

# The combination of different open innovations: a longitudinal case study

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## Abstract

**Purpose** – The purpose of this paper is to explore how an organization can combine different types of open innovations and what are the key factors that may influence the combination of different open innovations.

**Design/methodology/approach** – The basic methodology of this paper is the longitudinal inductive analysis within the conceptual framework of the open innovation proposed by [Dahlander and Gann \(2010\)](#). In this case study of Xiaomi Tech Inc., the open innovation combination is investigated through examining 25 new products created between August 2010 and December 2016 in terms of four general types: acquiring, sourcing, selling and revealing open innovation.

**Findings** – In practice, the combination of different types of open innovations can be realized. A firm may combine different open innovations at three levels: a single product level, a related product cluster level and a company level. In addition, different open innovations can be combined in diverse modes. The purpose of combining different types of open innovations is to overcome the disadvantages of each type and to exploit the advantages of all different types. Many factors may affect a firm's option of how to combine open innovations. At different development stages, a firm may make and implement corresponding strategic direction based on its innovation capacity and internal resource. For a given strategy, the firm needs to create profits and manage intellectual property in the implementation of open innovations. These factors are interacted each other, rather than isolated.

**Originality/value** – The findings of this paper are helpful for better understanding how and why an organization can combine different types of open innovations. From a managerial point of view, an organization may combine different types of open innovations to leverage advantages and avoid disadvantages of each certain type of open innovation. An appropriate combination of different open innovations can effectively improve new product development.

**Keywords** Open innovation, Combination, Longitudinal analysis, Xiaomi Tech Inc.

**Paper type** Case study



## 1. Introduction

Open innovation has been closely discussed in the innovation management academic community and widely adopted in practice, since [Chesbrough \(2003a, 2003b\)](#) introduced

the concept of open innovation. In the face of the intense competition, an organization has to cooperate with different types of partners to acquire external resources, rather than making an innovation in isolation (Chesbrough and Crowther, 2006). It is widely recognized that open innovation can provide various benefits to an organization, such as contributing new ideas, mitigating business and financial risks, achieving great market scale and accelerating the speed to market (Munsch, 2009). Laursen and Salter (2006) demonstrated that firms that are more open to external sources are more likely to have a higher level of innovation performance. In addition, the survey conducted by Arora *et al.* (2016) showed that more than half of US innovative firms had external source for the inventions that led to the important new product developments. In summary, open innovation can foster an organization's incremental or cumulative innovation (Murray and O'Mahony, 2007).

However, open innovation also has negative effects on organization performance because of potential risks of transferring technology (Lichtenthaler, 2015). In the process of implementing open innovation, there are at least three types of costs: coordinating cost, competing cost and the cost of protecting ideas. Both costs and risks may hinder organizations that have invested in open innovation activities from achieving profits (Enkel *et al.*, 2009). This disadvantage may drive an organization to adopt a closed innovation strategy, giving up open innovation (Dahlander and Gann, 2010). Indeed, many firms face a dilemma whether or not they will pursue an open innovation strategy or how to collaborate with external partners. Thus, how to manage potential risks and to capture substantial benefits are critical issues for the open innovation management.

A simple binary classification of innovations into open or closed ones does not reflect the reality. Many scholars have recognized that there are diverse modes of open innovations. During the open innovation process, knowledge exchange occurs across the boundary of different organizations. According to the direction of knowledge flow, open innovations can be categorized as inbound innovation and outbound innovation (Chesbrough and Crowther, 2006). In addition, knowledge exchange can be pecuniary and non-pecuniary. In terms of knowledge flow direction and the monetary nature of the knowledge exchange, open innovations can be divided into four types: acquiring, sourcing, selling and revealing (Dahlander and Gann, 2010). Acquiring and sources are pecuniary and non-pecuniary inbound innovations, respectively, while selling and revealing are pecuniary and non-pecuniary outbound innovations. Each type of open innovations has its advantages and associated problems (disadvantages). To enhance the performance, an organization may combine different types of open innovations. As pointed out by West and Bogers (2014), there are urgent needs to investigate why an organization combines different types of open innovation and to what extent these types of open innovations are complement or can be substituted each. No research has been reported to provide empirical evidence for the complementarity between inbound and outbound innovations (Cassiman and Valentini, 2016). At present, our understanding of the dynamic combination of different types of open innovations is very limited. There are three major knowledge gaps in the literature regarding open innovations:

- (1) Why does an organization pursue the combination of different types of open innovations?
- (2) How can different open innovations be dynamically combined in an organization?
- (3) What kind of relationship exists between different types of open innovations?

To fill in these gaps, we conducted a longitudinal study of different types of open innovations in the case of Xiaomi Tech Inc., and the developments of twenty-five new products during 2010-2016 were investigated. We first developed the conceptual framework for this investigation, and then analyzed each new product development. We examined the combination of different open innovations from three different perspectives and identified the primary factors that may influence the combination of different open innovations.

## 2. Theoretical background

The most widely adopted definition of open innovation is “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively” (Chesbrough and Crowther, 2006). Profit-seeking firms often consider external sources for innovations and align commercialization efforts – whether internal or external – to their business model (Zott *et al.*, 2011). In the light of knowledge flow direction, open innovations can be classified into inbound innovations and outbound innovations (Chesbrough and Rosenbloom, 2002).

Inbound innovations enrich an organization’s knowledge through the integration of suppliers, customers and external knowledge sourcing (Enkel *et al.*, 2009). It reflects the outside-in process in open innovations. To analyze inbound innovations in detail, the outside-in process in open innovations has been broken down into four phases, which are referred to as acquisition, assimilation, transformation and exploitation by Zahra and George (2002), strategy, sourcing, integration and metrics by Chesbrough and Schwartz (2007), want, find, get and manage by Slowinski and Sagal (2010).

Outbound innovations earning make profits by bringing ideas to market, licensing intellectual property and multiplying technology through transferring ideas to outside environment (Enkel *et al.*, 2009). In recent years, the importance of outbound innovations has been increasingly recognized along with a growing trend toward open innovations (Tranekjer and Knudsen, 2012). Two streams of literature related to inside-out process are theories on social status in the market for technologies and work on the descriptive capacity in outbound innovation (Hu *et al.*, 2015).

