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EXTENDING DIGITAL VENTURES THROUGH TEMPLATING

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INTRODUCTION

Abstract. Digital ventures typically face significant growth expectations. A common response is to extend the current operations into new areas through repurposing its digital core (e.g., search engine, data mining technique, platform, or voice interface). Grounded in prior literature, we surmise that the high-versatility of the digital venture's digital core facilitates such extension by reducing cost and increasing speed. However, we know little about the process by which digital ventures draw on their digital core to extend current operations. To this end, we use Penrose's work for analyzing a two-year in-depth case study of a Chinese digital venture's extension of their initial operations based on its credit rating technology. Our findings suggest that digital venture extension is facilitated by templating, which is a digitally-enabled process of generating and using generic solutions across business areas. Through our grounded analysis, we unpack templating by tracing three processes contributing to digital venture extension: concepting, generalizing, and porting. Synthesizing our findings, we contribute to the emerging digital innovation and entrepreneurship literature by developing a process model of digital venture extension.

Keywords: Digital innovation, digital entrepreneurship, digital ventures, digital technology, firm extension, templating, scope, versatile resources, case study

The idea that a firm's existing resources play a significant role in seizing new business opportunities is well-established in the study of entrepreneurial ventures. In fact, already in the late 1950s, Edith Penrose (1995) proposed that entrepreneurial use of a firm's technology reources offers significant potential for growth (Bradley, Wiklund, and Shepherd 2011; Naldi and Davidsson 2014; Nason and Wiklund 2018). In particular, such growth may come from extending the business into new areas by leveraging its existing technology resources. One of Penrose's prime examples of such resources is Frigidaire's cooling technology, which helped the GM-owned firm to extend their refrigerator business into air conditioning in the 1930s. Indeed, firm extension promises access to multiple markets (e.g., fridges and air conditioning) by leveraging existing resources[1]. Yet, Penrose also figured that all resources are not equally useful for business extension, since the usefulness depends on the extent to which a resource is versatile. Versatile resources are assets that can be changed for different purposes, and they

[1] Broadly speaking, such extension has been studied through resource-based lenses such as internal corporate venturing (see e.g., Burgelman 1983; Kuratko et al. 2015), product line extension (see e.g., Caldieraro et al. 2015; Pohl et al. 2005), resource orchestration (see e.g., Breton-Miller and Miller 2015; Sirmon et al. 2007), and diversification (see e.g., Mayer et al. 2015; Teece 1982).

"increase a firm's combinative possibilities and, thus, expand its productive opportunity set" (Nason and Viklund 2018, p. 36).

In this paper, we revisit Penrose's theory of growth in the context of digital ventures. Defining digital ventures as enterprises that have a digital artifact "at the core of their market offering" (Von Briel et al. 2018, p. 278), this is relevant since digital artifacts as a resource type is highly versatile. With a new search engine, data mining technique, platform, voice interface, or other digital artifact at the core, we surmise that digital ventures contingently[2] enjoy a "difference-in-kind" resource versatility as they draw on their digital core for extending into new business areas. In this regard, it should be emphasized that a focus on versatile resources marks a significant departure from the underlying assumptions of the resource-based view of the firm (Barney 1991; Nevo and Wade 2010; Ray et al. 2005). Digital ventures prioritize to build resources that invite agile recombination (Henfridsson et al. 2018) and productive opportunity expansion (Nason and Wiklund 2018), rather than those that fence off competition by being valuable, rare, inimitable, and non-substitutable (Barney 1991), even when being a result of capabilities deployed and combined with other reources and capabilities (Bharadwaj 2000; Rai et al. 2010). In fact, the idea of possession of resources is increasingly questioned. For instance, Gregory et al. (2021a) state, in the context of data as resource, that ventures are "increasingly able to leverage the portability of data to access and create value with data" with "the growing availability of open datasets and emerging markets for data".

The versatility of the digital core of a digital venture can be traced to, at least, two aspects of digital technology. First, the programmability of digital technology offers significant design flexibility (Henfridsson et al. 2014; Kallinikos et al. 2013; Nambisan et al. 2017) as the product can be repurposed with as little as a new set of instructions. Second, digital contents such as data and instructions are reproducible at nearly zero marginal cost[3] (Benkler 2006; Shapiro and Varian 1999). This offers

[2] Our use of the term "contingently" reflects a sensitivity to the idea that causality is contingent (Elder-Vass 2010; Sayer 1992).

[3] However, hardware and networking costs would still be relevant.

significant scope for scaling digital products (Henfridsson et al. 2014). Indeed, anecdotal evidence suggests that a digital core allows for swift modification that may involve supplementary, or even new, functionality. Consider, for instance, how Uber used its match-making technologies for extending into food delivery, and their app and payment technologies for extending into bicycle-sharing.

In prior digital innovation and entrepreneurship literature[4] (see e.g., Henfridsson et al. 2018; Nambisan 2017: Nambisan et al. 2019; Steininger 2018; Yoo et al. 2010), there is a recognition that the digital core influences the processes by which enterprises grow. Offering an alternative view to economic explanations of growth grounded in network effects theory (see e.g., Afuah 2013; Katz and Shapiro 1994; Parker and Van Alstyne 2005), this entrepreneurial view broadly recognizes changes in the underlying logic of the creation of new services and products (Nambisan 2017), as well as the realization of value from such creation (Henfridsson et al. 2018). While it does not address digital venture extension explicitly, there are at least two elements that seem to speak to its relevance. First, Nambisan (2017) observes that entrepreneurial processes and outcomes enabled by digital technology have become less bounded (cf. Von Briel et al. 2018; Yoo et al. 2010). This suggests that extension will become increasingly commonplace as digital ventures populate the entrepreneurial scene. Second, Huang et al. (2017) brief the notion "swift transformation," suggesting that digital ventures would exhibit a capability to reinvent what they are doing.

Despite the wide interest in digital innovation and entrepreneurship, however, it is essential to learn more about the way by which digital technology comes into play in the key entrepreneurship processes (Penrose 1995) of productive opportunity creation and opportunity actualization. After all, while these are the moments of digital innovation and entrepreneurship when design flexibility and scalability (Henfridsson et al. 2014; Kallinikos et al. 2013; Nambisan et al. 2017; Shapiro and Varian 1999) are put into the action of digital ventures, there is an insufficient understanding of the core

[4] We recognize that innovation and entrepreneurship are two different phenomena. Yet, in the emerging information systems literature, there is significant overlap in the way that the terms have been used. Our amalgamation of digital innovation and digital entrepreneurship is done in the spirit of including the relevant works in an area that is still emerging.

processes that make these promises operate in practice. To this end, we offer a grounded study to address the following research question: *what is the process by which digital ventures use their digital core to extend its operations?* We address this question through a two-year in-depth case study (Gerring 2007) of two episodes of venture extension initiated and managed by a digital venture called WeCash. WeCash focuses broadly on lending, but prosper from its in-house credit rating technology. After rapidly scaling its user base in its first eight months (see Huang et al. 2017), a period of venture extension around its digital core (which is the focus of this paper), that is, its credit rating technology followed.

Our findings offer several valuable insights that speak to the literature on digital innovation and entrepreneurship. In particular, we propose a process model that depicts templating as a process through which digital ventures generate and use generic solutions to extend their business. The remainder of the paper unfolds our line of argumentation by presenting the conceptual basis, methods, findings, and implications of this research.

CONCEPTUAL BASIS

The opportunity to extend firm operations into new areas is tempting for any manager subject to growth expectations. In digital ventures, this temptation tends to be even bigger as they often face winner-take-all expectations (Eisenmann et al. 2006; Parker et al. 2016; Schilling 2002). Growth seems to be the mantra repeated across the venture's touch points with venture capitalists, investors, technical advisors, and business press.

As a response, network views pay significant attention to the size of the user base of the digital venture, and how a growing user base offers benefits to all members in its network of users. Manifested in network effects theory (Katz and Shapiro 1994; Parker and Van Alstyne 2005), the underlying assumption is that all users of a technology benefit from additional users joining its network. As more users join, positive self-reinforcement is put into motion, making it difficult for other ventures to compete. In the presence of network effects, digital ventures are therefore expected to grow exponentially (Eisenmann et al. 2006; Parker et al. 2016). This expectation is grounded in the common perception that there is only space for a single dominant technology, or service, in a particular market (Schilling 2002).

Because a technology's trajectory is considered path-dependent (Arthur 2009), it involves a sense of urgency to reap the benefits of early momentum within a nascent market.

