

What is the Feasible Business Model in the Age of Big Data? Case Studies on the Business Models of Two Chinese Mobile Applications

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Abstract—The present day mobile application’s pick-and-shovel business is not thriving, as the vast majority of developers make very little revenue. In order to gain insights into mobile application business model, we conduct longitudinal case studies on two Chinese high profile health-fitness applications. The results of our study show both applications have experienced three significant business model innovations, from the initial freemium, hardware-application hybrid, and open source-based cooperation. We discuss the impact of these business models on value creation and appropriation. We thereby advocate that in the age of Web 3.0, embracing open source movement in an application’s business model is a smart move to turn competitors into collaborators and hence achieve a positive sum game. Our study contributes to the technology management literature by integrating the business model perspective with an analysis of open source. This also adds to the existing business ecosystem conceptualizations, which do not explicitly take competitors into account.

Keywords- Mobile Application; Business Model; Cooperation; Open Source; Web 3.0.

I. INTRODUCTION

The mobile computing technology has opened up new frontiers to do business that was inconceivable years ago [1]. The recent trend of falling device prices, easy accessibility and usability of mobile phone has also spurred the higher adoption of the smartphone. From being a device that was previously being used for voice or text based communication, a smart phone now offers a wide collection of functions and utilities including social connectedness, business agility and personal well-being. Thus these devices now keep users connected, organized, and amused through a range of multi utility applications.

The great “anything, anytime, anywhere” mobile gold rush is on with an unprecedented number of firms engaged in methods to best monetize the high-value touch points between their applications and users. However, the mobile application’s pick-and-shovel business is not thriving. Although a few savvy mobile application companies are like the golden eggs, the vast majority of developers find themselves with little revenue. There is a pressing need to understand how the business model of a mobile application creates value. In this study, we intend to fill in the abovementioned research gap by suggesting a new business

model that may help a mobile application to create and appropriate enhanced value. We broadly define the business model as the one that describes the rationale of how an organization creates, delivers, and captures value, and how market players in a business ecosystem are linked through business model components [2, 3]. Unlike the previous studies in this field that have mainly focused on Web 1.0 and some on Web 2.0 technologies, we focus on the emerging Web 3.0 technologies highlighting how these technologies have triggered the business model innovation in mobile application business. We have conducted longitudinal case studies of two Chinese mobile application start-ups. Our study reflects the business model innovation of these firms from a freemium (free premium) to an open-source-based cooperation (collaborative competition) model over the period of 2011-2014. We found that the consumer mobile application market at present has been flooded with too many players hence making business extremely competitive. The traditional freemium business model creates a zero-sum, red ocean market in which most mobile applications struggle to survive. By nurturing an open source IoT hardware ecosystem, mobile applications can create a blue ocean market [4], enhance value creation by involving collaborators and even competitors in their business model, capture greater value from the expanded market horizon and achieve efficiency in resource utilization. We combine these insights with a theoretical development, resulting in propositions on business model’s impact on value appropriation in mobile application business.

The results contribute theoretically to the technology management literature by integrating the business model perspective with the analysis of new technology trends. Our study also adds to the existing business model and business ecosystem theories, which we believe so far, have not included the open source movement and strategic alliances with competitors within their conceptual framework. We also advance prior cooperation studies [5, 6] by analyzing how the emerging open source IoT hardware ecosystem, that is a brand new governance mechanism, can benefit from the new features of Web 3.0. The remainder of this study is organized as follows. First, we review major theories in the field of business model, followed by the presentation of two longitudinal case studies. Thereafter, we discuss a set of propositions. Finally, we present our conclusions and suggestions for further research.

Two case studies will be presented in the second section. We will provide three propositions and conclude this paper in the third section.

II. EMPIRICAL STUDY

We conducted two longitudinal, qualitative case studies. A lack of prior theorizing about mobile application business model makes this kind of inductive case study approach an appropriate choice for a holistic analysis of previously unexplored phenomena, theory development and study of business network-related issues. Hence, to gain a deeper understanding in mobile application business model, we have conducted in-depth analyses of Gudong and Maikai, two leading health and fitness mobile application start-ups in China and elicited the sources of value creation from these descriptive case studies to explain the phenomenon and the real-life context of occurrence.