However, such simple dichotomy of open innovations cannot cover the actual spectrum of open innovation activities. The uncertainties around markets and technologies also make the dichotomy often a poor fit to the reality of innovations (Christiansen, Gasparin, and Varnes, 2013). To go beyond the unidirectional linear process, Enkel *et al.* (2009) proposed the coupled mode of open innovations, co-creating with complementary partners through alliances, cooperation and joint ventures. Furthermore, West and Bogers (2014) extended the mode of open innovations by incorporating the phase of interaction mechanisms, such as feedback loops, reciprocal interactions with co-creation partners and integration with external innovation networks and communities. In fact, the coupled mode of open innovations is the combination of inbound and outbound innovation. Organizations will combine the outside-in process with the inside-out process and jointly develop and commercialize innovations in the coupled mode of open innovations. The coupled mode has been widely studied in the open innovation management literature, because it is popular in firms that have substantial resource allocation (Enkel *et al.*, 2009).

In recent years, the disadvantages of open innovations have attracted a lot of attentions in academia. If the disadvantages of open innovations outweigh their advantages, then an organization may choose the closed innovation mode. The future of technology innovations

lies in an appropriate balance between the open and closed innovation activities (Enkel *et al.*, 2009). In this context, another typology of open innovations is established to distinguish between pecuniary and non-pecuniary inflows of innovations. Considering the interaction between knowledge flow direction and the cost of open innovations, Dahlander and Gann (2010) classified innovations into four categories: sourcing, acquiring, selling and revealing open innovations, as shown in Figure 1.

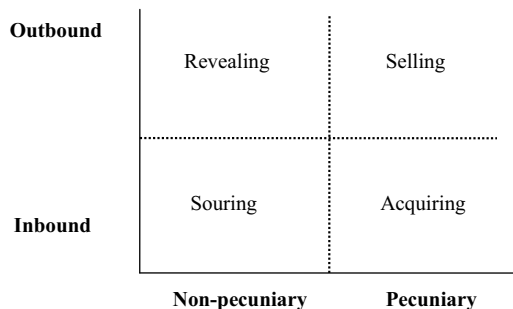
The first type is sourcing open innovation, meaning that an organization uses external sources of innovation without pecuniary. If the existing knowledge is free and available, then an organization can use it to initiate internal technology innovation. The logic behind sourcing is that firms engage in creating a synergy between internal resources and externally free ideas to develop new products. This mode of open innovations is about leveraging the free and available external resources.

The second mode is revealing open innovation, in which an organization reveals its internal resources to the external environment without immediate financial rewards. In particular, firms do not seek direct benefits from revealing internal resources. For instance, a company reveals its internal findings to its competitors or new ideas of a company are not protected by intellectual property rights. By weakening the protection of intellectual property in some cases, an organization may achieve greater opportunities in accumulating advancements.

The third type is acquiring open innovation, in which an organization acquires valuable outside resources with pecuniary. Firms may facilitate internal innovation by acquiring valuable technologies. In some cases, an organization has to pay a lot of royalty for acquiring external ideas that are protected by intellectual property rights. For instance, a company may buy a lot of patents or get a copyright license through the market place.

The last mode is selling open innovation, which means that an organization sells or licenses its internal resources to other firms. Firms can fully leverage their internal resources by selling or licensing-out intellectual property. This will shorten the time span between inventions and commercialization. For instance, a company may make a strategic priority to licensing-out its patents or copyrights.

In summary, Dahlander and Gann (2010) proposed four types of open innovations. Acquiring and sourcing are inbound, while selling and revealing are outbound in terms of knowledge flow direction. This typology of open innovations provides a good conceptual framework for empirical study of open innovation activities (Huizingh, 2011). In this paper, we conduct a longitudinal analysis with this conceptual framework to identify and examine the advantages and disadvantages of different modes of open innovations in the case of Xiaomi Inc.



**Figure 1.**  
The prototype of  
open innovation  
categories

### 3. Research design

Most of previous open innovation studies relied on case studies (Dahlander and Gann, 2010), because case studies can improve our understanding of how things actually work and enables us to identify important factors and features (Huizingh, 2011). Qualitative case study is a suitable approach to explore patterns of specific processes (Creswell, 1994), especially when boundaries between events and processes are not conclusive (Yin, 2009). A longitudinal analysis approach is well suited to examine the dynamics of an action over time, because the data collection and analyses can be conducted by considering historical and contextual dimensions (Miles and Huberman, 1994). Thus, we adopt the longitudinal analysis approach to the investigation of open innovations in this study.

The purpose of our investigation is to understand why and how why an organization combine different types of open innovations. To fulfill this purpose, we selected Xiaomi Tech Inc. as a case study to scrutinize the modes of combining different open innovations in depth. Xiaomi Tech Inc., founded in 2010, has been actively pursuing new product development by implementing open innovations in the Internet era. With the “more with less” strategy and internet thinking, it encourages numerous users to participate in new product development. Consequently, Xiaomi Tech Inc. has successfully developed a series of new innovative products and become one of the fastest-growing companies in China. Its success has also attracted the great attention in the world. MIT Technology Review published the 50 Smartest Companies for the year of 2015, highlighting the world’s most innovative technology companies (MIT Technology Review, 2015). Xiaomi Tech Inc. was ranked second in MIT’s list of 50 Smartest Companies, compared with its rank of 30th in 2014. The combination of different open innovations implemented by Xiaomi Tech Inc. contributes greatly to its success and rapid growth. A careful examination of the practices of Xiaomi Inc. in open innovations will provide some clues and insights for us to draw some general conclusions about the combination of different types of open innovations.

To support our longitudinal analysis, we collected data over a time period of 6 years since the establishment of Xiaomi Tech Inc. in 2010. To ensure the reliability and accuracy of the data, multiple data collection methods, such as archive search, field interviews, and user experience feedback, have been utilized, and the data from different sources are compared and cross-validated. First, we accessed more than 40 videos records about a series of new product releasing conferences. Xiaomi Tech Inc. usually holds a release conference to introduce and promote its new products. The conference videos provide the fundamental information related to technical features and development processes of new products. In addition, we examined over 1,500 records, including communication records in Xiaomi Forum and informal email feedbacks. This helps us to better understand the details about new product development. We also reviewed more than 20 interview videos and reports written by journalists about Xiaomi Tech Inc. and Mr Jun Lei, who is the chairman and CEO of Xiaomi Tech Inc. and always attracts the attention of the general public and press in China. Moreover, we studied three articles published in management journals about the emergence of Xiaomi Tech Inc. Besides these, we also reviewed the important book written by Wanqiang Li who is another founder and the vice-president of Xiaomi Tech Inc. This book provides details on the development history of Xiaomi Tech Inc. Second, we interviewed two high level executives of Xiaomi Tech Inc. and 11 engineers for new product developments. These interviews help us to get a better understanding of why and how they develop a series of new products. Finally, we participated in new product

experiencing activities as a user to ensure that the data reflect real user's experience. For this purpose, we have purchased 15 items of new products, registered and logged in Xiaomi community, shared and discussed user experience in Xiaomi's official website. This not only provides important complementary information but also helps us to address the problem of data error.