As a complement to the network view, the entrepreneurial view attends to the venture's own capability to create market space for its technology offering (Lusch and Nambisan 2015; Nambisan 2017). This line of research is in its emerging stages, as evidenced in the newly published special issues on digital entrepreneurship (see e.g., Fang et al. 2018; Nambisan et al. 2019; Shen et al. 2018). The entrepreneurial view recognizes that the underlying technology makes a significant basis for facilitating new services and products (Von Briel et al. 2018; Steininger 2018). In fact, sometimes digital technology takes on a role in the digital venture where it cannot be separated from the business itself (Steininger 2018: the ubiquity role). Indeed, as digital ventures grow by drawing on and adding to digital infrastructures (Huang et al. 2017), the entrepreneurial process and the underlying digital core co-evolve over time (cf. Davidson and Vaast 2010). For instance, Nambisan (2017) note "the scope, features, and value of offerings would continue to evolve even after they [products and services] have been introduced to the market" (p. 1030), observing that entrepreneurial processes and outcomes are less bounded when digital technology is involved.

Within the scope of the entrepreneurial stream of research, Huang et al. (2017) specifically study rapid scaling of digital ventures. They underline how data-driven operation and instant releases enable the digital venture to scale in a rapid way. Data-driven operation facilitates quick detection of slow-downs in the scaling process, while the ability to instantly release new ideas increases the responsiveness to perceived opportunities and problems in user base growth. Interestingly, they also discuss "swift transformation" as contextualizing core digital technology and projecting novel value-in-use. However, the focus on the early stage of scaling makes them look away from the possibility of repurposing the digital core for new markets once an initial user base is established. In view of Nambisan's (2017) observation that digital technology makes the entrepreneurial process less bounded to a specific area and Huang et al.'s (2017) idea of swift transformation, there is therefore ample opportunity to develop a

theoretically grounded perspective on how the digital venture extends its scope into new markets based on its digital core. In what follows, we develop our conceptual framework for doing this.

Digital Venture Extension

We ground our analysis of digital venture extension in the theory of the growth of the firm by Penrose (1995). While Penrose's work has been used widely in strategic management (Argyres, Mahoney and Nickerson 2019; Kor et al. 2007; Levinthal and Wu 2010; Lockett et al. 2011), it is only recently that the promise of adopting her work for understanding entrepreneurial use of existing resources for firm growth and performance has been realized (Bradley, Wiklund and Shepherd 2011; Naldi and Davidsson 2014; Nason and Wiklund 2018). In what follows, we first develop the notion of digital core as a versatile resource. We then introduce the creation of entrepreneurial opportunity and opportunity actualization as key entrepreneurship processes on which we base our process model.

Digital Core.

Digital ventures are enterprises with a digital artifact "at the core of their market offering" (Von Briel et al. 2018, p. 278). In turn, we use the notion of digital core to refer to the "digital artifact" of a digital venture. In this regard, the digital core can be a platform, a set of machine learning algorithms, voice recognition technology, game engine, or any other piece of technology around which a venture's market offering can be built. The digital core is "a ubiquity in entrepreneurial operations" (Steininger 2018, p. 379). It is at the heart of what a venture does. For instance, Uber's driver-rider matching algorithm is at the heart of its business.

We define the notion of digital core as a set of digital resources that are imperative to the venture's offering to its market/s. Such resources can be seen as informational entities, located at a particular layer of digital technology, that can be repurposed to create value in new settings (Henfridsson et al. 2018). Paraphrazing Penrose's work (Nason and Viklund 2018; Penrose 1995), we view the digital core as a versatile resource, that is, an asset that can be repurposed easily. Our decision to frame digital core as a versatile resource signifies a departure from the resource-based view (Barney 1991; Nevo and Wade 2010; Ray et al. 2005). In particular, we surmise that the value of digital resources for digital

ventures does not stem solely from its rarity, inimitability, and non-substitutability. As Nason and Wiklund (2018) explain, mechanisms that seek to isolate the competitive advantage of resources might be created at the expense of the flexibility required for future resource reconfiguration. In contrast, versatile resources are particularly relevant in high-velocity business environments, as they can be easily restructured, rebundled, and leveraged (Sirmon, Hitt and Ireland 2007). The power of versatile resources for product expansion in general (Naldi and Davidsson 2014), and for the creation of productive opportunities in particular (Nason and Wiklund 2018), follows from its low adjustment costs[5]. The more versatile the venture's resources are, the lower adjustment costs firms face, as versatile resources invite reuse, recombination, and removal of barriers to learning (Geroski 2005; Lockett et al. 2011; Nason and Wiklund 2018).

Reviewing the literature, there are at least two aspects of digital technology that allow for low adjustment costs. First, the stored program concept, oftentimes referred to as the Von Neumann architecture, makes computers programmable (Langlois 2007; Yoo et al. 2010). The programmability of computers (Langlois 2007; Yoo et al. 2010) offers significant design flexibility (Henfridsson et al. 2014; Kallinikos et al. 2013; Nambisan et al. 2017) as the product can be repurposed with as little as a new set of instructions. For instance, installation of new software can change the function of a tablet computer from an entertainment device to a cash register system. Second, digital contents such as data and instructions are reproducible at nearly zero marginal cost (Benkler 2006; Shapiro and Varian 1999). This offers significant scope for scaling digital products (Henfridsson et al. 2014) once a new productive opportunity has been created.

The design flexibility and design scalability that follow from these aspects are quite well documented in the literature. Since they were first outlined in Yoo et al (2010), they have been elaborated in other studies of digital innovation (Henfridsson et al. 2014; Henfridsson et al. 2018; Kallinikos et al. 2013; Nambisan et al. 2017). However, for the purposes of this study, these aspects of versatility of the

[5] Adjustment costs incur as a result of changing the resource during the management of the growth process (Lockett et al. 2011; Penrose 1995).

digital core need further work. In particular, it is essential to further understand how they come into play in key entrepreneurship processes such as productive opportunity creation and opportunity actualization, since these are the moments of digital innovation and entrepreneurship when design flexibility and design scalability are put into the action of digital ventures. In the literature, the core processes by which design flexibility and scalability operate still remains undocumented.

Productive Opportunity Creation and Opportunity Actualization.

In Penrose's (1995) writings, a prime condition for triggering firms to extend the scope of their product offerings is the existence of resource slack. While resource slack[6] might remain unexploited as firms sometimes lack appetite to experiment or prefer to protect their current positions (Mishina et al. 2004; Sinclair et al. 2000), it can trigger entrepreneurial managers to creatively imagine productive opportunities (Bradley, et al. 2011; George 2005). Productive opportunities encompass "all the productive possibilities that its "entrepreneurs" see and can take advantage of" (Penrose 1995, p. 31). The extension process unfolds based on two main entrepreneurial processes, namely "productive opportunity creation" and "opportunity actualization". Productive opportunity creation denotes the development of business opportunities in unserved market segments through entrepreneurial imagination. Opportunity actualization refers to the realization of productive opportunities through managerial action.

The degree of versatility of firm resources is key to the effectiveness of venture extension. Penrose (1955, p. 539) note that: "it becomes clear that the flexibility and versatility of its own resources are the important factors governing the possibilities of its expansion. So long as there are profitable production opportunities open anywhere in the economy, a firm can take advantage of them if its resources are versatile." In view of what we already know about the design flexibility and design scalability of the digital core, there are a number of possible implications for productive opportunity creation and opportunity actualization. First, digital ventures can create a multitude of entrepreneurial opportunities with a low adjustment cost and at a short time. This relates to the inherent design flexibility

[6] We propose that resource slack in the context of the digital core can be seen as the unexploited portion of its versatility.

of the digital core (Henfridsson et al. 2014; Kallinikos et al. 2013; Yoo et al. 2010). Whether being a new search engine or data mining technique, the digital core offers opportunities to reconsider earlier designs, working on parallel versions, and initiate new offerings while still maintaining and refining the existing one. While the digital core is used for developing a particular line of business, it can at the same time be used for developing another line of business. Second, the digital core promises to facilitate opportunity actualization, as it allows effective re-use of prior versions in the new market. The combination of effortless re-reproduction (Benkler 2006; Shapiro and Varian 1999) and the design flexibility promises quicker and speedier actualization of productive opportunities.

Even with these possible implications traceable in the literature, there is lack of a concerted attempt to trace the core process by which digital ventures leverage the versatility of digital technology as they extend into new business areas. The extant digital innovation and entrepreneuship literature (see e.g., Baskerville et al. 2020; von Briel et al. 2018; Henfridsson et al. 2014; Kallinikos et al. 2013; Nambisan et al. 2017; Steininger 2018; Yoo et al. 2010) points at possibilities but there is an overall lack of in-depth studies that seek to uncover its inner workings. In what follows, we embark on such a study in the context of a Chinese digital venture called WeCash and its credit rating technology

METHODS

We conducted a two-year in-depth case study at WeCash. In August 2016, WeCash had approximately 480 employees and a monthly revenue exceeding 83 million RMB. At the time of our study, WeCash consisted of three product-based business units: Micro Lending, Cell Phone Purchase Loan, and Farming Loan[7]. Cell Phone Purchase Loan and Farming Loan were the results of digital venture extension, that is, the focus of our study.

