Efficiency-Centered, Innovation-Enabling Business Models of High Tech SMEs: Evidence from Hong Kong

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Abstract

High technology small and medium-sized enterprises are compelled to innovate to differentiate themselves from their competitors but at the same time be efficient, as they do not have economies of scale enjoyed by larger organizations. This qualitative study explores this paradoxical challenge faced by Hong Kong SMEs in designing their business model to strike such a balance. In doing so, it investigates the competencies of these firms in technology management and their innovation practices. It is found that third party technologies that subscribe to international standards play a prominent role in the SME's technology repertoire, as they are keen to leverage upon the effects of network externalities and other positive spillover effects. Although the firms' business models enable product innovation, they also need to take efficiency into account to ensure that marketing and customer-intelligence are swiftly incorporated into their technology management and product development processes resulting in cyclic, incremental innovations. Our findings of efficiency-centered, innovation-enabling business models provide a more nuanced view of business model design in that efficiency and innovation need not be mutually exclusive. Four modalities of such business models are also identified: Focused, complementary, integrated innovation, and e-commerce-supported. These designs play an important role in enhancing product quality and performance, reducing time to market, developing new markets, and improving customer relationship and satisfaction.

Keywords: Business models, efficiency-centered, novelty-centered, technology management, innovation, ambidexterity

Are the business model design themes of efficiency and novelty mutually exclusive, or can they coexist in a somewhat ambidextrous manner (O'Reilly & Tushman, 2016)? Amit and Zott's (2001) seminal work proposed that there are two primary business model themes: Efficiency- and novelty-centered designs. Similar to Porter's (1996) view on the application of the generic strategies, some (e.g. Zott & Amit, 2008; Velu, 2015) have similarly argued that each theme should be separately adopted by the firm to avoid being "stuck in the middle" because if adopted together their contrasting logics are thought to create tensions that undermine firm performance (Prahalad & Bettis, 1986; Sabatier, Craig-Kennard, & Mangematin, 2012). However, recent work has revealed the role organizational ambidexterity plays in the dual adoption of contrasting business models, offering spatial separation as a solution (Markides, 2013; Markides & Oyon, 2011; O'Reilly & Tushman, 2016).

Nonetheless, studies on ambidexterity specifically regarding business model designs are largely premised upon larger organizations that have significant resources to draw upon (Khanagha, Volberda, & Oshri, 2014). For newer ventures however, the question of adopting dual business models (either with similar or contrasting themes) usually only emerges when the firm has grown to a certain size, such as a small and medium enterprise (SME). Change is generally thought to be linear, starting with the establishment of a disruptive business model that subsequently evolves into a more efficiency-orientated business model to exploit an increasingly established market (Brettel, Strese, & Flatten, 2012; Christensen, Bartman, & van Bever, 2016). Extant research that has focused on SMEs has also largely conformed to this linear change logic and exclusivity in business model design, specifically from the novel to efficient (Laudien & Daxböck, 2016) or the disruptive to sustaining (Ahlstrom, 2015; Christensen, 1997). Therefore, the question of co-existence of both efficiency and

novelty design themes in SMEs was assumed to be impracticable and thus has remained largely unexplored.

The literature has long indicated that technology plays a significant role as a catalyst for innovative business models (Chesbrough & Rosenbloom, 2002), as well as driving efficiencies within it (Davenport, 1993). Recent research suggests that the concomitant between technology and innovation practices is also potent in stimulating innovations in discrete business model components -- product innovation (value proposition), process innovation (value creation), and marketing innovation (value capture) (Clauss, 2016). Given this prescience (Corley & Gioia, 2011), what role does the management of technology and innovation play in SMEs' business model design for both efficiency and novelty?

In focusing on this key question, it is argued here that SMEs' technology acquisition and application, and innovation practices directly impact business model design for efficiency and novelty. We advocate a paradoxical approach that departs from the traditional "if/ then" approach (Qiu, Donaldson, & Luo, 2012) to one that embraces a "both / and" approach in that a business model can be simultaneously efficient and novel (Lewis & Smith, 2014). As such, this article responds to calls by scholars in deepening our understanding of how multi-paradigms (i.e. efficiency and novelty), can coexist in a business model (Klang, Wallnöfer, & Hacklin, 2014; Ricciardi, Zardini, & Rossignoli, 2016) and for clarity and insight as to how technology and innovation play a role in its design (Baden-Fuller & Haefliger, 2013).

We address this by focusing on high-technology SMEs in Hong Kong as nowhere is the paradoxical need to balance efficiency and novelty in business models more prominent as in SMEs characterized by limited resources and initial path-dependencies (Vos, 2005). High-technology SMEs are selected as they have the

proclivity to produce innovations, albeit usually incrementally, after their initial entry into a market (Ahlstrom & Bruton, 2002; Bougrain & Haudeville, 2002). High technology SMEs usually have one business model that needs to be moderately novel for differentiation and at the same time be efficient enough to sustain margins. A unique context in examining dual business model design themes is Hong Kong (Rousseau & Fried, 2001; Tsui, 2004; Whetten, 2009). Many entrepreneurial SMEs face penurious environments, however Hong Kong SMEs are especially exposed given its limitations in natural endowments as a metropolitan area economy. Nonetheless, Hong Kong is generally known as an entrepreneurial society (Ahlstrom, Levitas, Hitt, Dacin, & Zhu, 2014; Yu, 2000). Yu (2000) adds that a unique feature of Hong Kong entrepreneurs and SMEs are its ability to produce ordinary discoveries and adaptive innovations (p. 179) that are exploitative in contrast to exploratory transformative innovations (Ahlstrom, 2001). Yu (2000) adds that ordinary discoveries in Hong Kong SMEs are a result of Hong Kong's fairly unique style of commerce based upon a history of guerilla business strategy, rapid incremental innovation through imitation and adaptation, and regional arbitrageurship.

In examining the case of multiple SMEs in Hong Kong, this research seeks to make three contributions. First, we contribute to theory by deepening our understanding of SME business model designs (Guo, Su, & Ahlstrom, 2016; Massa & Tucci, 2014) in demonstrating how high technology SME firms in Hong Kong configure efficiency-centered, innovation-enabling business models. We show how environmental circumstances in Hong Kong may have been catalytic in their assumption of such paradoxical business models (Andriopoulos & Lewis, 2009) in catering to efficiency and innovation simultaneously. Our second contribution is to the business model literature by providing a more nuanced view of moderately novel

business model design, in particular the focused, complementary, integrated innovation and e-commerce-supported business model designs. In building upon the earlier work on business model typologies (Christensen et al., 2016; Massa & Tucci, 2014), we argue that these four designs play an important role in enhancing product quality; reducing time to market; developing/ penetrating new markets and improving customer relationship and satisfaction. The third contribution is to the SME literature and policy in showing how technology, innovation and customer relations also play a significant role in business model design (Wu, Guo, & Shi, 2013). In particular, for policy we show the importance of international standard-compliant third-party technologies for high technology SME firms in Hong Kong and government's potential role (Garud & Ahlstrom, 1997). And how product innovation is an important type of innovation involving effective customer relations for market intelligence, as well as sometimes being facilitated by flexible technology assessments by government (Dunbar & Ahlstrom, 1995).

