen With, which allows premium users to play as a disc jockey to show his/her preferred collections with others. KKBOX usually invited famous singers to build appealing "listen with" stations, which are used to hit the music charts as well as to attract considerable quantities of fans. This innovative service strategy is fitting to the grouping functional block [37] and based on the configuring modular operator to include users as the innovators and promoters. To further increase the size of the music user community, in 2012, KKBOX encouraged users to log into its own music platform directly from the accounts of other platforms, such as Facebook and Yahoo!Kimo (a Taiwan-based portal). Undoubtedly, the porting modular operator was used to leverage the installed bases of other platforms.

In addition, KKBOX continually broadened the product lines beyond streaming music. By integrating with other online and offline retailers, in 2012, KKBOX started KKTIX, which is an online ticket order system for selling concert tickets. The KKTIX ticking services also migrated the large amount of PC users to mobile phones by electronic QR-coded digital tickets. It is an innovative service to enhance the user flow through the functional block of relationship [37] and to leverage a cross-marketing program between users on the PC platform and smartphones. Furthermore, KKBOX also started music shops to sell music files, paying by downloading. Users can use the specific KKBOX playing software to listen to a single music offline or burn the downloaded music to CDs to customize their own music albums. So, KKBOX utilized the integrating modular operator to cooperate with outside vendors so that it can expand the service portfolio and adopt the augmenting modular to enhance the existed online music listening function with offline music album services.

According to the prosperous relationship among members [37], keeping on manipulating the porting and integrating modular operators with existing market giants to increase the installed base is always an important strategy for KKBOX, a new startup, to turn on the growth momentum. Since 2004, KKBOX issued a co-marketing program with a Taiwan-based Internet service operator, HINET, to promote online streaming music services by a micropayment approach on the HINET billing system. Therefore, KKBOX explored new

customers from HINET, while HINET increased its Internet portal value to users. Along with the growth of smartphone users, KKBOX kept on cooperating with HINET to migrate PC-based music users to the mobile phone network. In 2008, KKBOX, HINET, and Nokia launched an integrating service to allow HINET mobile users to listen to mobile streaming music, Music eXpress, through Nokia phones. Such a kind of KKBOX mobile music service also appeared on HTC smartphones in 2011. Furthermore, in 2012, KKBOX encouraged the music users to show their songs on the Timeline and Ticker of Facebook so that their friends can watch what the popular songs are currently. In 2014, when the Internet content giant Google entered the TV area with the Chromecast system, KKBOX started the Chromecast version, too. In 2015, when Apple Watch and Apple Wear went to the market, KKBOX immediately launched the Apple-specific version to catch the new platforms along with big market dominators. So, this is a leverage strategy resulting from porting and integrating modular operators for a small startup to attract more and more users from big customer bases of market giants.

However, KKBOX always kept the music-playing software secret when splitting the music system to share with compliments, augmenting new services, substituting old versions, integrating with outside vendors, and porting to big platforms. So, even to the current version 7.0, KKBOX reserved the core of the music software to retain the bargaining power by carefully utilizing the inverting modular operator when cooperating with many market giants. A small, local startup must not only open the business system so as to collaborate with complements but must also control the cooperation process in a way of close inversion to prevent the second-mover advantage.

Finally, Table 2 depicts how KKBOX manipulated the modularization strategies to continuously expand functions for attracting users and sustaining the competitive advantage of entertainment platform.

Table 2. KKBOX builds the platform of functional blocks by manipulating modular operators.

Year	Issued Services	Functional Blocks	Modular Operators
2004	Hinet billing	Presence	Splitting and integrating
2004	LOHAS music museum	Conversation	Splitting and augmenting
2007	Blogmusic	Identity, sharing, and reputation	Augmenting and configuring
2008	Music eXpress with Nokia	Relationship	Integrating and porting
2010	Removing Blogmusic	Reputation	Deleting
2011	Listen with	Group and reputation	Configuring
2011	Music eXpress with HTC	Relationship	Integrating and porting
2012	Logon by Yahoo!Kimo	Relationship	Porting
2012	KKTIX	Relationship	Integrating and augmenting
2012	Listing songs on timeline and kicker of Facebook	Sharing and relationship	Porting
2014	KKBOX on Chromecast TV	Relationship	Integrating and porting
2015	KKBOX on Apple Watch	Relationship	Porting and integrating
2015	Keeps KKBOX 7.0 secret	Identity	Inverting