[7] In terms of performance, WeCash achieved a monthly revenue of 83.47 million RMB based on the total monthly loan volume of 384.33 million RMB in August 2016 (this represented a 750.68% increase in two years, since the monthly loan volume was 24 million RMB in July 2014). In August 2016, the initial business area, Micro Lending, achieved a monthly loan amount of 122.60 million RMB, some 32 months since its launch. Cell Phone Purchase Loan achieved a monthly loan amount of 226.37 million RMB, some 17 months since its launch. Lastly, Farming Loan achieved a monthly loan amount of 35.36 million RMB, some 5 months since its launch.

WeCash provides an excellent setting to investigate our research question. First, WeCash is an extreme case, characterized as being "paradigmatic of some phenomenon of interest" (Gerring 2007, p. 101). It pursued a dedicated agenda to extend the scope of its offerings by extensively reusing its digital core. Second, WeCash offered two completed digital venture extensions that led to stand-alone revenue generating business units. It also involved a number of unsuccessful attempts[8] to increase the scope. Finally, we gained the trust of WeCash management and employees, which enabled us to collect in-depth data for each digital venture extension episodes.

Data Sources

We carried out extensive data collection in WeCash between September 2014 and August 2016. Divided into 9 field visits (2 in 2014, 3 in 2015 and 4 in 2016), our data collection was designed to follow the ongoing digital venture extension unfolding at WeCash.

Table 1. Data Collection

Data Sources	Total and Breakdown
Interviews	62 interviews (mean length: 41 minutes) with 46 interviewees generated an approximate word count of 465,000 (in Mandarin)
Participant observation	14 occasions, with average length of 51 minutes, include 3 project meetings, 2 workshops, 3 technology standard forums, 3 gate review meetings, 2 prototype brainstorms and 1 steering committee meetings
Archival data	Project descriptions, customer data base, credit assessment files, customer services log, meeting minutes, presentation materials for investors, sales forecasts, technical documents
Informal dialogue	Informal communication with the CEO, General Manager, and management team memebrs during field visits. In addtion, over 1200 Wechat exchange with the management team and 39 phone conversations with the CEO and 27 with the General Manager conducted between September 2014 and August 2016.

We used four methods to collect our data: interviews, participant observation, archival data, and informal dialogue (see Table 1). First, we conducted 62 semi-structured interviews with 46 WeCash staff in different roles and at different hierarchical levels. In addition to all members of the management team, we interviewed employees from each of the 2 business units with a broad range of expertise, including online user service, user experience, product improvement, user interface design, risk control, credit assessment, artificial verification, and business development. 41 out of the 62 interviews were recorded,

[8] Unsuccessful attempts included Credit Rating Service, Credit Rating Game, Cardless Payment, Credit Life, and Apartment Rental.

yielding 477 pages of transcription. For the unrecorded interviews, extensive field notes were taken. The interview data was particularly useful to capture each respondent's experience involved in preparing, launching, and managing each episode of venture extension. The interview data provided us their rationale, decision making, perception, assumptions, and understanding of how and why digital core has been constructed, continuously developed, deployed and renewed to enable the process of digital venture extension.

Second, participant observation, encompassing project meetings, workshops, technology standard forums, and other forms of meetings, permitted us to obtain first-hand insights about the actions related to each episode of venture extension. In particular, this data collection method was crucial to document: (a) different techniques and methods, such as A/B testing, user profiling, and risk threshold adjustment, in action; (b) how each unserved market segment was evaluated; (c) how the business model for each digital product was shaped over time; and (d) the general level of intensity and speed in progressing each venture extension episode.

Third, archival data supplemented our dataset. Since the pace and frequency of change sometimes made it difficult for our interviewees to accurately pinpoint when certain actions in fact were taken, the archival data, specifically requirement and design documents, test plan documents, system documents, technical documentations, installation guides, visualization guides and diagrams, was essential at different stages and aspects of the data analysis. For instance, the archival data was used to assist mapping and confirming key events of the case narrative, as well as triangulating interviewees' testimonies. Also, archival data allowed us to track ongoing modifications of venture extension, specifically different versions and upgrades of its digital core, on a granular basis.

Finally, in addition to the three data collection methods above, we benefitted from informal dialogue with the CEO and the General Manager on a regular basis. These conversations not only helped us to prepare and identify relevant interviewees and occasions for participant observation, but also gave first-hand access to the sensemaking of the two co-founders. This was particularly important in interpreting the vision, rationale, and anticipated outcome related to each venture extension episode.

Data Analysis

We position our research as a variant of grounded theory (Gioia and Chittipeddi 1991; Gioia et al. 2013; Langley 1999; Strauss and Corbin 1998). We adopted the analysis approach suggested by Gioia and Chittipeddi (1991) and Gioia et al. (2013). Following this approach, the 1st-order analysis involved identifying and using empirical codes and terms that were central to the respondents, while the 2nd-order analysis was geared towards identifying theoretical concepts related to the empirical observations. The results of the 1st and 2nd-order analyses were then aggregated to produce a data structure, as shown in Figure 1, which encapsulates the respondents' and researchers' voices in tandem. Iterating between the collected data, emerging findings, and the relevant literature, we were able to unpack and conceptualize the theoretical substance of digital core and how its use facilitates extension of digital ventures. We were then able to identify how our proposed process model engages with and contributes to the extant theorizing of digital innovation and entrepreneurship.

Our data analysis can be described as a four-step grounded process. First, we identified two episodes of digital venture extension, which contributed to WeCash's growth. These two episodes and relevant empirical observations, such as project meetings, project planning workshops, prototype brainstorms and gate review meetings, and archival data were used as a backbone to shape the preliminary case narrative. We crosschecked the digital venture extension episodes and preliminary case narrative with WeCash's CEO and General Manager to ensure our correct understanding of the organization and areas in focus.

Second, we used concepts from Penrose (1995) and digital innovation and entrepreneurship literature as analytical filters to shape and cluster empirical observations identified through open coding (Strauss and Corbin 1998). The task was to articulate the rationale, contexts, conditions, functioning, digital artifacts, ongoing changes, and outcomes behind or related to each digital venture extension episode. To ensure reliability, two of the authors conducted open coding separately twice approximately 14 months apart (cf. Lincoln and Guba 1985). Individually, we triangulated all the emerging 1st-order

codes by comparing with different sources of data in our dataset to avoid over-reliance on interview data. For instance, the code "reuse of digital templates increases the speed and permits the prioritization of development resource" was, in addition to frequently elaborated by several respondents, supported by our observations of project planning meetings and project reviews, as well as the archival data in various requirement and design documents, project resource outlines, and the enterprise architecture manual. Extensive discussion, while revisiting the dataset, helped to establish consensus about the 1st-order codes. In addition, we conducted comparative analysis to identify similarities and differences between the two digital venture extension episodes. This process led to the final list of our 1st-order codes with multiple responding empirical observations. The left-hand column of Figure 1 summarizes the result of our 1st-order analysis. These emerging findings were incorporated into the case narrative to create a more detailed and refined description than the version created previously.

In the third stage, we used the principles and techniques of axial coding (Strauss and Corbin 1998) for conducting 2nd-order analysis. After carrying out axial coding separately, two of the authors compared the outcomes to ensure the reliability of the 2nd-order analysis. This process involved iteration between the emerging concepts, empirical observations, and relevant literature (Charmaz 2006) with the goal of differentiating, categorizing, and relating the emergent concepts based on their properties and empirical substance. We highlight the conceptual observations in the middle column of Figure 1. These conceptual observations were synthesized to create the five aggregate dimensions (Gioia and Chittipeddi 1991; Gioia et al. 2013) listed in the right-hand column of Figure 1. We developed Tables 2, 3, 4, 5, and 6 to specify how the 1st-order empirical observations linked to the 2nd- order conceptual observations. Finally, we conducted selective coding (Strauss and Corbin 1998) to reveal the conceptual patterns and underlying process by which different episodes of digital venture extension intersected with the use of digital core. We drew on Penrose's (1995) notions of resource versatility, productive opportunity creation, and opportunity actualization to unpack the conceptual interrelationship amongst the aggregate dimensions identified in previous steps. We then created a process model (see Figure 3) to theorize how digital ventures use and reuse their digital core to extend the scope of its product offerings. To ensure the

reliability and trustworthiness of our analysis, one of the authors presented our findings and the process model to WeCash's management team. Apart of clarification questions during our 90-minute meeting, WeCash's management team confirmed our process model in terms of its correspondence with their reality.