Based on the above data sources, we construct a detailed timeline of launching new products in Xiaomi Tech Inc. The timeline is used to develop a narrative account that traces the flow of events that is critical to understand the combination of different open innovations conducted by Xiaomi Tech Inc. The detailed chronological records enable us to gain a better grasp of which events and processes lead to consequent innovations (Jain, 2012).

Finally, we addressed the theoretical issue emerged from our empirical longitudinal study and provided some theoretical insights in the context of existing literature. In summary, we used a conceptual framework to conduct a longitudinal case study of Xiaomi Tech Inc.

#### 4. Open innovations implemented by Xiaomi Tech Inc.

The life cycle theory can be applied to illustrate the growth of a firm. In general, the main life cycle of an enterprise or organization can be divided into four stages: creation, development, stabilization and crisis (Kniazieva *et al.*, 2017), though there are other different classifications of the development stages for the enterprise life cycle. As far as a venture concerned, a company will usually go over three main stages of developments: the early stage, expansion stage and maturity stage. In the early stage, a firm seeks to develop new products or services and carry out initial marketing, but the firm is often unprofitable. However, a firm may develop very fast and make a huge profit at the expansion stage, while the business model of a firm can enter the maturity stage after fast expansion.

Xiaomi Tech Inc. has gone through the above three development stages during the period of 2010-2016. The period between 2010 and 2011 was the early development stage of Xiaomi Tech Inc., and its revenue was almost zero in this period. Its original new product MIUI, a custom operating system for smart phone, was launched for the first time on August 16, 2010. Although Xiaomi Tech Inc. was unprofitable during this period, it successfully developed two new software products, MIUI and Mitalk, and made them freely available to users. The expansion stage of Xiaomi Tech Inc. was the period from 2012 to 2013. Xiaomi Tech Inc. started to make profit when its first core hardware device, Mi phone, was launched on August 16, 2011. As a result of Mi Phone's success, its revenue reached 0.55bn RMB Yuan in 2011. Xiaomi Tech Inc. entered the maturity stage in 2014. When a series of Ecological Products were launched, Xiaomi Tech Inc. started to make big revenue. The gross sales were 66.8bn RMB Yuan in 2015 and 68.4bn Yuan in 2016. The sharp increase in the revenue showed that the business model implemented by Xiaomi Tech Inc. had achieved a mature level.

Table I shows the chronology of events related to 25 new products launched by Xiaomi Tech Inc. between August 2010 and December 2016. These new products can be categorized into three types: software, core hardware and ecological products. It was interesting to note that the software products had been developed in the early stage, and most of core hardware products were developed in the expansion stage, while the ecological products were mainly launched in the maturity stage.

Code	Name	First launch date	Product description	First launch year
1	MIUI	August 16, 2010	A custom Android operating system for smartphone	2010 (2)
2	MiTalk Messenger	December 10, 2010	A popular mobile social application and an instant message software	
3	Mi phones	August 16, 2011	A series of smartphones with operating system MIUI	2011
4	Mi Box	March 1, 2013	An Internet TV set-top box	2013 (5)
5	Mi TV	September 5, 2013	A series of TV integrated a built-in Mi Box	
6	Mi Wi-Fi Router	December 19, 2013	A series of routers for getting access to Internet	
7	Mi Headphones	June 24, 2013	A series of headphones for smartphone	
8	Mi Power Bank	December 10, 2013	A series of Mobile Power Pack for smartphone	
9	Mi PAD	May 15, 2014	An Android-powered tablet computer	2014 (7)
10	Mi Band	July 22, 2014	A wearable wristband that can help users track their fitness and sleeping routine	
11	Mi Bluetooth Game Controller	September 22, 2014	A game controller with the Bluetooth gamepad supports	
12	Mi Blood Pressure Monitor	September 25, 2014	A smart blood pressure monitor accompanying phone dock	
13	Ants Smart Webcam	October 10, 2014	A series of smart camera for smart home security	
14	Mi Smart Power Plug	October 10, 2014	A series of smart socket or smart power strip	
15	Mi Air Purifier	December 19, 2014	A high performance smart air purifier for intelligent home	
16	Mi Smart Scale	March 31, 2015	A smart scale that can manage the daily weight data with a smartphone	2015 (3)
17	Mi Water Purifier	July 16, 2015	A water purifier which can be monitored by a smartphone	
18	Mi Scooter	October 19, 2015	A two-wheeled self-balancing electric scooter that can be connected with smartphone	
19	MiJIA IH Pressure Rice Cooker	March 29, 2016	A high-end cooker used pressure Induction Heating technology	2016 (7)
20	Mijia Intelligent LED Lamp	May 25, 2016	A smart LED desk lamp that can be remotely controlled via Mi Home app	
21	MiJIA Electric Kettle	June 12, 2016	An electric kettle and water temperature can be remote controlled via Xiaomi smart home App	
22	Mijia QiCycle Folding Electric Bike	June 23, 2016	An electric power smart bicycle with a companion App that gives real-time information on ride	
23	Mi Notebook Air	July 27, 2016	A portable computer that is pre-installed with Xiaomi Sync software	
24	Mi VR	July 27, 2016	A virtual reality headset that can fit smartphones	
25	Mi Robot Vacuum Cleaner	August 31, 2016	A robot vacuum cleaner which can be controlled and real-time monitored via Mi Home App	

**Table I.**  
Chronology of events – 25 new products launched by Xiaomi tech Inc., August 2010-December 2016

#### 4.1 Open innovations implemented in the early stage

In the early stage, Xiaomi Tech Inc. only developed two software products: MIUI and Mitalk. We will examine MIUI to identify the types of open innovations implemented in the early stage. MIUI is the common abbreviation of the words “Mobile Internet, You and I” that means mobile internet is wonderful due to your and my participation. In the software development process, Xiaomi Tech Inc. combined two types of open innovations: sourcing and revealing.