4. Discussion: Open Innovation and Modularization

For the purpose of continual innovation, the case study shows that two Taiwan-based Internet startups adopted modularization operators to establish their business platforms that collaborate with outside vendors and customers to achieve the benefit of open innovation, leveraging up growth on complements. According to partitioning demands of college student lives from the case of Youthwant and classifying music genres of the KKBOX case, splitting the complicated businesses into several compatible and assembled entry points is the first step to build the scalable business platform. Even though Internet content providers (KKBOX) and content market makers (Youthwant) do not provide physical, engineering products such as PCs assembled by standard chip modules, they indeed continually and independently issue the innovative, modularized contents to compatibly cascade diversified businesses. Youthwant began from personal blogging, chatting, and

storytelling, while KKBOX started with online music listening. Therefore, the proposition of a splitting modular operator is articulated as follows:

Proposition 1. *For a startup to seize an entry segment among complicated customer requirements, adopting the splitting modular operator is the starting point to grow up to become a scalable platform.*

Youthwant encouraged users to participate with the story composition by standard procedures and interfaces so that the user-generated contents including story texts and video files substituted the limited vendor-official ones. Therefore, the sources of content prospered. KKBOX also invited users to build personal music blogs to collect their favorite songs. Therefore, diversified user preference substituted vendors' dull provision just through standard drag-and-drop interfaces. One proposition of a substituting modular operator is articulated as follows:

Proposition 2. *When a service vendor intends to proliferate services, the substituting modular operator by means of standard interfaces can be used to invite multiple sources.*

After splitting the complicated system into chunks, firms could continually augment new functions into the common, scalable platform in an evolutionary expansion route. Therefore, service diversity could be maintained. Youthwant augmented text-based storytelling to funny video sharing and personal card designs. KKBOX began from classic and LOHAS genres of music and expanded related music services from personal music blogging, listening with famous singers, listening to customized CDs, to purchasing tickets for live concert. Therefore, the augmenting modular operator shows the way for small entrants to produce a complete product so that they can retain current users with much more related services and even satisfy the diversified demands of new users. One proposition of the augmenting modular operator is articulated as follows:

Proposition 3. *When a small firm intends to keep the growth momentum along an evolutionary path, the augmenting modular operator is one way to continually expand service scopes on the common platform to encroach to much more different segments.*

In contrast to adding more services onto the platform, sometimes the reduced forms are preferred to the complicated ones. Youthwant reduced the PC-based, complex webpages into lean services so that it can enter the mobile phone market, which need small-sized screen webpages and simple computation under the limited battery power. KKBOX also did the same transformation from heavy data computation to the lean design of light usage for mobile users. Therefore, the deleting modular operator facilitates firms to transform for discriminatory users quickly and seamlessly. One proposition of deleting modular operator is articulated as follows:

Proposition 4. *For the discriminatory, light users' demands, the deleting modular operator seamlessly facilitates firms from abandoning complexity to a lean design.*

In the server platform competition, industrial ecosystems usually result in dynamic succession. Youthwant searched for leverage to prevent from becoming obsolete. It ported to Facebook by adopting APIs that allowed Facebook users to quickly log into Youthwan and supported them to search the Facebook browsing logs in the Youthwant backup system. The porting modular operator made Youthwant complementary with Facebook and leveraged the social network of Youthwant by that of Facebook. Therefore, Youthwant can maintain its visibility as long as Facebook grows continually. KKBOX also let users of another Taiwan portal, Yahoo!Kimo, and Facebook have a quick logon. Beyond the fusion between firms' installed bases, porting to the prospective platforms, such as the broadband mobile network, is a way to extend the product life cycle and broaden the market coverage. One proposition of the porting modular operator is articulated as follows:

Proposition 5. *For prevention from obsoleting from industrial succession, the porting modular operator can be used to leverage the firm's position by the advantage platforms to extend the product life cycle and broaden the market coverage.*

According to the continual expansion of product lines by Youthwant and KKBOX, internal augmenting functions by using APIs or simple attachment are not enough to cover the users' whole usage. So, actively coordinating with related businesses of outside vendors for brand-new services is important. Youthwant expanded its services from social networking to Wi-Fi services by integrating with outside Internet-related vendors Spain Fon and Taiwan Pchome. KKTIX, issued by KKBOX, is a new service combining music listening and concert tickets. Music eXpress is also a mobile music service integrated by KKBOX with mobile phone manufacturers such as Nokia and HTC. Therefore, one proposition of the integrating modular operator is articulated as follows:

Proposition 6. *To keep on increasing the platform value and market dominance, the integrating modular operator can be used to coordinate the related outside vendors to continually expand the complete product lines and the value network.*

Due to the growing end-user computing power, the user-generated contents are increasingly important for augmenting and substituting firms' provision with up-to-date, innovative services. Youthwant allowed users to involve the contents creation so as to exactly configure user requirements only through simple toolkits and user-friendly interfaces. KKBOX also let users compose their own favorite music collections and encouraged users to listen with people with the same hobby. The self-configuration process reveals the real customer preference so that the vendors can adjust the business portfolio and market positioning accurately. Therefore, one proposition of configuring modular operator is articulated as follows:

Proposition 7. *To capture the increasing end-user computing power and profuse creativity, the configuring modular operator with simple toolkits and interfaces can be used to prosper innovative contents so that firms can adjust market positioning accurately and promote with users.*

When continually inviting the outside complements for innovation, keeping the business core secret is so important to prevent from the difficulties of second-mover advantage. KKBOX always maintained the self-developed music-playing software translucent to the outside complements whenever integrating with, porting to, and configuring by outsiders. The inverting modular operator is indispensable for emerging firms to retain platform leadership from coordinative collaboration and reduce the dependence on outside cooperators along the continuous growth. Therefore, one proposition of the inverting modular operator is articulated as follows:

Proposition 8. *To maintain the platform leadership, the inverting modular operator is used to keep the business core translucent somehow so that the emerging firm can reduce the dependence on outside cooperators along the continuous growth.*

5. Conclusions

This research investigated two Taiwan-based Internet service vendors, Youthwant and KKBOX, to explore the manipulation strategies of modular operators along their growth paths. Based on six modular operators by Baldwin and Clark [27] and two ones by Chou and Hung [29], this paper finally concludes from historical business operations of cases to articulate eight propositions about antecedents and consequences of maneuvering different modular operators to firms for sustainable growth. The exploratory study concerns how to strategically manipulate the modular operators beyond the computer industry that Baldwin and Clark [27] emphasized. The results also show the efficacy of modular operators in the

Internet businesses. For the academic contribution, this research validates the power of the original product design rule by Baldwin and Clark [27] to seize complementary assets and capture appropriation [40], and, therefore, extends it to the networking industry. Moreover, the manipulating strategies of modular operators investigated from these two Taiwan Internet vendors show the match to the conceptual framework for configuring functional blocks of social media proposed by Kietzmann et al. [37]. The content providers can also split the complicated information into chunks to select a few feasible entry points to expand a series of website functions sequentially. Keeping on augmenting, substituting, and deleting content chunks will enhance service differentiation, diversity to match different demands and, therefore, broaden business scopes and market coverage. Leveraging with the outside complements by integrating and porting with other scalable, prospective platforms is an approach to gain visibility continually and prevent obsolescence. The involvement of users results in unceasing creativities and self-configuration reveals a real customer preference for firms to tune right market positioning. Inverting the valuable core of enterprise is indispensable for firms to sustain the bargaining power because it stops the leaking of intellectual property rights and retains appropriability among complements.

The modularity operating strategies resulted from the research cases are consistent with academic research. Their dynamic manipulation of modular operators sense and seize the market opportunities with collaborators and, more importantly, capture the appropriation on the deliberate platform of open innovation. The underlying philosophy of product series is consistent with the strategic combination between modularity policy, open innovation and dynamic capabilities argued by Bogers et al. [7] and Henkel et al. [32]. Along the evolution of the Taiwan social networking industry, these two vendors adapted to the dynamics of tuning modular, task partition, and partner alliance to balance the benefits of discovery and the costs of divergence, which has been emphasized by Wang and Shu [6], Almirall and Casadesus-Masanell [20], and Hopkins et al. [32] for concerns of positive and negative effects from the open innovation evolutionary process. In addition, as the assertions of Yun et al. [8–10] about the entrepreneurial culture of open innovation, from the cases of Taiwan-based startups, the culture of open innovation has been built in their evolutionary stages with different modular patterns for searching growth. Therefore, the culture of continually driving for innovation lets them outperform competitors and finally win the acquisition by global star companies.

Further research may switch the focus to compare the differences of modular manipulation patterns issued by firms between industries or along the evolutionary stages of an industry. Empirical studies investigated from measuring modular operations of many firms are feasible to evaluate the propositions articulated by this paper.

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