Literature review

Efficiency and novelty business model designs

A business model links a firm's business strategy with its operational processes and outputs (Al-Debei & Avison, 2010; Morris, Schindehutte, & Allen, 2005). Business models are usually depicted as a framework that contains distinct but inter-related business activities (Osterwalder, Pigneur, & Tucci, 2005). Osterwalder and Pigneur (2010) argue that a business model contains nine components include customer segments, value propositions, marketing channels, customer relationships, revenue streams, key resources, key activities, key partners and cost structures, while some (Clauss, 2016) provide a more parsimonious view involving the value proposition,

value creation and value capture components. Although there are an indefinite number of business model types, Zott and Amit (2007) propose that there are essentially two main design themes: efficiency- and novelty-centered designs. The efficiency theme aims to decrease the transaction costs incurred in all of the activities, while the novelty-centered business model theme essentially aims to promote new ways of conducting business, which can be accomplished via new configurations in any of a business model's components such as new transactions with existing or new partners (Zott & Amit, 2010).

Amit and Zott (2012) also posit that efficiency is a key design theme for effective business models. They cite the example of Wal-Mart's business model of creating warehouse hubs and the use of sophisticated technology to increase the efficiency of its logistics operations. Efficiency can also be a result of vertical integration in reducing transaction costs (Williamson, 1981). Porter (1996) argues that business models must be efficient as anything that runs counter to this will fail in the long term no matter how novel or disruptive the new business model. Organizations with an efficiency-centered business model continuously look for ways to increase productivity and return to effort ratios, as well as to maximize the utilization of assets and resources, while eliminating waste (Johnson, Christensen, & Kagermann, 2008). Osterwalder and Pigneur (2010) add that efficiency also relates to a business model that has appropriate cost structures.

In contrast, novelty-centered business models are typically dichotomized in terms of high and low degree of novelty in terms its newness and impact, drawn from both external and internal perspectives of the firm (Garcia & Calantone, 2002). Radically novel business models are game-changing as they disrupts an industry's dominant logic (e.g. new or different performance metrics) (Ahlstrom, 2015; Garud &

Ahlstrom, 1997) and create new markets (Christensen, Anthony, & Roth, 2004; Garcia & Calantone, 2002). Radically novel business models adopt an external perspective as it concerns the repositioning of the firm in the industry or value network (Cucculelli & Bettinelli, 2015), which can result in substantial change in stakeholder networks (Garnsey, Lorenzoni, & Ferriani, 2008; Pedersen, Gwozdz, & Hvass, 2016). Examples of radically novel business models are well represented in literature (e.g. Abdelkafi, Makhotin, & Posselt, 2013; Desyllas & Sako, 2013), however as Johnson et al. (2008) argue, given their radical nature, disruptive business models are not common, with moderately novel business models relatively more so.

Moderately novel business models might be the result of significant adaptations (Mezger, 2014), improvement (Osiyevskyy & Dewald, 2015), or extension of an existing business model (Souto, 2015) and may involve refocusing of the firm's business logic (Cucculelli & Bettinelli, 2015). Newness in moderately novel business models largely adopts an internal perspective as it involves some degree of unique changes within the firm, such as innovations in the value proposition, value creation and value capture components. Newness may also arise from the use of new competencies and organizational routines (Cucculelli & Bettinelli, 2015), new technology (Denicolai, Ramirez, & Tidd, 2014), the recombination of existing or new resources (Enkel & Gassmann, 2010; Martins, Rindova, & Greenbaum, 2015) and structural (systems-level) reconfiguration activity systems, value chain or organizational structures (Ernkvist, 2015; Zott, Amit, & Massa, 2011). Moderately novel business model designs generally aims to further exploit current markets (Bohnsack, Pinkse, & Kolk, 2014), and maintain the firm's position in the value network (Sosna, Trevinyo-Rodríguez, & Velamuri, 2010). It modifies existing product service and how to deliver and capture value (Markides, 2006).

While the extant literature provides clarity regarding the nature and characteristics of both efficiency-centered and novelty-centered designs, the assumption that both designs are mutually exclusive needs to be revisited given how firms such as high technology SMEs need to be innovative yet efficient (Prabhu & Jain, 2015).

Technology acquisition and application

The resource-based view (RBV) argues that individual firms are a collection of heterogeneous resources and capabilities that provide individual firms the opportunity to create competitive advantage (Barney, 2001). While firm resources and capabilities vary significantly from one another, the most important and common resources and capabilities of contemporary firms such as high-technology SMEs are technology acquisition and application, and innovation management (Brem & Tidd, 2012).

The OECD (2001) states that technology refers to the state of knowledge (p. 125), while Clarke (2005) observes technology as created competence manifesting in devices, procedures, and acquired human skills (p. 6). Indeed, while technology is obviously an output of high-technology firms, the role of technology as an input and its role in the conversion process of creating subsequent technological outputs also play an equally prominent role (Ahlstrom, 2010, 2015). The ability to manage technology enables SME firms to get the most out of technological as well as non-technological resources that support it.

Ford and Saren (2001) surveyed 703 firms in the United Kingdom across seven sectors and found that the most common means of acquiring new technology is internal research and development (R&D) followed by licensing-in (i.e. external acquisition). Other means of technology acquisition and application include franchising, contracting-out R&D, and joint ventures (Liu, Chen, & Wang, 2017; Trott, 2011). Each means of technology acquisition has its benefits, costs and critical

success factors (Lei & Slocum, 1991). No single means of technology acquisition is better than another, and the choice of acquisition method depends on the circumstances of the firm. Those circumstances include the relative standing of the firm, category of the technology, urgency of the acquisition, the investment involved in the acquisition, and the technologies' lifecycle position (Tongur & Engwall, 2014).