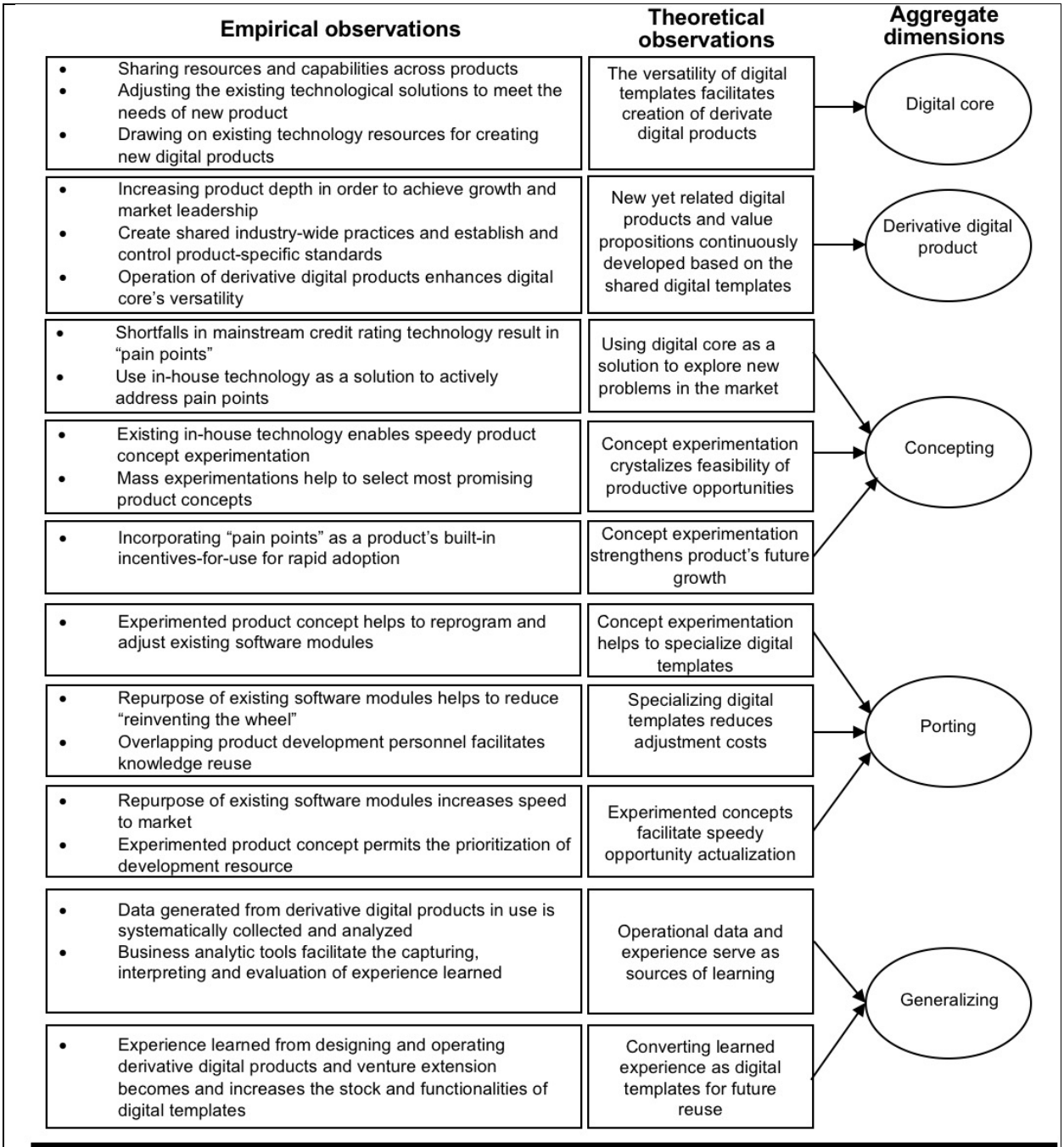

Figure 1. Data Structure

VENTURE EXTENSION AT WECASH

Since its inception in January 2014, WeCash has had a credit rating technology at the heart of its business. We consider this technology the digital core of WeCash. Using machine learning and an artificial intelligence decision engine, the technology constructs user credit profiles by integrating transaction data with social networking data. With its ambition to extend the business, WeCash has developed the credit rating technology significantly over time, both in terms of algoritm development and data mining.

One of the most significant developments, the digital architecture (Figure 2), serves as a basis for creating novel products. In particular, it offers reusable digital templates grounded in a set of modules. WeCash divided these templates into three broad categories: operation, technology, and data. For instance, credit rating is a generic business process key to all WeCash's products. Using machine learning and an artificial intelligence decision engine from the IT infrastructure layer, the technology templates layer offers the architecture for developing applications for user credit profiling through integrating transaction data with social networking data processed through the data templates layer. In doing this, WeCash uses more than 2,000 expert rules, 4,000 risk-control dimensions, and 7,000 data characteristics. The technology layer templates offer the logic for the multi-dimensional processing of data that leads to the final credit rating score.

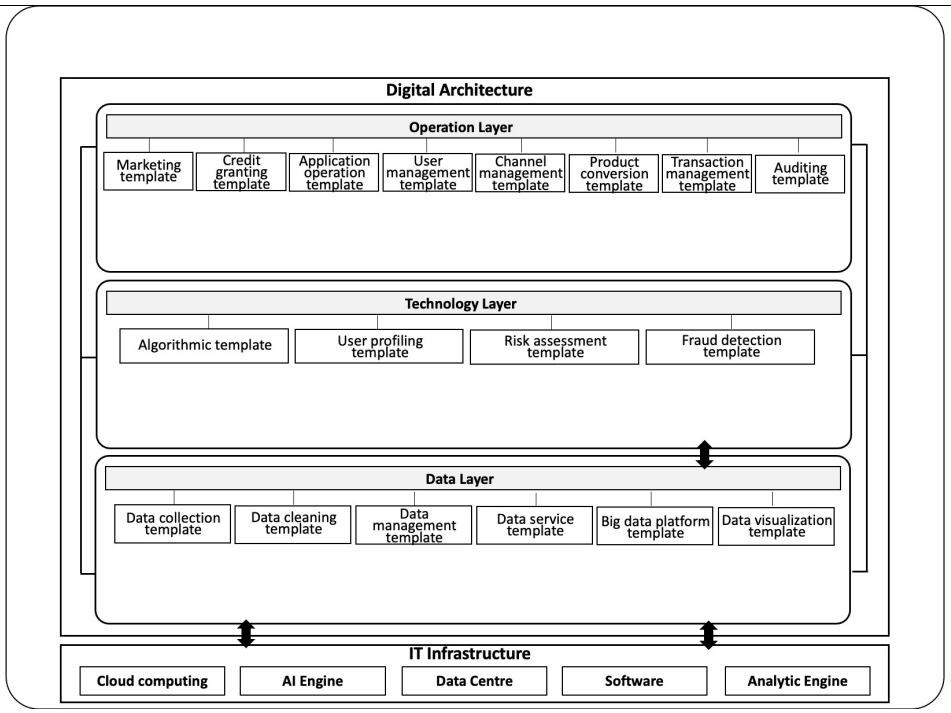

Figure 2. Digital Architecture (at the end of 2016)

The credit rating technology was originally developed and used for supporting and operating micro-lending. Early on, WeCash launched several new ventures in this space, such as cardless payment and credit life. However, revenues never took off for these ventures. Reflecting on this setback, the management team of WeCash traced the problems to the business concept by which they deployed its technology, rather than the technology itself. In October 2014, with a user base of 1 million, the pressure to rethink their micro-ledning focus increased, as WeCash confronted a sudden increase of competitors, including those proposed or backed by leading digital platforms and financial institutions such as Ant Financial (backed by the Alibaba Group). In view of this competitive pressure, diversifying into other market segments through repurposing its technology were seen as a promising way out. While micro-lending was the sole source revenue during its first 16 months, WeCash's venture extension efforts grounded in the credit rating technology was born.

During our two-year study period, we observed two such venture extensions, namely cell phone purchase loan and farming loan. Jointly with micro-lending, the three product categories generated a

monthly revenue of 83 million RMB at the end of our study in August 2016. In what follows, we describe each venture extension in detail.