First, MIUI was developed on the basis of sourcing open innovation. The core of sourcing open innovation is that an organization not only freely acquires external knowledge but also integrates external knowledge into its new product development. In the process of developing MIUI, both Android and users’ feedbacks were the external resources.

Indeed, open source software is an important external knowledge product for technology innovation. Android is open source software that is available for smart phone operation. The first commercial edition of Android was released by Google Inc. on October 22, 2008. A great number of Chinese consumers had complained that the original edition of Android was hard to fit their habit at that time. In this context, Xiaomi Tech Inc. was in pursuit of developing the advanced operating system MIUI that could offer the best user experience for Chinese consumers.

The special policy of the intellectual property is implemented by Google Inc. for managing Android. There are three components in Android: Linux Kernel, Middleware and Applications. Different parts follow different policies of licensing intellectual property. First, Linux Kernel follows the policy of General Public License version 2 (GPL2). Subsequent developers have to take the responsibility of disclosing modified source code, though they can freely modify the original source code, in light of GPL2. Second, Middleware is subject to the policy of Apache License, which grants subsequent developers to modify and distribute software without disclosing source code. Finally, Applications follow the policy that subsequent developers need not to disclose the modified source code. In this regard, Xiaomi Tech Inc. selected the friendly policy of intellectual property to develop MIUI and focused on further developing Middleware and Applications of Android, rather than improving Linux Kernel. In the absence of strong intellectual property protection, Xiaomi Tech Inc. has successfully developed MIUI by utilizing sourcing open innovation.

The feedbacks or suggestions from users are another external knowledge source. The important strategy of “public praise and fast” put forward by Xiaomi Tech Inc. is used to guide new product development. “Public praise” refers to the strategy that users are encouraged to participate in new product development, and the feedbacks or suggestions from users are used to perfect new products. “Fast” strategy means that perfecting new products by the development team is as quickly as possible.

In the MIUI development process, Xiaomi Tech Inc. invited volunteers to use MIUI and provide feedbacks. The first test version of MIUI was launched on August 16, 2010. There were only 100 volunteers who were willing to try MIUI in 2010. Afterward, Xiaomi Tech Inc. established a convenient internet-based Millet Forum for exchanging information with users. The volunteers continuously provided feedbacks or proposed suggestions for perfecting MIUI in Millet Forum. After received the feedbacks or suggestions from users, the development team engaged in modifying the older version, and testing the amended version of MIUI in pursuit of “Latest and Fastest” implementation. With the sharp increase in users, Xiaomi Tech Inc. has created the special development model, known as “Orange Friday” model. On Tuesday, users usually file the report of using experience, such as the demands or



suggestions for MIUI, to the development team through Millet Forum. If the suggestions are adopted, the development team may release the latest improved version of MIUI on Friday. To meet the different demands of users, Xiaomi Tech Inc. provides three versions of MIUI: internal test version, exploring version and stable version. Internal test version updates almost every day, while exploring version updates every week on Friday that is called Orange Friday. In addition, the stable version of MIUI is appropriate to the normal consumers and updates every one or two months. It was surprising that the number of MIUI users had reached 10 million in December 2012, and the global users had exceeded 200 million in May 2016. So far, more than 100 thousand fans have actively participated in the development of MIUI, and over several million of suggestions have been adopted by the development team.

Both advantage and disadvantage are existent for sourcing open innovations. In the Xiaomi case, Android and the valuable feedback or suggestion from users are external knowledge sources. The advantage of sourcing open innovations is that the cost of acquiring external knowledge is minimal. However, the disadvantages of sourcing open innovations are also obvious. The cost of integrating the valuable feedbacks or suggestions from users into the new products is very high. Most of the feedbacks or suggestions from users are diverse and fragmental. The development team needs to spend a lot of time and energy to identify the valuable suggestions. In addition, an organization must comply with the special intellectual property agreements, when open source software is taken as external knowledge for technology innovation.

Second, revealing open innovation was also implemented in the MIUI development process. Xiaomi Tech Inc. offered the MIUI to users for free, and the public could freely download and update the MIUI. This is a typical revealing open innovation, in which a firm initiatively reveals internal knowledge to outside without direct reward.

The advantages of revealing open innovations are that numerous loyal users can be quickly cultivated and many potential cooperators are attracted. The number of the MIUI users had reached 10 million in December 2012, while global users had reached 170 million, distributed in 156 countries, on December 31, 2015. The MIUI product is not only a free operating system for smartphone, but also a platform that can support various potential applications. In this context, revealing open innovation can create good opportunities to cooperate with potential partners in the future. Nevertheless, there are also disadvantages in revealing open innovations. That is, a firm hardly achieves direct financial reward from revealing open innovations. With a lack of profit, an organization is seldom willing to choose revealing open innovations.

#### *4.2 Open innovations implemented in the expansion stage*

Most of core hardware products were developed at the expansion stage of Xiaomi Tech Inc., except for the portable computer and Mi Notebook Air, which were developed at the maturity stage. The core hardware products refers to the key devices that can access the internet and includes six products, such as Mi phone, Mi Box, Mi Router, Mi TV, etc. Six items of core hardware products were developed through acquiring open innovations. Both the manufacturing capacity and the intellectual property are the precious resources for developing core hardware products. How to acquire the appropriate external sources is crucial for new product development. We dissect the development process of Mi phone to identify the types of open innovations, because Mi phone is the core of all Xiaomi products. The chairman and CEO of Xiaomi Tech Inc., Jun Lei, said, "Smart phone is the center of the world. We endeavor to connect devices with a smart phone because everything can be a plug-in device of a smart phone".

In the process of smart phone development, Xiaomi Tech Inc. took the strategy of “high-quality at an attractive price” for Mi phones. Because of lack of the manufacturing capacity, Xiaomi Tech Inc. sought to negotiate with top smart phone manufacturers in the world. Ultimately, Xiaomi Tech Inc. reached a series of cooperation agreements with many famous manufacturers, such as Qualcomm, Okwap, Fosconn, etc., to produce Mi phones.