The cases are based on a variety of secondary data sources, which have been accessed, analyzed, and synthesized in order to gain an accurate understanding of the diverse facets of the evolution of these firms' business model over the period of 2011-2014. The main data sources include: 1) the venture capital investment reports of these firms, 2) historical web pages of the firms' websites; 3) news releases, 4) expert reviews and 5) user comments on major App Stores. To ensure the quality of the secondary data, we mainly rely on more or less direct interview data of the CEOs and co-founders of these two firms and subjective reports written by industry experts. The limitations of the secondary data should be acknowledged. These limitations include the difficulty of assessing the reliability of the data, as well as a lack of relevant data access. We intend to tackle (at least some of) these limitations through the actions outlined above and through data triangulation by gathering additional primary data. In this way, the validity of our understanding of the business model of these firms will be enhanced. The primary data includes four semi-structured interviews (30 minutes each) with one chief engineer, one project manager and two senior developers regarding revamping the firms' existing business models. The insights gained from these primary data sources complemented with secondary data have assisted us in interpreting the business models of these firms.

This multi-sourced case study approach is chosen as we believe that current research on mobile application business model innovation is still sparse. We treat a series of information sources like a series of experiments. Each source serves to test the theoretical insights gained from the examination of previous sources, and we thereby modify or refine them. Prior studies prove that this replication logic can foster the development of a new theory with less researcher bias and allows for a close correspondence between theory and data. Such a grounding of the emerging theory in the data is especially useful in the early stages of research in which it is difficult to develop a proper research question based on existing theories.

A. Case Study 1

Gudong Sport, incorporated by five running enthusiasts, started its humble beginning in 2009 in a south-west city of

China with 1.53 million USD funded by a high-profit venture capital firm dealing in IT and mobile business. The first version of the application, released in August 2011, was a mobile pedometer to count the user's footstep based on the user's hip movement measured by the iPhone's inertial measurement unit. It was the first GPS-based running tracker in China. Just like millions of other mobile applications, irrespective of its rich collection of service offers the business model of Gudong could not go beyond the widely-adopted advertising-supported freemium model. As our interviewees pointed out, "the freemium version was so gimmicky that Gudong could not convert its free user base to its subscription model". Thus Gudong failed to solicit the desired customer loyalty and lost its customer base to other free applications in the extremely price sensitive mobile application business. In 2013, Gudong completely abandoned the freemium business model and embraced the centuries-long asset-sales business model.

But Gudong could not sustain its first move advantage in the wearables market for too long. The high profit margin of wearable devices attracted many new entrants. In a business characterized by fierce competition and lack of proper intellectual property rights regime, the application market is ruled more by players focusing merely on "imitation" than on "innovation". By late 2013, around 400 small and big manufacturers launched similar devices such as smart scale, wristband and portable activity trackers on Taobao.com (China's largest online store) creating a fierce price war. According to our interviewees, the average price of a smart wristband dropped to less than 20 USD from its initial price of 66 USD by spring 2014. The market share of Gudong shrunk quickly, which forced the firm to integrate and support several third-party devices in its application. Its business model was adjusted from "free App + devices sales" to a "sports social network" platform that could collect sport data from the devices made by different producers, integrate social elements and create an incentive mechanism.

The sports social platform of Gudong depended on one crucial hypothesis—a large amount of mobile phone users use Gudong application to manage their workout activities even though they may not necessarily use Gudong wearables gadgets. This hypothesis, as our interviewees stated, was flawed, "on one hand, the sport application market is highly fragmented with hundreds of producers who provide virtually the same application and closely similar wearable devices. There is no obvious advantage for most users to connect their non-Gudong devices with the Gudong application and on the other hand, the price of wearable fitness devices continues to decline". By mid2014, the market for wearables and mobile application turned into a red ocean with numerous players in a highly competitive market. Some business trends are clearly visible, including huge price drop in the wearable gadgets segment and hundreds of homogeneous mobile applications.