Venture Extension of Cell Phone Purchase Loan

While micro-lending is a general-purpose product, back in July 2014, the CEO of WeCash envisioned a new range of loan products tied to specific purchases of electronic goods. WeCash's research indicated three promising categories: household appliances, computers, and cell phones. Due to the distribution networks specific to each category, the company's user profile analysis, and the scarcity of established actors, in mid-December 2014, WeCash decided to focus on the lending services for the cell phone handset purchase market. The lack of alternative credit rating technology and credit facilities presented WeCash with a potentially profitable, yet unserved market segment, where its credit rating technology could be effectively repurposed. As the General Manager cheerfully recalled, "finding this market segment was like hitting the jackpot".

Without prior experience of this market segment, WeCash recruited (in late December 2014) a highly experienced manager (who used to be in charge of the national distribution of a well-known handset brand) to join the product design team and subsequently run the business development of the new venture. After joint research with a partner, WeCash specified the business concept and its operation roadmap with all the key procedures, data flow, requirements, risk management, settlement, and reporting structure to operate the cell phone purchase loan product. In early February 2015, the venture initiated the technical development with the intention to speed up by resuing the digital templates developed for micro-lending in cell phone purchase loan's technical components. For instance, credit rating was developed by adjusting existing templates, such as user profiling, risk management, and credit granting templates. The machine learning algorithms were developed by reprogramming existing algorithmic templates. The automated trading support system was grounded in the existing application operation template, while the cash transfer interface and repayment reporting functions mimicked the transaction management template. The functions of user management, auditing, data service, data visualization, and product conversion listed in Figure 2 were also used in developing the cell phone purchase loan product.

However, the average loan amount of 5,000 RMB represented a higher level of risk compared to WeCash's original micro-lending product. To mitigate the risk, a new image recognition system was acquired and integrated into the digital templates of user profiling, risk management, and credit granting. With this new system, each customer would be required to take a selfie and provide a picture of their photo ID while applying for the loan in the store. This enhancement of the digital templates helped WeCash develop a capability of processing image data. Subsequently, this capability was used for farming loan (see next subsection) and new products launched after our study period.

In April 2015, the cell phone purchase loan product was launched among WeCash affiliated retailers to offer loans (either through one-off payment or instalment) to customers of cell phones. The recruitment of affiliated retailers was straightforward since they only needed a QR sticker and WeCash's logo in their stores, and by the end of Novmeber 2015 the number of retailers reached more than 3,000 in total. Typically located in tier-2 or -3 cities in China, their handset customers did not necessarily have sufficient cash or credit facility to purchase the handsets. To enable the transaction, the retailers would recommend potential buyers to use WeCash's service by scanning the QR code to start the loan application. Even though each store only generated a handful of transactions each day, the extensive and still expanding network of affiliated retailers and high profit margin contributed to nearly 60% of WeCash's monthly revenues in August 2016. The Assistant Product Manager of Cell Phone Purchase Loan commented:

> *I suppose the beauty of our product (cell phone purchase loan) is that our partners are very keen to push it. Without our product, there is no alternative means in the market for some of the transactions to take place… You can imagine that many cell phone retailers in tier 2 and tier 3 cities want to sign up with us. They bring the users, quality users, and more importantly high value transactions.*

Due to the high demand, new products for handset upgrade and accessories, apps, and insurance purchase were added to make WeCash the leader in this market segment[9]. The success of the Cell Phone

[9] In August 2016, WeCash's number of Cell Phone Purchase Loan transactions was slightly over 45,000. As one anonymous reviewer rightly pointed out, this number was small compared to the total market for cell phones in China. However, as a market leader for this type of loan product, WeCash was nevertheless able to quickly create a revenue stream from this venture extension. As indicated earlier, Cell Phone Purchase Loan achieved a monthly loan amount of 226.37 million RMB and profit margin of 22.05%, some 17 months since its launch. In addition, the

Purchase Loan encouraged WeCash to move further towards purchase-specific loan products. The General Manager explained, "the underlying principle of having a business model (for venture extension) is simple. Once we get the first one done, the rest can be endlessly reproduced."

Venture Extension of Farming Loan

In December 2014, the World Bank and the Chinese Government backed an initiative to explore the possibility of using WeCash's credit rating technology for the farming community. They hoped to pave the way for offering farmers much needed credits through alternative ways of assessing credit risk. Jumping on the opportunity, the CEO of WeCash envisioned that the collaboration would unravel a significant new market, and set the foundation for making WeCash into a leading financial provider in the farming market. As the CEO commented at the time, "*you never know. Maybe one day, we would have food financed by WeCash on every dining table in China*."

Led by the General Manager, the early research of the farming sector showed that a targeted approach was required to accommodate its diversity and geographical spread. After profiling, modelling, and evaluating the risks of different farming segments, the project team decided to go for pig farming. Pig farming was considered to involve lower risk, the General Manager reasoned, as pigs require vaccination and insurance, and virtually all farmers use fixed physical structures to protect their livestock in case of extreme weather conditions.

Traditionally, pig farmers buy the feed from their local suppliers, only to pay after the pigs are sold. Feed suppliers charge a significant premium to cover the risk during the long payback period. With WeCash Farming Loan, both parties benefitted: the farmers could purchase the feed at market price, while the suppliers could free up capital and lower their credit risks. The collaboration with suppliers was essential in obtaining farmers as customers. As the Head of Farming Loan explained, "*it was extremely hard to reach users in this market, where you just have to tap into existing social networks to get your*

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massive size of the cell phone market in China offered plenty of scope for future growth. Following up with WeCash recently, we have learned that as of August 2019, the monthly number of Cell Phone Purchase transactions exceeded 207,000.

product noticed." In this context, the affiliated suppliers became the primary driving force in encouraging the farmers to take up such product.

Farming loan shared similarities with cell phone purchase loan in terms of the underlying business logic and process. To shorten development time, WeCash therefore reused virtually all digital templates developed for the cell phone purchase loan product with minor adjustments. However, some new technology development was required. Given that pig farmers were infrequent social media users, and the fact that the loan amount was higher than in other products, new methods for collecting data for constructing the credit profiles of framers were needed. Based on a method used in German-speaking countries for lending to SMEs, a new scorecard was developed to process interview data and complement the function of credit rating by adding new modules in various categories of digital templates, such as user profiling, risk management, application operation and credit granting. Even though the seven-week development time was substantially longer than anticipated, it was an important addition to its digital core, which enabled WeCash to significantly increase the loan amount for very different unserved market segments.

Farming loan was launched in early March 2016. Even though extensive human intervention was required to support this product, its relatively high average transaction value (100,000 RMB), well justified the cost. Only 3 months after its launch, WeCash had established a network of more than 200 affiliated suppliers for promoting the offering to an estimated market of 15,000 farmers. Even with its relatively small user base, this offering contributed to almost 10% of WeCash's total monthly revenue in August 2016, and still had plenty of scope for growth, as more affiliated suppliers were signed up.

After our study period, two further developments were initiated. First, new products for covering pig farmers' different requirements such as loan products for equipment repair, constructing new pig pens, and purchasing farming equipment such as vehicles and tools. Second, WeCash explored opportunities to provide similar offerings to other types of farming of livestock.

FINDINGS

As exemplified by Gioia et al (1991) and Turner and Rindova (2012), this section presents our first-

and second-order findings jointly, including our empirical observations, theoretical themes, and the aggregate dimensions derived from them.

Contextual Conditions and Digital Core

Competitive imperfections characterize a significant driving force in firm growth (Chandler 1962; Penrose 1995), as entrepreneurial managers can capitalize on unmet demands that reflect changes in factors such as technology and market conditions (Alvarez and Barney 2007). The two studied digital venture extensions addressed two rather distinctive market segments: cell phone retail and pig farming. However, characterized by competitive imperfections, they shared some common contextual conditions. First, in both cases, the credit rating product addressed a part of the market that incumbent banks considered undesirable, simply because the potential customers could not be evaluated via conventional credit rating methods. Second, as noted by respondents with banking experience, the traditional banks' operating cost for a loan product was typically around 3,000, making products with small loan amounts financially infeasible.

However, these market segments could have remained inaccessible. As Alvarez and Barney (2007) argue, the sheer recognition of competitive imperfections do not directly result in entrepreneurial opportunities. In other words, our first aggregate dimension, digital core (see Table 2), and its three associated empirical observations, is significant for generation of entrepreneurial opportunities.