In addition, the intellectual property is the essential resource for developing smart phones. As a complex device, a smart phone needs to integrate or assimilate numerous technologies that are protected by intellectual property. Xiaomi Tech Inc. reached a series of ex-ante agreements to get intellectual property in-licensing in China. Even by doing so, Xiaomi Tech Inc. still had to face the risk of infringing intellectual property in the process of globalization. For instance, the lawsuit related to Xiaomi’s patent infringement happened in India. Xiaomi Tech Inc. sought to cooperate with Indian online retailer Flipkart. When the amount of online orders for Mi phones had reached 150,000, Xiaomi Tech Inc. was sued by Ericsson for infringing eight patents in India in July 2014. Afterward, the Delhi High Court of India passed an *ex parte* order that banned Xiaomi from importing, selling, and advertising its smart phones Red Mi1 and Red Mi Note in India. In this situation, Xiaomi Tech Inc. had to provide a deposit \$1.57 on each of Red Mi1 smart phone to guarantee no patent infringement. Ultimately, the *ex parte* injunction was dismissed because the smart phone Red Mi1 assembled the chip produced by Qualcomm Inc. that had reached a cross licensing agreement with Ericsson. Meanwhile, Xiaomi Tech Inc. had got patent license from Qualcomm that was an important cooperator of Xiaomi. To address the patent issue, Xiaomi Tech Inc. had to export smart phone Red Mi1 that equipped Qualcomm’s chip from China, rather than Mediator’s chip. This case showed that the cost of acquiring intellectual property from outside was extremely high in the process of acquiring open innovations.

The advantage of acquiring open innovations is that an organization can acquire much precious resources from outside, such as manufacturing capacity and intellectual property. The value of Mi phone primarily came from the attractive price and high-quality. Xiaomi Tech Inc. had become one of the top five smart phone vendors in China, when the sale volume of Mi phones reached 61.12mn in 2014. However, the disadvantage of acquiring open innovations is that a firm must pay high prices for acquiring external sources. A considerable portion of the revenue is apportioned to the partners, or paid for intellectual property licenses. That is, the cost of acquiring external knowledge is very high.

#### 4.3 Open innovations implemented in the maturity stage

Most of the ecological products were developed in the maturity stage, though a few items of ecological products were launched in 2013. Ecological products referred to the relevant products of intelligent household electrical appliance that were developed by Xiaomi’s ecosystem enterprises. In our analysis, 17 items of ecological products, such as Mi Band, Mi Smart Power Plug and Mi Air Purifier, are included. Xiaomi Tech Inc. implemented selling open innovations in the process of a series of ecological product developments.

The primary feature of selling open innovations is that the firm’s internal resource is licensed or sold to the other company that develops a new product. Xiaomi Tech Inc. sought to establish a broad open innovation ecosystem based on Mi phones with MIUI, when the users of MIUI had exceeded 30 millions. The huge potential market attracted numerous potential partners to seek collaborations with Xiaomi Tech Inc. In this context, Xiaomi Tech

Inc. started to invest in numerous ecological enterprises to develop a series of ecological products, which could be accessed by Mi phones. As a result, 17 items of ecological products were developed through selling open innovations by December 2016. Many internal resources, such as, product design style, trademark “Mi” and E-commercial platform, were diffused to the ecological enterprises. We focused on Mi Band, a wearable wristband, to identify the type of open innovations implemented in ecological products.

The Mi Band was released on July 22, 2014. A user could use Mi Band to monitor his activity levels, track walking distance, calculate calories burned and analyze sleep quality, etc. The sale volume of Mi Band products broke the record of one million within three months and reached twelve millions in 2015. In fact, the Mi Band was designed and produced by Huami Tech Inc. that was one of ecological enterprises invested by Xiaomi Tech Inc. in China. In the case of Mi Band, four kinds of internal resources were diffused: trademark “Mi”, design style, potential users and marketing channel. Xiaomi Tech Inc. achieved huge profits from the initial investment and trademark royalty.

The advantage of the selling open innovations is that an organization can achieve profits from selling or licensing internal resources. The disadvantage of selling open innovations is also obvious. The company that implements selling open innovations has to not only give up the opportunity in developing new products, but also share the growing value of new products with the cooperators.

#### *4.4 The combination of different open innovations*

Table II presents the types of open innovations implemented in 25 new products. To develop new products, Xiaomi Tech Inc. implemented four types of open innovation. However, the distribution of different types of open innovations was asymmetric. Table II shows that the combination of sourcing and revealing open innovations emerged in the early stage of Xiaomi Tech Inc. and implemented in the development of two software items, while the acquiring open innovation was used in the expansion stage to develop six items of hardware products. It is surprising that seventeen items of ecological products were developed by utilizing the selling open innovations in the maturity stage. Moreover, the smart ecological products invested by Xiaomi Tech Inc. will keep increasing in the future, with the commitment of Xiaomi Tech Inc. to build an open innovation ecosystem. That is, the modes of open innovations with pecuniary were more frequently used in both expansion and maturity stages, while the modes without pecuniary were limited to a few items of software development in the early stage.

To maximize advantages while controlling disadvantages, an organization can combine different types of open innovations. Xiaomi Tech Inc. has successfully applied the combination of different open innovations at three levels: a single product level, a related product cluster level and company-level. Figure 2 presents that an organization can combine different types of open innovation from three different perspectives in different life cycle stages of an enterprise.

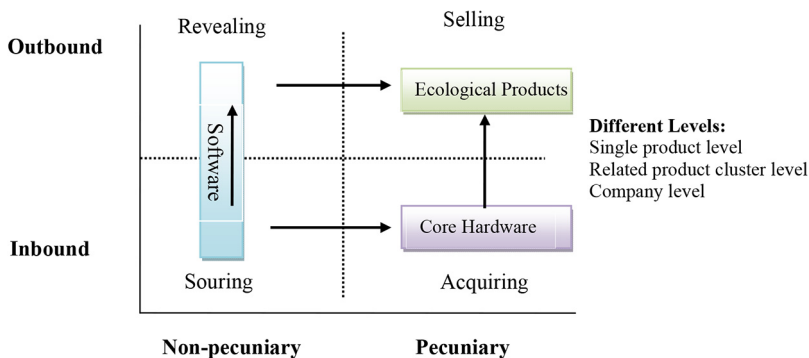
The first level is that combining different open innovations in a single new product development. For instance, the software MIUI was the outcome of combining the sourcing and revealing open innovations. The success of MIUI shows that the combination of sourcing and revealing can promote a firm by absorbing external knowledge and sharing internal knowledge.