Innovation management

Innovation takes many forms and may include new or vastly improved products, services and technology development, development of new and more efficient production methods, the addition of new distribution methods beyond the current channels, identification of new markets, as well as the introduction of new ways of doing business (Cortimiglia, Ghezzi, & Frank, 2015; Nagji & Tuff, 2012). The process of innovating can take the form of a virtuous cycle where innovation begets innovation (Souto, 2015). For instance, an innovative technology may be used to create innovative products, and a new innovative product may require a new novel business model for effective commercialization (Christensen & Raynor, 2013). In addition, innovative products may require novel innovative processes.

Although innovation and new venture creation may be modest in form, this is nonetheless a core activity of many high-tech, higher growth SMEs (Ahlstrom & Bruton, 2002; Chen, Chang, & Bruton, 2017; Newman, Schwarz, & Ahlstrom, 2017). SMEs also tend to be flexible in how they innovate adopting exploitative and arbitrage modes (Yu, 2000). SMEs are exploitive by seeking to maximize their product's potential capacity, and also opportunistic in seeking new markets interchanging between product and market-led approaches contingent upon environmental circumstances. There are generally two catalysts for innovation – (changing) technology and markets (Lane, 2011; Rothwell, 1992). The technology-

driven means for innovation suggests that opportunities for innovation are largely premised upon the discovery of new technologies and/or new applications for existing technologies to create markets through product innovation, particularly simplification. On the other hand, in market-driven means for innovation, firms look to markets first and identify unmet needs before selecting and using appropriate technologies to meet those needs (Boudreau & Lakhani, 2011; Kok & Biemans, 2009).

Strategic research site

To better understand the manner in which high-technology SME manage their technology acquisitions and application, it is important to consider firm environment as a strategic research site (Bijker, Hughes, & Pinch, 2012). The World Economic Forum (2015) and many researchers suggest that the degree of innovation in countries is shaped by formal (Nair, Ahlstrom, & Filer, 2007; North, 1990; Rodrik, 2009) and informal (Ahlstrom, Young, Nair, & Law, 2003; McCloskey, 2006; Landes, 1998; Mokyr, 2016) institutional factors such as economic policies, intellectual property, culture, and policies to encourage innovation and new venture creation. This not only encourages innovation and new ventures (McCloskey, 2013; Yu, Hao, Ahlstrom, Si, & Liang, 2014), but Siu (2005) also adds that national culture influences entrepreneurs' style of management and approach to business such as with guerilla marketing, facilitating intergenerational firm development (for family business), and encouraging growth mindsets in the organization (Dweck, 2007; McCloskey, 2010), allowing for trial and error experimentation (Wang, Ahlstrom, Nair, & Hang, 2008).

Hong Kong's manufacturing and trading sector made the largest contribution to the city in much of the twentieth century (HKTDC, 2006), with most firms in the sector classified as SMEs and original equipment manufacturing (OEM) firms. Low cost was a primary competitive means (Ahlstrom, 2001). Some (Yam, Lo, Tang, &

Lau, 2011) have described Hong Kong as a labor intensive exporter with low technological content, for example. Over the years Hong Kong SMEs have attempted to compensate for the lack of technology use and indigenization by innovating with their manufacturing and marketing processes, (Gilboy, 2004; Siu, 2005), which has provided a basis for developing business modelling capabilities.

Nevertheless, the business environment in Hong Kong has gradually been changing since the late 1990s as Baark and So (2006) reported:

> the Special Administrative Region state put forward a new developmental strategy to turn Hong Kong into a global high tech city. Various programs such as Cyberport, the Innovation Technology Fund, the Hong Kong Science & Technology Park, and the Applied Science and Technology Research Institute were launched (p.102).

As Hong Kong conceded its labor cost advantages, government policy has prioritized the enhancement of technological, innovation and branding capabilities (Eng & Spickett-Jones, 2009). However, the drive towards technology and innovation as drivers of Hong Kong's economy is still at a decidedly nascent and the path forward is still emerging (HKSAR, 2014). Given the unique challenges of the context, we therefore examine more closely the role technology and innovation in the design of business models of high technology SMEs in Hong Kong.

Methods

A case study approach was selected due to the potential complexity in the management of technologies and innovation processes, and business model design. This approach allows the researchers' to gain insight into the intentions and thinking of executives in each firm (Yin, 2017). A multiple case-study design was also adopted to address the research questions of this study, as it allows for emerging theory to be identified, replicated, contrasted and/or extended, generating more robust and generalizable theories compared to a single case study (Eisenhardt, 1989).

Purposive sampling was adopted and the four firms were recruited based on a set of predefined criteria relevant to the research question posed (Eisenhardt, 1989; Yin, 2017). Eisenhardt and Graebner (2007) add that the rigor of theory improves when data is drawn from at least four cases. As both technologies and innovation are essential elements in the research question of this study, the Hong Kong Science and Technology Park (HKSTP) was used as a sampling framework. The aim of the Park is to transform innovation and technological advancement in Hong Kong. It provides facilities and services to SMEs involved in electronics, information technology and telecommunications, precision engineering, biotechnology, and green technology. We further applied two criteria; the firm is headquartered in the Park, and firms had to be in business for at least three years so as to allow for its systems and methods, and business models to be fairly established.

Senior executives were contacted via e-mail and/or phone and invited to take part in the study. Although fairly obvious, we nonetheless required firms to confirm that technology and innovation plays an integral role in its business. As soon as the invitations were accepted, follow-up invitation letters containing details of the research were distributed. Four firms, anonymized as Alpha, Beta, Gamma and Delta, fitting these criteria were selected. The firms are involved in software development and consumer electronics. The firms selected had been in business between 4 to 15 years.

These include Alpha, a firm established in 2010, which designs, develops and sells premium mobile device accessories. Its suite of products include backup batteries, chargers, headsets, speakers and play-bulbs using Bluetooth wireless technology. Alpha has offices in Hong Kong, Chicago, London, Shenzhen and Tokyo. It has over 300 employees in its various locations. The average annual revenue of the company in

the last five years was approximately USD 7.5 million. Beta is the second firm. The firm has been developing and providing logistics software solutions for international freight forwarders such as DHL since 1998. The firm is a software developer partner with Microsoft. It has six employees and the average revenue the company earned in the last five years was about USD 700,000 annually.

Gamma is the third firm studied. The firm was established 2011 and offers technology solutions to help clients better manage their facilities involving technologies such as radio-frequency identification (RFID). It has in total of 30 employees, mostly full time, and its average annual revenue the company earned in the last five years was close to USD400,000. Finally Delta is the fourth firm examined. The firm was founded in 2011 to design and develop technology solutions to support clients in the supply chain sector. It employs nine full time employees and the average annual revenue the company earned is approximately USD 200,000. Similar to Beta and Gamma, Delta is a business-to-business company.