Gudong noticed a new business opportunity with most fitness and wearable devices not sharing their data with third party applications. Gudong has decided to create a new business model by opening its hardware framework to public access. It provides a variety of micro-sized modules that are highly customizable, for example a battery charger module,

acceleration sensor module, heart rate sensing module, OLED display module and so on. The modular-design enables any third-party producer to create various wristbands based on the user's requirements by easily assembling the relevant modules together and slipping them onto a wearable rubber ring. This open source design offers far better options of customization to end-users. Gudong also provides its Software Development Kit (SDK) and APIs to third-party application developers. By opening the door to its competitors, Gudong intends to develop a collaborative wearable gear ecosystem that co-creates China's wristband market with its low-cost open source product. Gudong's business model has evolved from an asset sales based to a more open and ecosystem based business model. In 2014, Gudong partnered with Kangtai, one of China's largest life insurance companies to jointly develop mobile health metrics. Now, data collected by millions of wristbands will empower Gudong and Kangtai joint-venture to unleash some innovation into the connected health-fitness market. More importantly, Gudong's open source hardware becomes a social hub to support the growing community of third party developers. The collective intelligence co-creates continuous modifications along with new health-fitness algorithms that would have never been developed by traditional business models. As our interviewees state, Gudong expects that its new open-source-based cooperation business model can "unite wristband and fitness gear producers and fitness mobile application developers to build a strong ecosystem that will be able to co-develop highly intelligent applications to be built on top of the sensor data and thus make big data health metrics affordable and actionable". Also thanks to its new business model, Gudong has managed to substantially reduce the cost and development time in the rapidly evolving mobile IoT market. Thus by anchoring a collaborative ecosystem Gudong's open-source-based cooperation model creates valuable competitive advantage.

B. Case Study 2: Maikai Ltd.

Beginning with its humble origin in 2011 by three young entrepreneurs it was not until 2012 that Maikai launched its sports and fitness mobile application on China's leading mobile App Stores. The mobile application allowed users to share sport/fitness experiences on the social network, helped in community building (through online friends feature) and also offered an e-commerce platform dealing with the sale of fitness gears such as activity trackers and Bluetooth scales. Following the crunch of being a late entrant in the health-fitness application market, Maikai failed to differentiate itself from its competitors, and finally could not provide any appealing value to end customers. In late 2012 and early 2013, Maikai decided to follow Gudong to launch its own branded activity tracker and Bluetooth scale. Maikai successfully raised about 20 000 USD through a crowdsourcing website for its R&D projects. According to our interviewees, these low-cost products (about 10 USD) turned out to be quite successful and generated sufficient cash flow (about 1.4 million USD) to support the firm to expand. In the middle of 2013, the CEO decided to launch Maikai's own wristband but soon realized

the market for wearable gears was turning red. With too many hardly differentiable products, the fierce price war made the CEO believe that Maikai could not compete with hundreds of wristband producers. Hence the firm had to stop the venture.

The firm made a strategic shift to a related but unexploited IoT segment called the "smart mug". After months of R&D in June 2014, the firm launched a wired mug "CupTime" that was meant to automatically log the hydration habits of its users throughout the day. The benefits of this 53USD device included not just to remind the user to drink water but also to eliminate the need to manually update the water intake in Maikai's mobile application "CupTime App". This smart mug used thermoelectric semiconductor material to convert the heat of the beverage to electricity. Evidently Maikai smart mug was an innovation in the market of health and fitness. As a result, Maikai received huge media coverage and its sales surged. With this new product, Maikai was able to leap over competitor pressure by expanding its own market horizon. However, Maikai was aware that the blue ocean for smart mugs would soon turn red because its product and application may not be able to lock in customers for too long. Also our interviewees stated, "CupTime's novelty could be easily imitated by its competitors as the innovation is incremental but not radical". For start-ups like Maikai, it is important to engage partners in order to enhance the value of its smart mug with partners' additional offers and to appropriate value from the locked-in customers through its smart mug ecosystem in which third-party applications provide complementarities. Hence Maikai started building its "health data ecosystem" by providing its smart mug SDK and APIs to other health and fitness gear producers and mobile applications that could automatically baseline the fluid intake according to the physical activity. Maikai also partnered with weather and pollution data providers to synchronize weather information and enrich the user experience according to different external environment condition. Through data sharing, Maikai's latest mobile application is able to offer complementarities in value by combining the core product in novel ways with partners' offerings, thus eventually resulting in customer lock-in.