The second level refers to a cluster of the multiple related products. As mentioned above, Xiaomi Tech Inc. developed a series of core hardware products through acquiring open innovations. MIUI was a key component of each core hardware product,

Product category	Code	Title	Knowledge flow	Cost or benefit	Life cycle stage	The types of OI
Software products (2)	1	MIUI	Inbound and outbound	Non-pecuniary	Early stage	<i>Sourcing &amp; revealing</i>
	2	MiTalk Messenger	Inbound and Outbound	Non-pecuniary		
Core hardware products (6)	3	Mi phones	Inbound	Pecuniary	Expansion stage	<i>Acquiring</i>
	4	Mi Box	Inbound	Pecuniary		
	5	Mi TV	Inbound	Pecuniary		
	6	Mi Wi-Fi Router	Inbound	Pecuniary		
	9	Mi PAD	Inbound	Pecuniary		
	23	Mi Notebook Air	Inbound	Pecuniary		
Ecological products (17)	7	Mi Headphones	Outbound	Pecuniary	Expansion stage	<i>Selling</i>
	8	Mi Power Bank	Outbound	Pecuniary		
	10	Mi Band	Outbound	Pecuniary		
	11	Mi Bluetooth Game Controller	Outbound	Pecuniary	Maturity stage	
	12	Mi Blood Pressure Monitor	Outbound	Pecuniary		
	13	Ants Smart Webcam	Outbound	Pecuniary		
	14	Mi Smart Power Plug	Outbound	Pecuniary		
	15	Mi Air Purifier	Outbound	Pecuniary		
	16	Mi Smart Scale	Outbound	Pecuniary		
	17	Mi Water Purifier	Outbound	Pecuniary		
	18	Mi Scooter	Outbound	Pecuniary		
	19	MiJIA IH Pressure Rice Cooker	Outbound	Pecuniary		
	20	Mijia Intelligent LED Lamp	Outbound	Pecuniary		
21	MiJIA Electric Kettle	Outbound	Pecuniary			
22	Mijia QiCycle Folding Electric Bike	Outbound	Pecuniary			
24	Mi VR	Outbound	Pecuniary			
25	Mi Robot Vacuum Cleaner	Outbound	Pecuniary			

Combination of different open innovations

**Table II.**  
The types of open innovation implemented in different life cycle stages



**Figure 2.**  
Combining different types of open innovation from three levels

and all devices of core hardware products are connected by the operating software MIUI. To develop MIUI, Xiaomi Tech Inc. acquired external resources without pecuniary cost. Then, Xiaomi Tech Inc. engaged in making friends with users, meeting users' demand and perfecting products according users' suggestions. A majority of MIUI users had become the customers of their core hardware products. Thus, the success of core hardware products can be attributed to the combination of sourcing and acquiring open innovations.

In addition, combining revealing and selling open innovations contributed to the success of developing a series of ecological products. Revealing open innovation made it possible for each user to freely get and use the MIUI software. In all, 75 million users were a big gold mine for many manufacturers. To construct a large innovation ecosystem, Xiaomi Tech Inc. actively implemented selling open innovations to develop as many ecological products as possible.

The third level is the company-wide combination of different open innovations. In all, 25 new products include various software, core hardware and ecological products. Of all, 17 ecological products can be accessed and controlled by core hardware products with the software. Different categories of products implemented different types of open innovations. Therefore, various combination modes of open innovations can be selectively used by an organization in different life cycle stages.

## 5. Discussions

To clarify the ambiguity of the concept "open innovation", many scholars attempted to categorize complex open innovations. The classification of open innovations is helpful to better understand open innovations (Huizingh, 2011). So far, however, the modes of combining different open innovations remain less explored, because most previous studies focused on one type of open innovations. In the absence of substantive empirical evidence, it is still unclear how firms can combine different types of open innovations (Dahlander and Gann, 2010). Our longitudinal case study highlights how and why a company pursues to combine different types of open innovations. The case of Xiaomi Tech Inc. demonstrates that the combinations of different open innovations are not only existent in practice but also implemented in diverse modes.

### 5.1 *The practices of combining different open innovations*

Our case study highlights three important findings concerning the combination of different open innovations:

- (1) In the process of developing a single new product, a company can combine different types of open innovations.
- (2) In the development of new complementary products, a company can combine different types of open innovations based on prior related products.
- (3) From a firm-level innovation perspective, a company can deeply combine different types of open innovations to develop a series of new products.

Previous studies primarily investigated open innovations from two dimensions: a single product development project and the whole company. Christiansen *et al.* (2013) investigated eight product development projects to explore how individual project teams implemented open innovations in practice. Firms' managers need to consider open innovations at both the company and the project levels. Our analysis results confirm their conclusions that open innovations should be fully taken into account at both the company and project levels. Furthermore, our analysis results greatly extended their research with additional insights.

Our study demonstrated that both a firm and a project team may deeply combine different types of open innovations. In particular, we newly discovered that the combination of open innovations played an important role in developing a cluster of complementary products. To build a dynamic innovation ecosystem, a firm can seek to develop a series of new complementary products, rather than a single product. If the investment in one product increases the marginal return on the other, then these products are complementary. That is, these new related products are complementary assets instead of substitute products. The complementary relationship between new products contributes to the combination of open innovations. To develop a series of new products, therefore, a firm can consider the combination of open innovations at three levels: a single product level, the related product cluster level and the company level.

### *5.2 The diversified modes of combining different open innovations*

Our case study highlights diversified modes of combining different open innovations. According to the classification proposed by [Dahlander and Gann \(2010\)](#), open innovations can be divided into four types, namely acquiring, sourcing, selling and revealing open innovation. In theory, there are various modes of combining different types of open innovation. Either two or three types of open innovations can be combined. Our case study demonstrates that an organization can combine different types of open innovations in almost any mode. For instance, a firm can combine the sourcing and revealing open innovations in developing a new product, and it can also synergistically use four types of open innovations to develop a series of ecological products.

More importantly, we found out that the types of open innovations combined are usually complementary. There is no consensus whether the relationship between different types of open innovations is complementary ([Dahlander and Gann, 2010](#)). [West and Kuk \(2016\)](#) pointed out the inherent complementarity of selective openness strategies between open and proprietary components and suggested when and how a startup or incumbent firm should combine open and proprietary elements. However, [Cassiman and Valentini \(2016\)](#) argued that no substantive evidence for such complementarity was found in the empirical study of Belgian manufacturing firms. Both the sales of new products and R&D costs increased in the process of firms' buying and selling knowledge. This case illustrates that an organization seeks to balance the advantages and disadvantages of open innovations by combining different types of open innovations.