Although the case sample size is modest, this is, however, countered by the intensity, richness and quality of data (Morse, 2000). We adopted a mixed methods approach in our data collection; interviews with key executives, survey questionnaire from other staff members and analyses of firms' documentation was employed. We used semi-structured interviews with the individuals who had the most comprehensive and intimate knowledge of the firms' strategy and operations, in particular, sound knowledge of their firms' technology, innovation processes and business model, that is, managing directors and directors -- the Chief Executive Officer (CEO) and other top management). Data obtained from the interviews were supplemented and validated with data from an extensive questionnaire provided to staff and an

examination of each firm's documentation in relation to its use of technology, innovation processes and business model.

We interviewed five individuals in total, with each interview lasting between five to eight 8 hours; Alpha's Product Development Director, Beta's Director, Gamma's Technical Director, and Delta's CEO and Principal Consultant. The significant length of time in the interviews was due to interviewees providing documented evidence in support of their explanations. To enable the researchers to gain more insight and to enhance the effectiveness of the interviews each interview protocol was developed in a somewhat customized manner. We did this by providing each interviewee a survey for them to complete. The information gained from the returned survey provided the researchers a better understanding of the firm's business, its products, markets and operations. This in turn allowed the researchers to develop bespoke interview protocols for each firm. We also distributed questionnaires to all members of staff in each firm to validate data obtained from the interviews. We also requested documents such as product catalogues, client presentation slides and corporate literature (e.g. for investors).

Data analysis

In terms of data analyses from the interviews, first, the varied and extensive raw text data were condensed and summarized into a brief format (Thomas, 2006). Data from the surveys and documents were used to develop a 'thick description', which was reiteratively analyzed, as well as being used to validate the interview data (Bryman & Bell, 2011) to discover the interrelationships between the constructs. Second, the process of coding data segments for the purpose of categorization, pattern and thematic identification were undertaken (Miles, Huberman, & Saldana, 2013). Third, "a model or theory about the underlying structure of experience or processes that are

evident in the text data" was developed (Thomas, 2006, p. 238). For example, the links between technology and innovation in this study were generalized across all four of the cases in terms of the research question posed. The multiple-case study design enabled the themes and patterns found in one case to be triangulated against others to improve the rigor of the findings (Eisenhardt & Graebner, 2007).

Results

Proven technologies and network externalities

All four firms are highly dependent on the creative but practical use of technology that has proven utility and demand. For Alpha, who produces power management, sensors, lighting and audio products for mobile phones, complementarity and connectivity with other technologies are important as the Product Development Director stated, "we don't currently sell anything, which can't be connected to wireless mobile phones." As indicated in corporate documents, Alpha is dependent on technologies developed by Apple and Samsung to inform its technology strategy. While this means the firm is captive to the fortunes of these larger firms, its Product Development Director argue that this approach has-paid off as it has made Alpha a capable competitor in its market.

Such connectivity and upgradeability associated with network effects (Arthur, 1996) is also similarly important for Beta. The firm develops logistics management software and uses standard programming language to ensure that its software can be customized to suit and integrate into their clients' existing technology environment. However, as the survey results suggests, apart from their programming language, the other technologies employed are entirely third party proprietary. Delta also develops software solutions but for the logistics and truck management market. Similar to Beta,

much of the technology applied are propriety except for the codes used. However, the firm uses to a number of international standards such as the Electronic Product Code Global Standard to ensure that their solutions are complemented by capabilities in tracing and identifying goods in transit. The interview data further suggest that Delta maintains a narrow core competency and therefore uses external technologies and services such as cloud computing provided by other vendors to enhance their solutions, rather than developing many of their own.

The theme of leveraging upon proven technologies is especially observed in Gamma, who creates suites of products for facilities management. The Technical Director confirms data from the survey in that third-party technologies are crucial as he states,

> we continuously look out for integration opportunities to better couple our IT capability [software programming] with the 'new' and proven technologies such as RFID and Bluetooth 4.0.

Indeed, for Gamma, many of its products would not have materialized without third party technologies. The firm's use and integration of RFID has made it an expert in this technology, which in turn enabled it to develop new applications for the technology such as in energy and building management. The Technical Director of Gamma cited the following example of how the firm innovated to develop a new suite of products based on its RFID capabilities,

> Some energy dashboards need to be built in one part of the Zero Carbon Building project. We have tried various protocols of RFID and eventually we were successful. We have worked with large firms such as Siemens in implementing such projects.

The firms adopt a pragmatic approach in the acquisition and further development of external technologies. They proved willing to experiment with new technologies but within their immediate technological locale, and expected to pay-off within one to

two years. These short technological horizons suggest the firms' balance the gradual development of their own technical capabilities with attending to commercial realities to survive. The management of technology product development is oriented towards improving product quality, decreasing time to market whilst enhancing market acceptance. The use of proven third-party technologies is important to all four firms to meet industry standards for connectivity and to enable its products to be more easily accepted by the markets. Such connectivity and upgradability is important for the effects of network externalities to materialize (Nair & Ahlstrom, 2003). The effects of network externality are reflected in the product offerings of Beta, Gamma and Delta as the value of their products to current users is increased the number of new users grow. Table 1 summarizes the results.

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Product innovation through customization enabled by third party technologies

All four firms' product offerings do not have a dominant design in their respective markets and participants opined that it is unlikely that any will emerge in the near future. As a result, firms tend to focus their efforts on product innovation such as improving the features, functionalities and performance, and to some extent novel marketing approaches. Indeed, Alpha's Product Development Director was categorical as he remarked that "without product innovation, the company cannot maintain its long-term survival," as the firm continuously looks towards integrating new value-added applications in its products (e.g., smart lighting and audio). As the firm's publications show, Alpha undertakes two primary activities: i) enhancement/ improvement of current products and ii) new product development activities. Product

enhancement is a major program of incremental innovations involving enhancing its portfolio of product suites in terms of features and functionalities. New product development initiatives are more moderate forms of innovation that are narrower in focus using sensor technology as a basis to develop new products.

Beta also engages in customization as a moderate form of product innovation. The survey indicates that customization involves a market-driven approach in the redesigning and redeveloping product features and functionalities based on existing customers' requirements. The customization processes in Beta tend to range from low to (moderately) higher degrees of customization. For example, new functionalities such as custom clearance reports for in-boarding shipment to the more complex customer relationship management (CRM) function (almost as an entire module in itself) complement its logistics solution suite. A Director of Beta stated that this approach,

> enables us to be a capable competitor even with the 'big boys. Some of our competitors in the logistic IT are really the market leaders, such as those international logistic software providers (e.g., SAP).