Our interviewees predicted that the smart mug market became a red ocean in just a few months. Maikai decided to use open source hardware as a weapon against future competitors. They are designing a Smart Mug Kit (SMK) that provides the 'building block' components and free ROM source code to third-party mug producers and application developers or even consumers who need to build a connected mug with minimum skills and tools. The design will be based on the GNU Lesser General Public License (LGPL), so that anybody can integrate Maikai's SMK into their own products without being required by the terms of a strong copyleft license to release the source code of their own development-parts. As a modular platform, SMK will also allow third-party companies to easily create, alter, customize and fabricate their own-branded mugs with additional sensors and mobile applications. Maikai expects that its open source SMK will lower the price and help it gain a major market share so that it can become the hub of water intake and lifestyle data in an ecosystem around its open hardware kit. Maikai is building a brand-new open source hardware ecosystem in which it

provides the hardware framework for developing advanced projects and kernel algorithms that might be beyond the available resource of any single start-up and involves many developers who might not collaborate otherwise. In addition, Maikai hopes its ecosystem will bring network effects and open new revenue streams through beverage sales and advertisements. Maikai's latest business model seems to be promising and it has received its very first round 0.8 million USD venture capital investment in 2014.

III. DISCUSSION

These two cases vividly present the visible trend of business model innovation resulting from different business models created in response to changing competitive environments. Having started from the famous "freemium" model, both mobile application start-ups evolved into a hybrid business model manufacturing IoT products and finally ended up embracing open source-based cooperation model.

There are two significant takeaways from these cases. First, being that continuous business model innovation as a business strategy can provide firms with the much desired momentum to success and stay in business. The second and the more prominent trend is the emergence of "open source based cooperation" as a successful business model. This can present newer and diverse ways of engagement through "cooperation over competition" and allow mobile application start-ups to generate value in ways that would not have been previously possible with conventional competitive strategies. The direct implication of this business model is to unearth unexplored blue oceans (i.e. new business opportunities) from the red ocean (i.e. over-exploited market).

In the following section, we formulate distinct propositions based on the insights of the two case studies. In particular, we take into account the characteristics of Web 3.0 to understand how the open source-based cooperation business model creates and appropriates value. We hope to enrich the fundamental business model theories through these propositions that answer our research questions on how a mobile application business model increases value creation by collaborating with competitors while allowing collaborative market players to appropriate value for themselves.

1. Freemium is no longer a lucrative business model for mobile application business.

Acknowledging well that free aspect of freemium applications are online traffic aggregators, yet there is hardly any scope for customer lock in with the freemium model. This was the cause of failure of Gudong's freemium business model. When it comes to the freemium model, even though mobile-specific ads are designed to be less obtrusive, with the screen space they occupy the ads only create major visibility issues to users. As every pixel counts on a 3~5-inch screen, users do not prefer viewing ad-banners which obstruct the screen space and distract them. Thus the free part of this business model usually results in compromising both user experience and potential opportunities to appropriate value from customers. In addition, the urgency to reach out to the customer segment and to improve bottom-line is seen as the primary requirement for most startup developers. Focusing too much on monetization through regular pop ups further

jeopardizes user experience and reduces traffic to the application. This also affected the sustainability of Gudong's business model.

The premium part of Gudong's business model also could not materialize owing to a weak value proposition. The explosive rate of mobile application development has resulted in far too many nearly similar applications in the market. With increasing competition, it becomes extremely difficult for any market player to retain its customers because most users may prefer to switch over to a competing application that offers consumers the free option. With several free applications in the market, even the novelty of differentiated applications available in premium versions gets tarnished and it becomes difficult for developers to convert free users to a subscription model. As the two cases suggest, due to the lack of proper intellectual property rights regime in the software industry, novel features are prone to quick imitation by competitors. A part credit of this phenomenon goes to the open source movement revolution and technological upgradations like open APIs and mashups with which communication between applications has been rendered easy to allow developers integrate various functionalities with other applications to produce much richer applications. The unique features of open APIs and mashups are more eminent with the open boundaries principle that lowered the entry barriers of application development. Thus, open API and mashups are double-edged swords for mobile application start-ups. On the one hand, businesses have benefitted immensely from open resources by effectively expanding the business horizons and leveraging free technical upgradations through novel business propositions. But on the other hand, the freely available open knowledge stand the chance to hamper the ability of any novel mobile application to fully capitalize its innovation effort, as open source makes imitation so easy that innovation is no longer cost-effective in a crowded market. As the resource based theory states that "a firm's resources and capabilities are valuable if, they reduce a firm's costs or increase its revenues compared to what would have been the case if the firm did not possess those resources", it becomes critical for application developers to ascertain the choice of resources (i.e. innovation or imitation) to attain a novelty. For the extremely price sensitive mobile application consumers and in a market filled with free substitutable offers, imitation may work better for reasons of cost effectiveness. Given that mobile application business is ruled by players focusing merely on "imitation" than "innovation", it is not easy for any mobile application to achieve adequate returns on innovation through its novel, value-added features. In short, freemium business model may slacken the value creation potential of an application.