In open innovation paradigm, each type of open innovations indeed has the advantages and disadvantages. Although both advantages and disadvantages of open innovations have been deeply discussed by previous studies, our case study shows that combining different open innovations is helpful for remedying deficiencies of open innovations. If the advantages of one type can be used to offset the disadvantages of the other type, then these types of open innovations may be combined together by an organization. To overcome the disadvantages of open innovations, an organization can use the advantages of this type of open innovations to overcome the deficiency of the other type.

[Table III](#) summaries the advantages and disadvantages of four types of open innovations. Both sourcing and acquiring can be regarded as the inbound innovations. In the sourcing open innovation, a firm can acquire external resource for free, but needs to spend time identifying the valuable external resources and integrating these resources into new product development (NPD). Moreover, there are a lot of potential limitations for the sourcing open innovation. In general, open source software is an important external resource for new product development. Nevertheless, some

intellectual property agreements may require firms to disclose the modified source codes. Such limitations of intellectual property may hinder a firm's new product development. In addition, the acquiring open innovations can help an organization acquire precious resources from outside but must pay the fee. More importantly, firms have to apportion a certain percentage of the revenue to other parties in the case of intellectual property license. The high cost for acquiring external resources may prevent an organization from implementing the acquiring open innovations.

On the other hand, the outbound innovations are comprised of the selling and revealing open innovations. In the selling open innovations, the advantage is that a rich profit can be captured, but the opportunity for NPD may be given up or the growing value of new product will be shared by cooperators. In addition, the revealing open innovation can cultivate a massive number of users and create many opportunities for collaboration. The disadvantage of the revealing open innovations is the difficulty in capturing financial reward. In this context, implementing the revealing open innovations independently is less sustainable for a firm. As a result, the combination mode of different open innovations has been diversified. An organization can combine distinctive types of open innovations together to overcome the deficiency of a single type of open innovations.

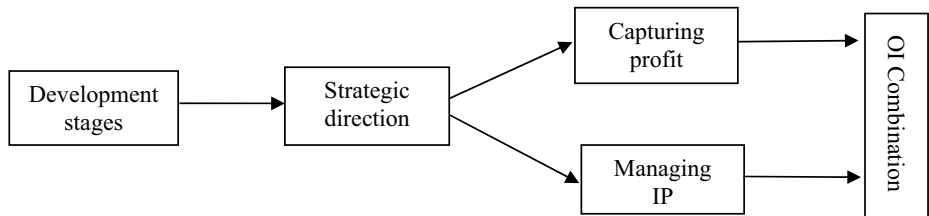
5.3 Key factors influencing the combination mode of different open innovations

To date, the dynamic combinations of different open innovations remain less explored. Our case study highlights why a firm prefers to combine different types of open innovations. This help us to understand what are the key factors influencing the combination mode of different open innovations. We find that four factors, including the life cycle stage, development strategic direction, the form of capturing profit and intellectual property management mechanism, may influence the option of how to combine different open innovations. Figure 3 depicts the basic mechanism in which main factors may influence an organization's option of the modes for combining different open innovations.

**Table III.**  
The Advantages and disadvantages of different open innovations

Types	Categories	Advantages	Disadvantages
Sourcing	Inbound innovation	Acquiring external resource for free	Identifying and integrating cost, Some potential limitations
Acquiring	Inbound innovation	Acquiring precious resources	Acquiring cost, apportion a part of revenue
Selling	Outbound innovation	Capture huge profits	Give up the opportunity for NPD, share the value of internal resource
Revealing	Outbound innovation	Cultivate users, create opportunities for collaboration	No financial reward

**Figure 3.**  
Key factors affecting the combination mode of different open innovations



First, the development stage of an organization may strongly affect the option of how to combine different open innovations. According to the life cycle theory of an enterprise, a start-up firm usually goes over three important stages, namely, the early stage, the expansion stage and the maturity stage. Our case study shows that the combinations of different open innovations vary with the development stages of an organization. In general, a start-up firm may trigger technology innovations from sourcing open innovations at its early stage. Sourcing open innovations usually help a venture to quickly acquire external resources without cost. A few options of combining the other type of open innovations with sourcing are available for a start-up firm. When entering the maturity stage, however, a firm may combine different types of open innovations in almost any mode in order to capture a rich profit.

A reasonable explanation is that precious resource or knowledge owned by an organization varies in the different stages of its life cycle. In the early stage, for instance, a start-up firm usually lacks sufficient internal knowledge or resource to develop a new product. Implementing sourcing open innovations may be a wise option at this stage. When grew up, a firm would seek to acquire more precious knowledge or resource from outside with pecuniary cost and prefer to implement acquiring open innovations. After entering the maturity stage, however, a firm would like to pursue outbound innovations by implementing selling or revealing open innovations. From a longitudinal perspective, a firm may combine different types of open innovations together in the process of evolution.

On the other hand, there is no a clear boundary between a firm's development stages in many cases. The fuzziness of development stage boundary may also lead to the special combination of open innovations in a special stage of a firm. For instance, sourcing open innovation is most suitable for the early stage, while revealing open innovation is popular in maturity stage. Sometimes, a start-up firm that is still in the early stage may use the combination of sourcing and revealing open innovations to develop an item of software. The primary reason is that the developed software has entered the maturity stage, though the firm is still at the early stage. This is a special combination of different open innovations.

So far, most studies about open innovations adopted a static perspective. For instance, [Christiansen et al. \(2013\)](#) studied eight product development projects implemented by one European medical company. Our case study examined the open innovation activities from a longitudinal perspective. We found out that a firm may combine distinctive types of open innovations at different development stages. This suggests that, in general, the development stage of a given firm is a key factor affecting the combination of open innovations.

Second, the strategic direction of an organization can influence the option of combining different open innovations. Strategic direction adopted by an organization may create the proper behaviors for the continuous superior performance of the business ([Cheng and Huizingh, 2014](#)). It is usually pertinent to a firm's long-term goals, visions and activities. Many essential activities of an organization have to depend on the firm's basic strategic direction, such as how customers are treated, or what priorities are made ([Jansson et al., 2017](#)). [Cheng and Huizingh \(2014\)](#) discussed what kind of organizational context suited open innovations best and found out that a more explicit strategic direction could enhance the effectiveness of open innovations, by investigating 223 Asian service firms. Our case study demonstrated that the combination of different open innovations has to follow a firm's strategic direction.