Table 2: Digital Core

Empirical observations	Theoretical observations	Aggregate dimension
Sharing resources and capabilities across products When we started back in 2014, we had only one line of business. […] With the exponential expansion in our business lines, we had to make a choice as whether to recruit people and develop systems for each product line or approach the growth with a more joint-up manner. Strategically, growing the headcount at the same rate of the business line would limit our flexibility and eat up our resources, the joint-up approach was a no brainer. Given that modules, systems, solutions and infrastucture created for one product could be easily shared or modified to work for other products, the emphasis has shifted from purely considering the speed to market to the speed plus the reusability of the resources we developed. (Chief Enterprise Architect) We run a lot of A/B tests for our app to ensure our app is running at maximum efficiency and providing our customers with nest the best experience possible. The resulting new designs, new algorithms and new models then would be "learned" and "documented" back to our platform for future use. (Apps Development Engineer) With the expansion of our lending business, in particular, by developing different partnership arrangements with other companies, we are able to acquire a lot of new user data, which was	The versatility of digital templates facilitates creation of derivate digital products	Digital Core

not feasible before… I suppose the diversity does give us a lot more to play with. (User Profiling Specialist) **Adjusting the product to meet the needs of the new business** When you unpack the underlying process, technological solutions, and data requirements of each product involved, you can tell that there is a very high degree of commonality amongst various products we operate. To us, these common processes, solutions, and data requirements are just like commodities, which should be developed with the broadest possibilities of reusability in mind. In other words, if a system can support 3 products, you would not want to have 3 similar or identical systems. To fulfil the growing need, we then adjust the existing system to meet the needs of the new business, and there is no need to continue developing new techniques and approaches. Based on this way of thinking, we have structured our entire platform to encompass all shared IT infrastructure, systems and solutions for data, technology and operation for the full business life cycle of marketing, interaction, transaction, payment, and data. (Head of Operation) We are at heart a technology company. We know our strength and opportunities lie in our ability to apply the same technology to solve many problems in the market, and create and meet the demand of many unserved areas in the market. (Head of Credit Life) **Drawing on existing technology resources for creating new digital products** Compared with many start-ups which have been seeing time-to-market as life or death and throwing in all resources to achieve the goal. With growing maturity, we simply could not work based on such an "all or nothing" approach in developing new products like how we did it before. This is not to say that speed to market is no longer critical to us. Rather, the growing maturity is reflected in a number of different aspects of our business logic. First, the way by which we plan, develop and manage our resources, in particular technology resources, has to take into account and prioritize resources with the greatest level of reusability. Second, the way we develop our products need to ensure that new products can be supported by existing resources and infrastructure for the greatest level of synergy and effectiveness. Third, the way we structure our organization needs to facilitate and underpin the first two aspects, so that that these logics can be truly ingrained into our business. (General Manager) Preventing and controlling based on the data model is a characteristic of business security and has been widely used in the banking industry. As the brain of the overall business protection, the model can not only defend against known risks, but also many unknown threats, helping enterprises to plan ahead. The model is based on the large-scale data sampling and data analysis of the target group, mining out the actual features or the phenomenon and the operating law of objective rules, using abstract concepts to analyze existing problems or risks, and calculating and deducing to reduce or prevent problems or risks. Countermeasure process, and form a systematic strategy or rule set (digital template). Model construction is a complex project and involves in every aspects of product development, which generally requires several or dozens of professional developers, and can take several months or even six months to complete. Through technical service [digital template], we make model construction and application more quickly. (Manager- Risk Modelling)		

We use the term *digital core* to represent *the stock of firm-specific digital templates.* The term captures the capability to share, adjust, and reuse technology resources as new derivative products are developed. WeCash executives and engineers repeatedly came back to the significance of relying on an architecture that allows for seizing on productive opportunities with reusable solutions that can be adapted to the new situation. As elaborated in Figure 2, WeCash's digital core can be clustered into three distinctive yet interrelated categories, namely operation, technology, and data templates. Consisting of numerous stand-alone modules, each digital template encapsulates a strand of capabilities and functionalities that can be developed and refined individually, as well as connected with other digital

templates to fulfill varieties of business requirements. Connections amongst different categories of templates were created to support the business process of each product. For instance, user management as a digital template could only function in conjunction with other templates, such as channel management, marketing, product conversion, and user profiling, as well as modules such as authentication, settlement, and cash transfer.

Inspired by a presentation by Alibaba's Chief Enterprise Architect on the architecture and launch of Juhuasuan.com, the CEO of WeCash organized its organizational structure to enable the development and reuse of its digital templates, which gradually increased the overall quality and substance of its digital core. As explained by the General Manager:

> *Our business service units are structured as semi-independent units for multiple front-end business services, so we need a standard service interface, mature service governance capabilities, and efficient, agile R & D technology. In the current technical environment, we use a REST-style synchronous API, message queue asynchronous communication as standard service interface technology, and use service frameworks (such as Spring Cloud, etc.), API gateways, APM, and so on. (…) We no longer use traditional ESB-based service-oriented (SOA) technology, because ESB products are too involved in the business logic. When changes in business applications are required, business users have to be heavily involved throughout. As a result, a lot of coordination time occurs, which compromises development efficiency*

In the context of venture extension, this new approach to manage the digital core was found valuable in a number of ways. First, already at the outset, the importance of developing the reusability of each digital template was recognized. Over time, effective use of digital templates in venture development became a governance principle. Second, extensive reuse of digital core for developing new products did not necessarily lead to significant growth in the number of digital templates, but in the expanded level of depth and sophistication of the digital templates. For instance, the cell phone purchase loan product was created grounded in templates developed for the micro lending product, while the farming loan product was established reusing templates developed for the cell phone purchase loan product. Third, with its increasingly matured digital core at hand, WeCash changed their way to approach unmet demands and unserved market segments. Specifically, what used to be undesirable users, such as the farming community, became more attractive as the digital core allowed for identifying and pursuing business

opportunities that seemed impossible just a few years back. In this regard, the versatility of digital core afforded design flexibility and scalability through which novel applications could be continuously reproduced rather effortlessly (cf. Henfridsson et al. 2014; Yoo et al. 2010).

Derivative Digital Product for Venture Extension

Our analysis shows that WeCash's reuse of digital templates was significant for extending its venture into new areas. Both the Cell Phone Purchase Loan and the Farming Loan products were grounded in the stock of digital templates that WeCash cultivated over time. At the same time, even after launch, they would benefit from WeCash's further improvements of the digital core. We use the term *derivative digital product* to represent *products created from a previous product.*

Table 3. Derivative Digital Product

Empirical observations	Theoretical observations	Aggregate dimension
Increasing product depth in order to achieve growth and market leadership For each category of product we offer, the initial offering was developed pretty much like a launching pad, based on which you can keep adding new variations. Given that massive investment has already been put in to come up with a template, adding new variations based on the existing offering is relatively straightforward and cost effective… You can expand the product range by having different loan period, loan amount and payback flexibility to fulfil different demands. You can also add more contexts where the loan can be used… The possibilities are endless. (General Manager) When we started, our CEO was very confident that 'every dining table in China should have a dish or two financed by WeCash'. One year on, we have covered nearly 5% of the pigs in the Chinese market. (Assistant Product Manager- Farming Loan) Let me give you an example. If a new business area has the potential scope of 10 billion, and you think it is plenty big enough to get you going for a while, you won't survive in the long run. Once you show its revenue generating potential, many will follow suit. How long will your revenue and profit margin last? You simply have to be several steps ahead and ready to move on.(General Manager) Given that the profit margin is generally very slim and cost is very high in our industry, you have to approach a new business opportunity rather carefully. It is not just about asking whether this new business can sustain itself financially, but also whether it can complement other areas. Can we cross-sell other products to this group of users, for instance? (Head of Cell Phone Purchase Loan) **Create shared industry-wide practices and establish and control product-specific standards** Part of our selection (of partners) criteria is whether we can be in the driving seat in defining the industrial standard for risk management. For instance, what are the key parameters for risk assessment, what is the level of acceptable risk in relation to product specs, capital flow and its management, pricing methodology for risk management service, and so on. (General Manager) Without making a product unattractive, launching a new product is about knowing what rules of the game will give you the upper hand and how much control you have… This is particularly crucial when you are the first in the market. (Head of Product- Farming Loan) **Operation of derivative digital products enhances digital core's versatility**	New yet related digital products and value propositions continuously developed based on the shared digital templates	Derivative Digital Product

Operating a fully linked product system enables us to cover the entire life cycle scenarios and at the same time generates a lot of synergy. These full life cycle scenarios ranging from are marketing, interaction, transaction, payment, and data, providing marketing anti-fraud, application anti-fraud, transaction anti-fraud, account security, and data anti-crawling, etc., are shared amongst all the products. Given the shared nature of product, technologies and services developed to support the products can be highly modularized. This structure has multiple benefits. On the one hand, we can meet multiple business needs with minimal resource requirements. On the other hand, the more products we have, the more sharing can be materialized. (Head of Operation)		