Similarly, Gamma adopts a customization approach in its product innovation that results in the enhancement of functionality and application performance. However, its customization is driven by evolving industry best practices as Gamma's Technical Director explained,

> We are using some very mature frameworks to do development and on top of the framework we build our solutions. Let me take our customers Big Telco and Big Airport [both anonymized] as examples. They both used the same module, which derived from our industry best practice framework.

Delta is also primarily involved in product innovation, ranging between incremental to moderate degrees. The firm has developed an innovative modularized solution in-built through the design of its software that allows users to 'self-

customize', maximizing the technologies' capabilities and anticipating clients' future needs. Its CEO stated,

> what we have are components (software modules). We do not wait for requirements to be raised by our customers. We have a number of pre-fab and ready-to-use components

which the CEO argues is quite radical for its market, "what we are doing in our business is far ahead of others". As the product innovation is relatively radical, Delta has had to also innovate part of its business model to deliver the new solution (e.g. introduction of new service level agreements and management with cloud computing providers) and support the modularization approach (e.g. pricing and technical support). In summary, all four firms' innovation activity is primarily aimed at enhancing and improving the features, functionalities and performance of their products albeit at varying degrees.

The product innovation process of all four firms is centered on quick turnaround, that is, the efficiency of incremental, sustaining innovations. This process is enabled by the firms' internal logic reflected across all four firms that involved continuous search in looking for new innovation opportunities, be it from the markets and customers or industry best practices. Their organizational processes are also developed to emphasize incremental innovation, for example straightforward product development decision-making and non-bureaucratic approval processes. In addition, its people management systems such the development of staff's technical capability supports and enables staff to sustain its innovation initiatives.

Customer relations, intelligence, and business model design

As technology firms, it is not surprising that the four firms' business models are largely shaped by its unique technical capabilities in terms developing indigenous and integrating propriety third-party technologies, as well as enhancing their respective

value proposition through product customization and innovation. This requires firms to not only design their business models to permit its technical capability to emerge and drive innovation, but also be able to assimilate evolving market requirements and industry best practices that informs the product enhancement and development process. Therefore, a tightly linked and efficient relationship between the firm and its external environment is crucial, in particular with its markets and customers.

Alpha, for instance, is largely a business-to-consumer (B2C) firm and therefore needs to be sensitive not only to the technical features, functionality and even performance of its products but also its aesthetics. Given its needs to anticipate market's needs, it has developed customer intelligence process with its distributors to keep track of its customers' preferences as indicated by data from the survey and firm artifacts. As the Product Development Director indicated,

> in terms of being competitive or being successful, distribution channel is the most important component . . . if we don't have a good distribution channel, then just forget about it [having good performance from effective intelligence].

As such the firm is not only concerned with further exploiting its present distribution channels but also intermittently reassessing its current arrangement to identify more efficient distribution channels and gathering more accurate and timely feedback from customers, much the reasoning Apple had in setting up its first retail stores (Ahlstrom & Bruton, 2009). This is a key activity in Alpha as it is unable to identify its customers due to the nature of its sales and commercial arrangements. Therefore, until it is able to identify its customers through some form of loyalty scheme or lock-in mechanisms, it is reliant on its distributors.

Beta articulates its value proposition itself as an IT partner-of-choice for local and international freight forwarders; in particular clients can rely on the firm to anticipate its needs and to develop a long-term orientation to their respective business

relationship. The Director of Beta emphasized the importance of the firm's relationships with its customers, which allows the firm to obtain access to customers' ideas for the purpose of engaging in innovation activities to create new features/ functionalities for current and/or new products. Unlike Alpha, recurring income is important in shaping its business model premised upon intimate customer relationships. The revenue model that allows Beta to maintain the software for its clients provides it the opportunity to gain insight into its clients' business and internal organization that better enables it to develop client-specific solutions, as well as target key individuals in its account management practices.

Gamma's Technical Director argues that the firm's key value proposition is "providing the power of control," specifically how its products offer clients the ability to control any aspects of facilities and potentially other areas of the clients' business. Although much of its value proposition lies in the solution, data from the interview and the firm's artifacts suggest that consultancy plays a crucial role in the firm's value proposition. This approach allows Gamma to leverage upon customers as a source for new ideas in co-production of solution. The Technical Director recounted, "normally it is the users who tell us the problems they have…we then work with them to look for different approaches to getting the problem solved." Similar to Beta, recurring income is a significant aspect of its revenue model, providing customer intelligence that allows the development of client relationships.

Delta's value proposition lies in the performance and flexibility that its software solutions provide to its clients. The firm's artifacts show that the use of Enterprise Social 2.0 platform is crucial to the overall application as it allows for the establishment of a collaborative approach in the use of the software (e.g. peer-to-peer). The solution integrates social elements in the joint enterprise development that

encourages interaction and the cooperation of various actors in the value network, in sharing and exchanging industry knowledge and best practices. This mechanism acts as both an intelligence gathering and marketing tool. Delta's revenue model relies on usage fees on a pay-as-you-use basis, similar to the 'software as a service' business model.

Summary

The data suggest that the firms place importance on getting close to its customers and markets to gain insight into future needs. This allows firms to anticipate future product enhancement and development initiatives, identify user innovations, and the resources required. In particular, it enables the more nimble among them to jump through technological windows when they open and not getting caught flat footed. Given their limited resources, the firms in our sample were able to make regular incremental improvements and thereby mitigating risks associated with significant one-off investments involved in radical innovation or committing completely to one technological standard – making little bets as it were (Sims, 2011). The emphasis on client relations allows firms to not only enable incremental product innovation to take place as well as positioning firms to jump through technological windows as they open (using off-the-shelf technologies to start) but also allow this process to be reasonably efficient and lower risk. These firms may not grow as fast as the bet-the-company firms, but the still can be innovative and become closely involved in innovative trends as they coalesce (Rumelt, 2011).

Efficiency-centered, innovation-enabling business models

The data revealed three additional important findings. First, product innovation was the primarily method the extracting optimal benefits from proprietary technology owned by each firm. Second, standard third-party technologies were leveraged in

product innovation for both its technological utility and its network externality, which was a prominent feature in Alpha, Gamma and Delta. Third, client relations and intelligence competencies were equally important as an input to product design as well as in marketing, in particular allowing firms to jump through technological windows as they opened, often as a fast follower, or fast participant.