A rational explanation is that innovation behaviors of a firm have to be compatible with the business strategy in a given stage. In practice, the life cycle stages of a firm have been considered to create a proper strategy for new product development. Under strategic planning, a firm shall adjust the plan of developing new products with its production capacity and market demand. The combination of strategic direction with the life cycle stages of a firm can improve the effectiveness of the management decisions taken (Kniazieva *et al.*, 2017). The combination of open innovations in any mode has to follow the business strategy adopted by an organization in a given stage, though an organization may take distinctive strategies in different development stages.

Third, the form of capturing profit can also deeply influence the combination of different open innovations. To implement an open innovation, an organization needs to select an appropriate business model. The root of business model is how to create, deliver and capture profit for a company (Osterwalder and Pigneur, 2010), or how a firm can create and sustain profit margins for growth (Euchner, 2013). The modification of existing business model or the creation of new business model is an important factor affecting innovation performance (Christiansen *et al.*, 2013). There is a formal or informal mechanism to capture profit and allocate profit in a business model. As the essence of an enterprise is to capture rational value from its business, the form of capturing profit will influence the option of combining different open innovations. Our research results indicated that the asymmetry of combination distribution can be attributed to different forms of capturing profit implemented in new product development.

As far as a new product development is concerned, the key of commercial success is how to capture profit from a new product. In the process of open innovations, sometimes, an organization may not directly achieve revenue from its new product sales, but create value indirectly by attracting numerous users and potential cooperators. On the other hand, sometimes, a firm can capture rich profits from its new product that strongly depends on the other complementary products. In this context, the combination of different open innovations can balance direct and indirect values created by a series of new products. As a result, the form of capturing profit may determine how to combine different open innovations and whether a new product development can succeed.

Finally, the mechanism of managing intellectual property may affect the option of combining different open innovations. Intellectual property can protect innovators who have developed new products from imitators, and make innovators to gain monopolistic profits. This is the traditional function of intellectual property. For an open innovation, moreover, intellectual property is regarded as a commodity. Project teams can both acquire external intellectual property and offer internal intellectual property as part of the innovation process (Christiansen *et al.*, 2013). To achieve massive profits, leveraging intellectual property through professional management is the secondary function (Gassmann *et al.*, 2010). Intellectual property management is an important enabling factor for standardization-oriented innovation (Fang *et al.*, 2016), and usually is one of important problems encountered by new enterprises (Tang *et al.*, 2014). Our case study suggests that an efficient mechanism of managing intellectual property can facilitate the combination of different open innovations.

Our case study highlights that intellectual property management have played an increasing role in both inbound and outbound open innovations. Most previous studies observed intellectual property from the dimension of inside-out process. In the outbound open innovation, a firm can capitalize on unused intellectual property and can license out what they do not use as well (Chesbrough, 2003a, 2003b). Intellectual property can also control internal innovative ideas and maintain a firm's competitive edge, though the outward transfer of proprietary technology has "only recently become an important

dimension of corporate strategy” (Lichtenthaler, 2009). Intellectual property can be considered as a tool to sustain innovations, by generating rents that are reinvested in the company, creating a positive loop of innovations (Christiansen *et al.*, 2013). In the process of the inbound open innovation, an organization has to identify and comply fully with the intellectual property policies when get knowledge from outside. Even in sourcing open innovation, intellectual property policy, such as General Public License (GPL), must be complied with. Otherwise, a firm will suffer from the risk of infringing intellectual property. On the other hand, a firm needs to draw up appropriate intellectual property policy when implementing outbound open innovations. In this context, a dynamic mechanism of managing intellectual property is helpful for combining different types of open innovations. For instance, a free policy of intellectual property can facilitate the combination of sourcing and revealing, while the strong protection policy of intellectual property may encourage firms to combine acquiring and selling open innovations.

In summary, each type of open innovations has the advantages and disadvantages. An organization, which prefers to combine different types of open innovations, seeks to overcome the disadvantages and exploit the advantages of open innovations. In theory, the mode of combining different open innovations may be diverse. However, whether a firm chooses the combination of open innovations or how to combine different types of open innovations may be influenced by a set of factors. Our case study highlights that these factors simultaneously affect the combination mode of different open innovations together.

## 6. Conclusion

As a rich concept, the open innovation can be implemented in various ways (Huizingh, 2011). To balance disadvantages and advantages of specific types of open innovations, an organization may seek to combine different types of open innovations, although little research has been conducted on how firms combine different open innovations (Dahlander and Gann, 2010). This paper conducted a longitudinal case study of Xiaomi Tech Inc. in order to explore how an organization can combine distinctive open innovations. The case of Xiaomi Tech Inc. demonstrates that a firm may combine different types of open innovations at three levels: a single product level, a related product cluster level, and a whole company level. In addition, four factors, including the development stage, strategic direction, the form of capturing profit and the mechanism of managing intellectual property, can strongly affect the combination mode of different open innovations. Our findings have a number of theoretical and practical implications.

The results of our research contribute to a theoretical understanding of how and why an organization can combine different types of open innovations. First, the mode of combining different open innovations has diverse options. An organization can select the combination mode of open innovations from different perspectives. Second, the types of open innovations to be combined should be complementary. The purpose of combining different open innovations is not only to overcome the disadvantages of certain type of open innovations but also to exploit the advantages of all types of open innovations. Third, we proposed an explanatory framework in which four key factors may affect the option of combining open innovations. These factors are interacted each other rather than exert their effect independently.

From a managerial point of view, an organization may combine different types of open innovations in order to leverage advantages and offset disadvantages of certain open innovations. Managers of a company should be aware that the combination of open innovations can be both feasible and reproducible in practice. In addition, managers have to consider a series of important influencing factors in the process of implementing open

innovation, because the mode of combining open innovations is diverse in theory. In different development stages, a firm may adopt and implement different strategic directions according to its innovation capacity and internal resource. Under a given strategy, the firm needs to capture profit and manage intellectual property in the process of implementing open innovations. An organization may select an appropriate combination mode of open innovations after these factors are taken into accounts.

Like many previous studies in this area, our study has limitations too, and further research is necessary in the future. A series of new products developed by Xiaomi Tech Inc. are electronic products that are iteratively updated very quickly. Our findings are applicable to the manufacturers that are engaged in establishing the innovation ecosystem by developing many new products. However, these findings may not be applicable to a single product development. Different industries usually have unique features for new product development. Thus, further research is needed to test whether our research findings are applicable to  $r$  new product development other than electronic products.

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**Further reading**

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