As summarized in Table 3, three aspects of derivative digital products were reflected in our empirical observations. First, WeCash increased the depth of a digital product category by adding more related products to the same product family. The General Manager explained:

> *"I suppose our underlying principle is very clear and consistent. For every new business area we enter, we have to incorporate plenty of 'depth' in our design. The depth is not just about the range of services we offer now and in the future, but also the degree of integration in linking these existing and new services to help us differentiate from competitors."*

The need and business implication to increase product depth was further elaborated by the Product Design Manager, "the idea is to create a one-stop shop where each user's needs can be fully catered". For instance, once signed up for the first loan, pig farmers could apply for other loan products, such as farming insurance, vehicle repair, and vehicle purchase. Second, once a digital product was created, it served as a basis for adding variants and customization possibilities in each product. The Head of Marketing informed us "to make our products attractive and to create better user experience, each product needs to cater for customized 'loan amount', 'loan period' and 'payback flexibility'." Third, to facilitate the continuous increase of product depth and variations, WeCash ensured its control over the setting of standards by which each product should be operated and managed. For instance, WeCash predominantly defined each product's acceptable risk level, credit worthiness, loan ratio, profit sharing scheme, and user data management. Clearly, these actions were only possible with the support of its digital core. The Head of Operation reinforced that "without our technological infrastructure, you simply cannot run a highly complex business like WeCash."

For each derivative digital product, the management team set ambitious performance targets, such as market leadership and threefold annual growth rate. The general expectation of the management team

was that each derivative digital product would be developed into a fast growing semi-stand-alone business venture. Each new venture extension would in turn expand the scope of its product offerings to create more revenue streams. For instance, additional loan products, such as farming equipment purchase, vehicle purchase and repair, were added to the product family of farming loan, while accessories purchase and apps purchase were added to the product family of cell phone purchase loan, many of which were introduced based on the requests of WeCash's affiliated partners.

Even with WeCash's capability to generate derivative digital products from its digital core, they were relatively easy to imitate. Once a digital product was on the market, other digital ventures could create competing products based on the same product concept and market segment. The General Manager elaborated:

> *"once you have a product in the market that shows high growth potential, you also quickly notice that it won't take long for others to imitate and better what you can do… In this market, you just need to be very quick on your feet. So that you are always several steps ahead and let others play the catching up game."*

Moreover, the management team stressed the importance of fit and coherence between venture extension and WeCash's main business, namely credit and risk management. As noted by the General Manager, "any FinTech innovation is about how you improve or create new service by linking users, capital, and risk management together. We constantly search for areas where our risk management technology can be deployed to change the links."

The Process of Concepting

We use the term *concepting* (see Table 4) to denote *the deployment of the digital core in designing and experimenting business concept for a new venture*. In both episodes, we observed that the insufficiency of conventional credit rating methodologies left a sizeable unserved market. As the Head of Cell Phone Purchase Loan noted, "as for the cell phone retailers, some of sales would not materialize unless the buyers were able to obtain credit facilities in situ." This "pain point" was something that the Cell Phone Purchase Loan addressed. Similarly, the Product Design Manager told us: "pig farmers were the worst off, as their profits have been greatly reduced due to the way they financed the purchase of pig

feed… Suppliers of pig feed were taking on a lot of financial risk, too… Our product is great in solving the pain points of both parties." The digital core in general and the credit rating technology of WeCash more specifically served as a pre-defined set of solutions through which WeCash actively searched for new problems, or pain points in the respondents' words, as business opportunities in such unserved markets.

For WeCash, the benefits of exploring unserved markets were evident, yet there was virtually no prior example to benchmark. Consistent with prior research, such uncertainty may affect the willingness of entrepreneurs to pursue opportunities (Kier and McMullen 2018; McMullen and Shepherd 2006; Packard et al. 2017) and shape the business conception for the envisioned new venture (Witt 2007). The concepting process was therefore much about mitigating the uncertainty through extensively experimenting and matching the design of product concepts with the identified and articulated shortfalls and problems encountered by the market. As the CEO elaborated, WeCash typically set up a small project team to plan and mobilize existing resources and capabilities without full commitment to actually launch the new venture. Given the success rate of venture extension was typically low, the chance could be improved by increasing the speed and number of small-scale trial and error projects. With its digital core, WeCash was able to continuously try out new product concepts without being constrained by resource limitations. Furthermore, uncertainties related to planning, development, and launching could be minimized through extensively reusing the stock of existing digital templates. In addition to support trial and error, the digital core also influenced the management's viewpoints and judgment in terms of selecting and shaping different business opportunities within which WeCash could best exploit and capitalize information asymmetries in the value chain. For instance, in both digital venture extension episodes, WeCash fully controlled the user information, and did not reveal the credit scores of users to the affiliated partners.

Table 4. Process of Concepting

Empirical observations	Theoretical observations	Aggregate dimension
Shortfalls in mainstream credit rating technology result in "pain points"	Using digital core as a set of solutions to	Concepting

Essentially, two-third of the Chinese population are considered by mainstream banks as undesirable users, simply because they do not have credit history. (Assistant Product Manager- Cell Phone Purchase Loan) I used to work in the loan division of a commercial bank. On average, each loan transaction, over its life span, would cost us around RMB2000 to manage. It would not be in the bank's interests, indeed most banks' interests, to offer loan products that cannot yield sufficient return. (Business Development Manager- Cell Phone Purchase Loan) Leading credit rating agencies, such as Equifax, Experian and TransUnion, calculate individual users' credit scores based on their credit histories… Credit rating technologies based on this principle are highly problematic (in China), simply because more than 2/3 of users do not have credit history. (Credit Rating Analyst) **Use in-house technology as a solution to actively address pain points** Our (credit rating) technology is like a solution for many problems. Essentially, we just need to find new 'pain points', so that we can apply our technology to solve them. (CEO) Given that we have already got a great solution at hand, a huge part of the thinking is about knowing how far we can stretch our solution to explore new market opportunities. (Marketing Director) **Existing in-house technology enables speedy product concept experimentation** Even though the success rate is extremely low, like many tech startups, you just need to try out so many different ideas before finding a new product that can help you break another ground. This is an integral part of what we do. The plus side is that we use our existing technology to create, simulate and trial our product concepts, sometimes even with our partners and users. It is very fast and cost effective to gain a deep overview about a product before you fully commit to it. (Chief Enterprise Architect) There is no doubt that as a FinTech company we do try a lot of different ideas. However, we are essentially using the same technology in different settings for different services. At the end of the day, the technology has to be used in connecting the users and capital together, so that our value can be created and sustained…. These overarching principles are simple to understand, but hard to materialize. We have several trialled projects running in an given that, so that we can use these projects to help us to get to the bottom of the nitty-gritty of what would work and what would not. (Product Technology Manager- Cell Phone Purchase Loan) **Mass experimentations help to select most promising product concepts** The farming community in general is very underserved by mainstream banks… Nevertheless, the demands are not universal across the entire community. You need to know which segments fit your technology and business best. Through numerous simulations, trials and prototypes, we can generate some preliminary understanding about the anticipated performance of different product designs. In our case, there is a lot to do with selecting product designs with the level of uncertainty and risk that we are able to calculate and tolerate yet with strong revenue potential. (Product Manager- Farming Loan) **Incorporating "pain points" as a product's built-in incentives-for-use for rapid adoption** I will say we put our initial effort in getting a strong understanding as where the complexity lies. For example, with a new partner, you need to know what procedures are carried out online and what is done offline. You need to know where the 'profit points' are, so that you know where the pain points are. You need to trial out different business models to find out where your added values will come from. (Product Manager- Cell Phone Purchase Loan) When you offer a product that revolutionizes the conventional way, you can often have more options to play with. I suppose the beauty of designing a new financial product is that you can have so many different configurations in your algorithms. You can simulate and test your products rather robustly before you fully commit to it. (Chief Enterprise Architect) Your products have to offer strong incentives, e.g. convenience and great saving, so that they would get used. Our users will compare what is on offer. They are savvy shoppers. We often involve our users in designing and trialling different product prototypes, so that we get a good overview in terms of how the products will perform in the market (Head of Product- Cell Phone Purchase Loan) No, the incentives are geared more than just towards the users. It is equally vital for our local affiliated partners, as they are the driving force in pushing our users to use the products. (Product Design)	explore new problems in the market Concept experimentation crystalizes feasibility of productive opportunities Concept experimentation strengthens product's future growth	

From Penrose (1995), it is clear to us that entrepreneurial imagination and judgments are key to the creation of productive opportunities. Nevertheless, it is through managerial actions these opportunities can be brought to life. However, such a sequential relationship between productive opportunities and managerial actions seems to become blurred in what we have observed at WeCash. As demonstrated in Table 4 and the discussion above, extensively experimenting emerging product concepts has become a distinctive feature of concepting. This increasingly action-oriented approach towards developing and experimenting business concept encompasses several meanings and implications. First, business conception has shifted from a cognitive exercise (Witt 2007) to become action-packed activities, as reflected in the sheer amount of simulations, experimentations and small-scale trial run projects. Second, the shifted action orientation permits the process of concepting to yield in-depth understanding about the business concept by crystalizing its feasibility, as well as informing their selection and prioritization. Third, given that each product concept has been through extensive experimentation, sufficient care and attention has been paid to incorporate and build in incentives to use the product, which was crucial to ensure its future adoption and growth.