Technology influenced the firms' business model design through technology partner selection, the process of product innovation and efficient and intelligence gathering distribution channels. Innovations emerged in internal and external collaborative processes, and in incremental product innovations. Product innovation, in turn, further shaped the firms' need to develop higher degree of technical and customer relations capabilities. The best firms exploited customer relationship capabilities to gain insight to its clients' needs to better design its business model by incorporating feedback loops between marketing and operations (technology and innovation processes). The congruence and seamlessness of value creation and capture components in supporting the value proposition allowed for rapid feedback and therefore regular incremental innovation reflecting Sabatier, Mangematin, and Rousselle's (2010) contention that business models connect core competencies with the market and customer.

Each of the firms' business models are designed to enable a tight integration of its value creation and capture components in supporting its value proposition. This allowed the firms to regularly experiment and customize to its value proposition, and thereby enhancing its value creation processes and value capture mechanisms, establishing the building blocks to develop innovative business models (Guo, Su, & Ahlstrom, 2015). Table 2 summarizes the role technology and innovation practices in creating efficiency-centered, innovation-enabling business models.

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insert Table 2 about here

There are indications that the firms' current business model are working fairly well. For example, for Alpha, where brand name recognition is a priority have received market and industry awards in particular the 27 Red-Dot Design Award and the iF Awards in Europe, and the Good Design Award in Japan. For Beta, data from the survey suggest the business model has supported the firm's need for short order-to-build turnaround times, while Gamma's business model has enabled it to maintain the 'affordability' of its offerings. Finally, Delta's business model has facilitated the firm's need for organizational learning, in particular how it is able to transform know-how in the logistics community and industry into software features and functionalities, as posited by a senior manager.

In short, the business model elements reinforce one another resulting in efficiency-centered, innovation-enabling business models (Figure 1). First, technology is directly used for product commercialization by strengthening the firms' distribution channels. Second, the use of industry standard third-party technologies enabled incremental product innovation to take place with partners using the same technologies. Third, the deepening of collaboration allowed each firm to better develop internal capabilities such as absorptive capacities and knowledge creation (de Jong & Freel, 2010; Su, Ahlstrom, Li, & Cheng, 2013), enabling a higher degree of internalization of external knowledge and technologies, stimulating collaboration and co-creation of process innovations. Fourth, a higher degree of collaboration coupled with increased absorptive capacities, ultimately increases the speed of incremental product innovation, and novel approaches to marketing intelligence. Fifth, the success

encourages the further co-development of indigenous technologies and further adoption of other third party technologies recommended by firms and the partners (i.e. reciprocal influence). The emergence of market and process innovations spurred by success in incremental product innovation, and cumulatively effecting the firms' business model configurations, gives rise to a virtuous circle between technology, innovation and business model design underpinned by the mutuality of efficiency and novelty.

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insert Figure 1 about here

The results suggest that efficiency and novelty can co-exist in a business model design, specifically a business model can be orientated towards efficiency but at the same time support incremental innovation. These results are particular to technology SMEs in Hong Kong as the firms' focus on technology inevitably means that innovations is an integral part of its raison d'être, but due to their limited resources in comparison with larger organizations, these firms have designed their business model to be efficiently linked to their respective external environments, in particular with its customers and markets, and technology management and product innovation processes. These firms are intensive technology users but as noted, tend to acquire and apply proven technologies compared to large corporations that have larger budgets in developing indigenous technologies. These results are consistent with view entrepreneurship in Hong Kong that is characterized for its adaptive innovations and arbitrageurship (Yu, 2000). The quick turnaround of incremental innovation are a proven strategy of cyclic incremental innovation used by Hong Kong's Asian counterpart Japan during its early forays into the electronic industry (Gomory, 1989).

In addition, Browning and Sanders (2012) support the view that efficiency and innovation can co-exist. They found that innovation does not mean the need for excess resources for experimentation, but can be lean by adopting a systems approach in the appropriate reconfiguration of a firm's entire business model.

Efficiency-centered, innovation-enabling business model typologies

While an efficiency-centered, innovation-enabled business model was the shared design theme, this study also found there were nuanced differences amongst them. In particular, the firms' business models were also differentiated in terms of emphasis, reflecting four business model designs; focused, complementary, integrated innovation, and e-commerce-supported business model design. Each of design is represented by each quadrant in Figure 2, which maps each business model design along the two dimensions discussed; internal/ external orientation of technologies and scope of innovation activity.

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insert Figure 2 about here

The focused design generally relies primarily upon using the proprietary technologies owned by a firm, but closely followed by third-party technologies and focused almost entirely on product innovation through enhancement and customization. This was the basic characteristic of Beta and Delta. The complementary design, which is an attribute that was particularly prominent in Alpha, Gamma and Delta, is significantly dependent upon technologies sourced from third parties that have a high degree of openness and favorably subscribes to industry standards. Similar to the focused design, innovation is aimed at product enhancement. The integrated innovation design, as reflected by all four firms, primarily uses the firms' own propriety

technology but its innovation activities have a broader remit involving marketing. This business model design help firms to communicate and educate markets about its product knowledge and/or deliver their products to targeted customers in a more cost-effective way. The e-commerce-supported design, particularly progressive in Alpha and Delta, is similar to the integrated innovation design involving primarily product innovation, but including marketing innovation to a lesser extent. However, in addition, this design also involves firms making significant use of third-party technologies.

Evolutionary change for moderately novel business models in high-tech SMEs

Changing business models is a risky affair given the time it takes and the disruptiveness it causes internally to organizations. Therefore, high technology SMEs should change and develop moderately novel business models in an evolutionary manner. Although business model evolution is considered passive (Cucculelli & Bettinelli, 2015; Schneider & Spieth, 2013) as firms mostly maintain existing resources and capabilities (Khanagha et al., 2014) while co-evolving with other firms in the industry and institutions (Hopkins, Crane, Nightingale, & Baden-Fuller, 2013; Huygens, Baden-Fuller, Van Den Bosch, & Volberda, 2001), it still requires proactive adaptations. In addition, the scope of change for business model evolution can be substantial especially to qualify as 'business model' change rather than merely process change. Demil and Lecocq (2010) describe business model evolution as "progressive refinements to create internal consistency and/or to adapt to its environment" (p. 228), while Miller, McAdam, and McAdam (2014) describe it as a series of transitions.

Demil and Lecocq (2010) argue that there are positive outcomes from business model evolution such as new revenue streams and/ or change in cost structure, new

resources used and the reengineering enterprise-level processes. Although decision making in business model evolution is path dependent (McGrath, 2010) that results in similar patterns of decision making over time (Bohnsack et al., 2014), Demil and Lecocq (2010) argues the business model evolution still involves 'deliberate' and rational decision making based upon 'given' options. Adeptness in business model evolution may prepare SMEs to more radically change and innovate its business model.