Proposition 1: Freemium business model does not appropriate value for a mobile application.

2. IoT products are indispensable for mobile applications.

Our cases illustrate that both Gudong and Maikai abandoned the freemium business model while adopting the new model that associates mobile application and IoT products. This "App+IoT" hybrid business model not only creates new revenue streams for an application but also serves as an effective mechanism to create greater value for

customers. This business model is a successful way to harvest the monopoly rents derived from innovation. IoT products contain advanced circuitry, possess independent processing capability, and add mobility as these can be worn by the user or placed close to the body for an extended period of time. Significantly enhancing the user's experience, IoT products play a crucial role in the age of Web 3.0 because IoT technologies permit access of information from disparate sources and machines/sensors to make the Web technologies more valuable to its users. The advancement in IoT also allows machine to machine content sharing resulting in superior applications by adding the context variable to the content generated on the Web. The ability to closely link IoT products to a wide variety of services has emerged as an opportunity of success for any mobile application. The two companies in this study are good examples of this continuously evolving relationship between "smart things" and mobile applications as a fertile ground for innovation. Both the hardware and software of these two firms were interwoven and mutually supportive, and increasingly, these firms effectively utilized the combined potential in a networked context. IoT products and mobile applications designed for their own unique "efficiently connected" destiny create a novel business model that helps firms in redefining industry boundaries, avoiding cut throat competition and moving into a blue ocean in which demand for health-fitness gears is created so that there is ample opportunity for growth that is both profitable and rapid.

The case of Gudong shows that as an extension of smartphone, wearable gears become the dominant gateways to complementary business opportunity for a mobile application. The beauty of a smart gear is that it is sleek, easy to interact with, more socially acceptable in certain situations, and less cumbersome to carry, adding novelty in business model re-design. Wearable gears also extend the boundary of mobile applications by providing complementary functionalities about physical activities which could otherwise not be possible through mobile applications alone. Also wearable gears offer aesthetic benefits to users without obstructing their physical activity regime. Thus enhanced complementarities are offered by the combination of hardware and mobile application services. In addition, IoT products such as Maikai's smart mug can provide new, unique data collection methods supported with powerful processing capabilities of the mobile applications. This uniqueness turns out to be an efficient mechanism to lock in mobile application users. In short, embracing IoT products alters the boundaries of the over-crowded mobile application business and therefore,

Proposition 2: IoT products create and appropriate value for a mobile application.

3. Open source-based co-competition business model is a win-win choice in the age of Web 3.0

Beyond the "App+IoT" business model, our case studies show that both Gudong and Maikai chose the open source-based co-competition and are trying to develop an ecosystem in which they serve as focal firms while third-party IoT product manufacturers as well as application developers are engaged as co-competitors. There are several reasons that they adopt the open source-based co-competition business model.

Firstly, for both the firms IoT products alone could not guarantee a competitive position, making value appropriation difficult. Our cases show that, as more and more manufacturers are entering the growing consumer IoT business, what looks like a blue ocean will soon turn red with far too many players. Open source hardware can improve the firms' competitive position. By encouraging open source hardware innovation, Gudong has been able to offer stiff competition to the existing giants like Fitbit and Jawbone in the fitness activity tracking market, as it allows third-party developers to develop new algorithms for Gudong's open wristband. It is not only the sale of wristbands, but also Gudong's latest mobile application that seamlessly integrates with any third-party developed complementary functionalities that steer the monetary and strategic wheel of success.

Thus, through open source-based co-competition, focal firms like Gudong and Maikai can weave an ecosystem in which they enjoy a hub position. The collaborative ecosystem anchored on open innovation can help the focal firm to gain the valuable and intangible collective creativity added by the vast ecosystem participants that engages with the focal firm to create their own innovations and refurbish the same to the larger developer ecosystem. This novel business model helps the focal firm to accrue knowledge repositories, lower cost of innovation, reduce development time and thus achieve resource efficiencies. In addition, open innovation allows reuse of IoT data by third-party developers in other applications. Increasing returns from the same data service can be achieved at a lower cost of same knowledge creation or acquisition by a single firm.