Indeed, whilst radically novel business models are generally qualified from an external perspective i.e. new entrepreneurial firms creating new markets (Osiyevskyy & Dewald, 2015), such innovation does require the firm to draw upon experience in changing and evolving its internal dominant logic, resources and competencies. For example, firms need to refocus its own internal logic before changing industry's logic (e.g. selling a product to providing solutions) (Laudien & Daxböck, 2016), which results in the alteration of routines, competences, technology and resources at the same time (Andries, Debackere, & van Looy, 2013). Radically novel business model may require internal transformational change in organizational culture (Hock, Clauss, & Schulz, 2015) to support new dominant logic and business model.

Discussion

Contributions

This research responds to calls by researchers to deepen our understanding of how multi-paradigms -- efficiency and novelty -- can coexist in a business model (Klang et al., 2014; Ricciardi et al., 2016), as well as for insight as to how technology and innovation play a role in business model design (Baden-Fuller & Haefliger, 2013). In doing so, this research makes three primary contributions. In terms of theory, it is

argued that the right technology acquisition and application enables open innovation to take place and thereby widens and deepens external collaboration. In addition innovation practices involving product, marketing and processes enables firms' business model to cater for both efficiency and novelty for mutual effect. This paper demonstrates that the technology, innovation and business models are reinforcing constructs and can lead to virtuous circles. This study also enriches the Asian management literature by demonstrating an extant paradox paradigm (Andriopoulos & Lewis, 2009) among some Hong Kong SME business model designs premised on environmental circumstances and bricolage (Guo et al., 2016) or jugaad (Prabhu & Jain, 2015). Whereas business models in larger firms tend to be more efficiency-orientated to take advantage of economies of scale and to serve large sections of a market more profitably (Casadesus-Masanell & Ricart, 2010; Magretta, 2002), and entrepreneurial ventures are inclined to develop disruptive business models to create new markets (Christensen & Overdorf, 2000), SMEs' business model, however, may have to be both efficient and novel to serve existing markets while exploring newer ones.

Our second contribution is to the business model literature and practice by providing a more nuanced view of moderately novel business model designs, in particular the four efficiency-centered, innovation-enabled business model designs -- focused, complementary, integrated innovation, and e-commerce-supported business models. Building on recent work on business model typologies (Christensen et al., 2016; Massa & Tucci, 2014), the four design has implications for practice as it provides an instructive frame for other SMEs to reference to enhancing product quality; reducing time to market; developing new markets and improving customer relationship and satisfaction. Each of the four designs are bespoke in catering to the

firm's scope of innovation activity and internal or external orientation to technologies. Nonetheless, all four designs lead to equifinality (Gresov & Drazin, 1997), centered on creating efficiencies and innovations in all business model components, such as maintaining efficient processes for value creation, or enabling the firm to compete on speed, that is, a high rate of rate of incremental innovation in product, marketing and processes.

This study's third contribution is to SME literature and policy by showing how technology, innovation and customer relations also play a significant role in business model design (Wu et al., 2013). In particular, we suggest to governments, especially of Asian Newly Industrializing Economies including Singapore, South Korea and Taiwan, the importance of international standard-compliant third party technologies, and how product innovation is an important type of innovation undertaking involving effective customer relations for market intelligence. Governments should provide further incentives to encourage SMEs to adopt international standard-compliant third party technologies. These incentives may be financial or via the facilitating a consortia or cooperative to assist with the licensing, appropriation and management of such technologies.

The implications for practice and policy reinforce one another. While SMEs are autonomous in the design and development of their business models, government must provide the right incentives and environment, that is, procuring standard-compliant third party technologies themselves when building public infrastructure, to the shaping of the appropriate trajectory, including specific sectors and technologies, for SMEs to thrive. When SMEs flourish, so does foreign direct investment as partners and alliances establish operations in the SMEs' home country as the closer proximity induces more effective collaboration, and ultimately innovation.

Limitations and future research

Similar to other studies, our research has a number of limitations. All four of the participating firms were selected from two particular sub-sectors sectors (software solutions and consumer electronics providers). Therefore, the generalizability of the results may be limited to these particular sectors, that is to entrepreneurial SMEs in the information communication technology (ICT) sector. Entrepreneurial SMEs that use technology other than ICT such as those in manufacturing and health sectors should be studied in future research. A similar direction of research on entrepreneurial SMEs that run their businesses in other national contexts should be undertaken in future research, particularly in developing Asia, which is rich in growing SMEs (Liu, Serger, Tagscherer, & Chang, 2017; Liu, Wang, Zhao, & Ahlstrom, 2013). Although the cross-sectional nature of this study offers insights into the dynamics of the interrelationships between technology, innovation and business model design, a longitudinal study should be conducted to examine the effects of time on these relationships and how they evolve together. To improve the robustness of the data, future research could collect data from third parties such as partners. Finally, future research could adopt a quantitative approach in examining the nomological effects of technology, innovation and business model design on organizational performance. Work that helps to inform strategic entrepreneurial practice is particularly important to SMEs that are seeking to grow and develop beyond their initial business ideas. Research on business models and business model innovation is especially important to management scholars seeking to intervene effectively in the key markets for such useful ideas and their implementation (Abrahamson & Eisenman, 2001).

Conclusion

The results of this study drawing on research on Hong Kong technology SMEs suggest that the business model design themes of efficiency and novelty are not mutually exclusive, and technology and innovation management play a key role in SMEs' business model design for efficiency and novelty. This study suggests that business models can be designed for both efficiency and innovation, and technology and innovation do interplay with the business model in a virtuous cycle. Technology helps to enable a firm's business model to be efficiency-centered by enhancing distribution channels and thereby market intelligence and internal product innovation processes. Technology, by the same token, is innovation-enabling as the use of industry standard third-party technologies facilitates incremental innovation in the value propositions. As collaborations deepen, process innovations emerge that enable business models to be efficiency-centered, specifically in value creation and value capture, that is, distribution and marketing. An indirect effect over the longer term is the firm's absorptive capacity, specifically, its adeptness in internalizing external knowledge, may improve and increase the efficiencies in incremental product innovation. In conclusion, if this article could convey one primary message, it would be that the paradoxical challenge evoked by efficiency and innovation can not only be successfully addressed but also harnessed as a recursive, virtuous cycle (even for SMEs with limited resources). This hybrid business model can help SMEs maintain the innovative edge they need to hop through the window of opportunity when technologies or market preferences shift, something market leaders often do very well (Rumelt, 2011).