Secondly, the ubiquitous connectivity of Web 3.0 makes it clear that the key resource in a Web 3.0-based business model is not the product (i.e. wearable gear or application) but the way in which the data services are implemented. With its power of context awareness, semantic Web technologies and superior business analytics, Web 3.0 has rendered immense strength to mobile services with free linking of disparate data sources, adding personalization through extensive social computing, and allowing businesses to better organize collective knowledge systems. There is an increasing need to access both structured and unstructured data, and derive better knowledge lessons from it by the enhanced data-mining and artificial intelligence technologies. Essentially, value is created by the fast acquisition of rich information and the generation of wisdom through business analytics. Therefore, the business model of any mobile application should focus on how to better deliver more open and intelligent web services with the capacity of enhanced data analysis and crunching.

The open-source-based co-competition business model enables mobile application to collect and aggregate information from different sources, making the same data exponentially valuable. Gudong represents a good example. Releasing its wristband hardware design, ROM and SDK to the ecosystem for free largely facilitated the production of wearables by third party manufacturers and stimulated the consumer adoption. As more and more wristbands were worn by users, huge amount of user behaviour data was collected and transferred back to Gudong, enabling the firm to develop value-added intelligent algorithms.

Thirdly, a big challenge to nurture big data services is that most IoT products work in silos with an IoT device (for instance, a property wearable gear) locked in with its own supporting mobile application. The open-source-based co-competition business model can overcome the “information silo” issue by encouraging open collaborative networks based on both insourcing and outsourcing of knowledge and expertise. Both Maikai’s and Gudong’s open source products are compatible with all smartphone equipped with Bluetooth and their APIs allow any third-party mobile applications to receive data from their devices. The firms gain value as their hardware platforms gain novelty of usability through new applications developed by the developer ecosystem. The platforms of these firms also become richer and they are able to counter competition and foster novelty from new entrants.

IV. CONCLUSION

To sum up, it is definitely not be easy for any mobile application start-up to enjoy the market leader position though traditional generic strategies and freemium business model. The open-source-based co-competition business model offers an out-of-the-box solution to substantially increase the size and the total value of the pie in collaboration with other market players rather than fighting for a larger share of a small pie.

Proposition 3: The open source-based co-competition business model creates and appropriates value for a mobile application.

Our study proposes several important managerial implications for mobile application practitioners. Firstly, open-source-based co-competition business model creates a collaborative ecosystem which differs from today’s supply chain networks. This ecosystem is the coalition of self-motivated, proactive market participants that pursue a common goal and provide common network benefits. Open source eliminates the potential conflict that usually happens in the traditional supplier/OEM network and encourages participants to invest their resources. This non-conflicting business model increases customer intimacy, creates operational efficiencies, enables fast-paced innovation and allows all parties to reap rewards while pursuing individual interests. Secondly, the evolving nature of business model innovation driven by pervasive connectivity and open source movement has shifted the center of value creation from close ended, proprietary products / applications to more open and collaborative business ecosystems. Competitive advantage of a business model no longer lies in outperforming their rivals to grab a greater share of product or service demand usually through marginal changes in offering level and price, but in the creative use of big data resources and the real-time, intimate multi-sided interactions they make possible. This is because the open-source-based co-competition business model enables focal mobile applications to aggregate data from market collaborators and to provide the central processing power. These applications cannot be eliminated from the value-creation loop by competitors thanks to their possession of key data resources, which allow them to offer services more intelligently and create distinct barriers to competition. And finally, mobile application start-ups should not be wary of adopting the open-source-based co-competition business model for fear of diminishing value and differentiation. As

revolutionary and far-reaching as the positive-sum business ecosystem is, the greater opportunity usually creates the greatest value for all ecosystem participants. No doubt, there are risks associated with open technology such as dilution of brand identity and loss of control of customer relationships. However, the risks of openness can be compensated by the value that the new, collaborative business model creates in a blue ocean environment with more connected products and intelligent applications. Indeed, the greatest risk is to be surpassed by risk takers who experiment with the business model innovation.

This study is a first step in attempting to understand the business model innovation issue faced by mobile application start-ups in a fast-changing digital market. We acknowledge the inherent limitations of our study. We are limited by our reliance on the information of only two start-ups. Our propositions may not be sufficiently universal and hence a larger sample is needed to re-examine their applicability as well as their boundary conditions. Further, as our study deals with the health-fitness category of mobile applications more inter-category comparisons on business model innovation are necessary to take the category idiosyncrasy into account. Finally, future large-scale survey and quantitative analyses on the impact of different business models on mobile application value should be implemented to test our propositions.

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