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Table 1 Summary of results

Firm	Themes		
	Proven technologies and network externalities.	**Product innovation through customization**	**Customer relations and intelligence gathering in business model design.**
Alpha	Use technologies from Samsung and Apple	Enhancement/ improvement of current products and new product development activities, leveraging on technology-push	Co-develop customer intelligence processes with distributors
Beta	Application of standard programming language in software	Low to high degree of customization processes favouring a market-driven approach	Account management approach to develop bespoke functionalities with clients and to gain foresight of industry trends
Delta	Applies Electronic Product Code Global Standard	Customization driven by evolving industry best practices	Use social media for collaboration with clients to develop bespoke solutions
Gamma	Integrates RFID and Bluetooth 4.0 into value proposition	Incremental to moderate product innovation leveraging on both technology push and market pull.	Consultancy approach to access intelligence
Results	*Gain efficiencies in incremental product innovation. Process innovation as a by-product*	*Wide range degree of product innovation outcomes leveraging on third party technologies and markets*	*Anticipating market needs for incremental product innovation. Marketing innovation as a by-product.*

Table 2 The role technology and innovation practices in creating efficiency-centered, innovation-enabling business models

Business model themes	Role of	
	Technology acquisition and application used to:	**Innovation practices resulting in:**
Efficiency-centred	Enhance distribution channels and increase speed of incremental product innovation process	Process innovation for value creation e.g. operations and value capture e.g. marketing.
Innovation-enabling	Improve collaboration for product innovation with external parties using industry standard third-party technologies	Incremental innovations in the value proposition e.g. product/ service innovation

Figure 1 Virtuous circle efficiency-centered, innovation-enabling business models

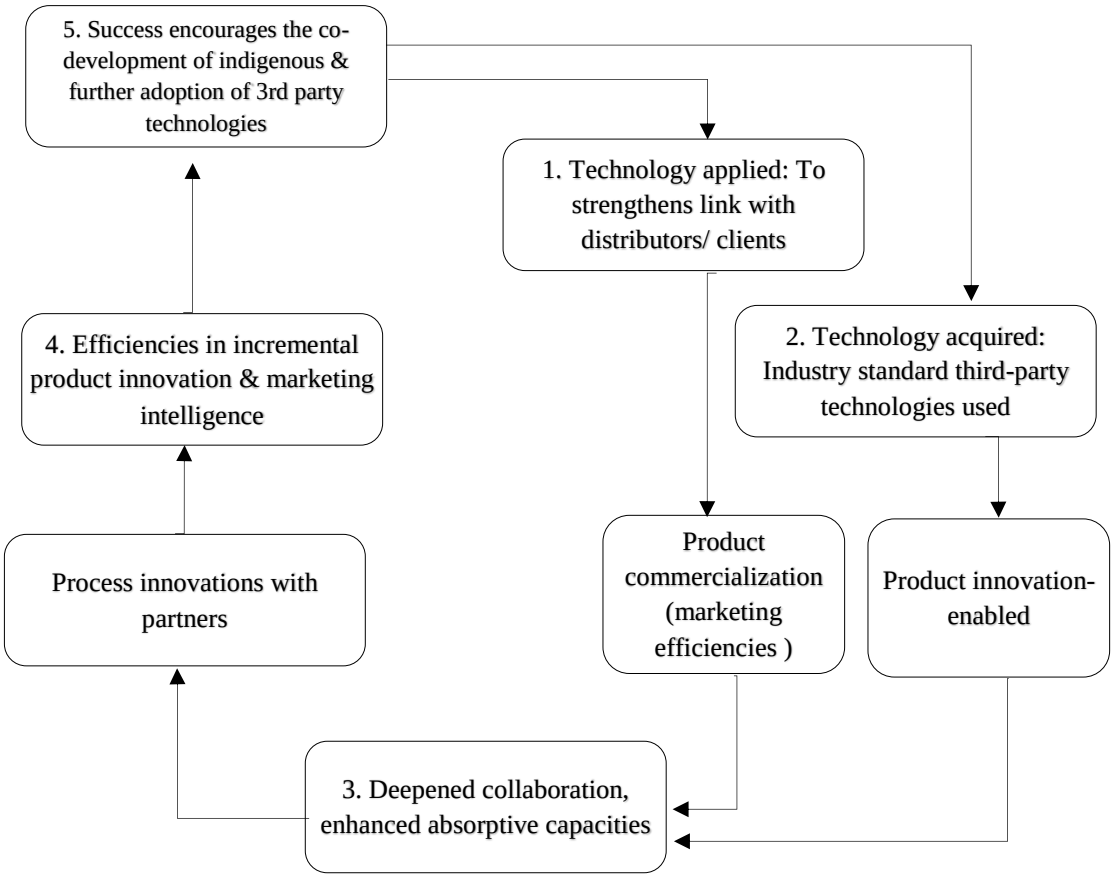
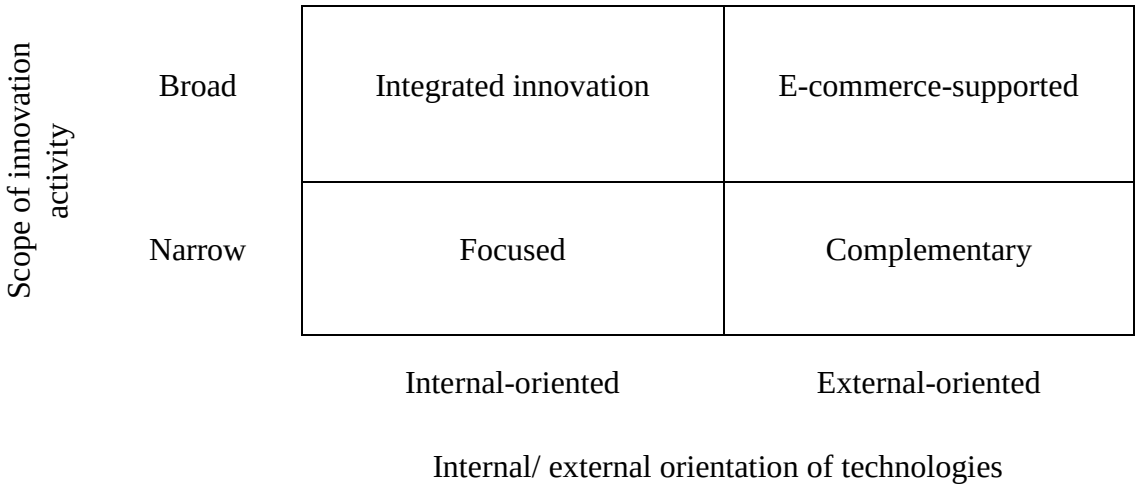


Figure 2 Efficiency-centered, innovation-enabling business model typologies



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