The Process of Porting

Whereas managerial actions are key to the creation and actualization of productive opportunities, some necessary adjustments to these actions are often required, leading to adjustment costs (Lockett et al. 2011; Penrose 1995). Adjustment costs can occur when new managers are recruited, or new facilities are added to manage the creation of a new venture. In this regard, a vital part of digital venture extension is related to the process by which adjustment costs can be kept low when new derivative digital products are launched. We use the term *porting* to represent *the specialization of a venture's digital templates to actualize productive opportunities with minimal adjustment costs*. Table 5 outlines our theoretical observations with illustrative evidence.

Table 5: Porting

Empirical observations	Theoretical observations	Aggregate dimension
Experimented product concept helps to reprogram and adjust existing software modules No, it is not quite like how you described. The concept of reusing is not just using whatever software modules as they are. Rather, each module has to be reprogrammed and tweaked to fit	Concept experimentation help to	Porting

the new specs. Reprogramming existing modules still takes time, but far less than developing brand new modules end-to-end. If you think about all the modules required to support a product, this can be several months of difference in development time, as well as difference in cost. (Chief of Enterprise Architect) When we were developing and trialling cell phone purchase loan, we had identified that the only additional requirement was to have users submitting their photos taken in the store. Other than that, all the supporting technology is virtually identical to Micro Lending, of course with some rather minor adjustments. (Assistant Product Manager- Cell Phone Purchase Loan)	specialize digital templates	
Repurpose of existing software modules helps to reduce "reinventing the wheel" The way we manage the growing variations of a product is to make sure that they are all supported by the same procedure and technology, so that you can maximize the efficiency. (Head of Operation) Well, it is undeniable that the hardest thing in a new venture is to come up with a brand new product. By comparison, technology is relatively easy, as it is already there and proven to work well. Our policy is not to develop any new system or recruit any new technologists, unless a clear strategic value exists. You simply don't permit someone to reinvent the wheel, as the emphasis is on the product. You want to make sure that the new product has plenty of scope for depth. You use the same technology and same business model to increase your speed and product depth. It is pretty straightforward. (Product Design)	Specializing digital templates reduces adjustment costs	
Overlapping product development personnel facilitates knowledge reuse We use the same guys (software engineers) for building every new solution. They will be allocated temporarily to the (new product development) project. Once the project lead has a reasonably clear idea, it will not take them long to get the solution ready… The apps might take a week or two, the rest is essentially the same. (General Manager) Cross-functional collaboration is always challenging especially when we need to develop new products. This is particularly the case when we have very short time frame to get the products ready for market. The experiences we learned from previous projects are always useful, because those product app modules, data, software design from previous projects enable us to do new things with shorter learning curve. The best way to make sure the experiences are fully reutilized is to have the same team of people. (Product Design Manager)		
Repurpose of existing software modules increases speed to market Having the shared technical resources gives us tremendous benefits in flexible deployment and effective reduction of construction costs. For instance, based on this architecture design, the risk control center can achieve the unification of business security services and standards, provide self-service agile capability output for the front office business, and facilitate flexible deployment by the modular combination, which greatly reduces time required to launch our new products. (Assistant Manager- Risk Control) Of course, one of the key selling points of reusable architecture is about speed to market. It is reflected in not just development time, but also testing. Given that existing modules have been tested before, we can run neighbourhood tests in parallel, instead of waiting for every module to be ready before running the end-to-end testing. This is precise why this architecture has such large uptake in the financial sector. (Chief Enterprise Architect)	Experimented concepts facilitate speedy opportunity actualization	
Experimented product concept permits the prioritization of development resource One of the most challenging aspects of developing new products is to model and control the risk.... The entire risk control modelling includes collaborative recommendation algorithm, LR algorithm, XGBoost, marketing model, multi-head model and credit score model. These algorithms and modules mainly use multi-dimensional features to build risk control models autonomously…. When we design and plan new businesses, we use the entire risk control modelling logic to design, plan and test the blueprint of a new business. This approach is very effective to quickly build features and generate risk control results, as well as identifying new solutions to add. To this end, we have developed and launched a true decision engine to provide customers with risk control rules at the rule design level, allowing business personnel to flexibly operate through rule processing at the rule execution level to achieve the purpose of rapid inheritance of experience. (Risk Modelling Manager)		

Our findings clearly shows that WeCash managers actively focused their actions on reducing technological development time and cost by extensive extensive repurposing and specializing of its digital

templates. Technological adjustment costs for each venture extension varied in relation to the degree of newness of the new area. For instance, compared with micro-lending and cell phone purchase loan, the farming loan product required more extensive adjustment of its credit rating technology. First, the loan amount was substantially greater than in the micro-lending and cell phone purchase loan cases. For the average loan of 100,000 RMB, it imposes significantly higher financial risk on WeCash. Second, the pig farmers were not WeCash's typical users with extensive social media usage. In this regard, social media usage data, normally used by WeCash, provided limited value in constructing pig farmers' credit profiles. Instead, WeCash adopted an interviewing technique, commonly used in German speaking countries for lending to SMEs, was incorporated as the main source of data collection. As a result, new modules, as additional functionalities, were added to the digital templates, such as data collection, data cleaning, data management, user profiling, risk assessment, application operation and user management.

As evident in both venture extensions analyzed, once the blueprint of the product concept and operating business model was generated, the project teams specified which and how digital templates would be repurposed and specialized to new business contexts. Essentially, porting involves incremental adjustments and extensions to support the new venture based on the same digital core. Therefore, through extensive repurpose and specializing of existing digital templates developmental efforts and resources could be effectively reduced and prioritized. For instance, in the episode of cell phone purchase loan, the team reused most of the digital templates developed in the past and identified photo ID as critical, leading to the incorporation of an image recognition module into the data collection template. This facilitated connection to other relevant templates, such as application operation, user management, risk profiling, and fraud detection. Furthermore, a new module for managing affiliate partners was developed. This resulted in the reorganization of other modules to form the channel management template. These new functionalities, as enhanced or new digital templates, were in turn reused in the development of the farming loan product.

To ensure the effectiveness of porting, members of staff, such as in product design, risk modeling, and user interface, could be involved in multiple venture extension projects to permit the reuse of their

knowledge and experience gained. Nevertheless, extensive reuse of digital core could potentially lead to the tension towards innovation in technology. As the Head of Product Design explained, there was a tendency for the technologists to go for the route of developing brand new systems rather than reusing existing ones. He recalled that there were several occasions when the technologists were frustrated with the lack of support from the management team for new technological solutions, which they believed were far more superior than those already available. While the benefits of porting were multifold and reinforcing the principle of "not to reinvent the wheel", as stressed by several funding partners, was extremely crucial; there was potential danger, as highlighted by a small number of interviewees that extensive reuse could potentially kill the technological innovation capability in the long term.

The Process of Generalizing

Digital ventures are essentially data driven operations (Huang et al. 2017) that seek to generate and benefit from data network effects (Gregory et al. 2021b). Data network effects encapsulate the ongoing process of learning from vast amounts of data to improve products and services. In turn, this helps recruiting more users and generate more data. While operating derivative digital products affords data network effects, it is equally crucial in enabling WeCash to abstract and validate digital templates created and repurposed during the processes of concepting and porting. We use the term *generalizing* to denote *the creation and refinement of general solutions for specific sub-problems that can be reused and adapted in the development of derivative digital products*. Table 6 outlines the three related empirical observations, which reflect the three distinctive yet interrelated characteristics of generalizing.

Table 6: Generalizing

Empirical observations	Theoretical observations	Aggregate dimension

Data generated from derivative digital products in use is systematically collected and analyzed We study our users' credit rating and default rate data in order to understand how we could cut back on the number of parameters we use in accessing our user databases. Throughout the years, we have reduced the number of parameters we use from 17 to 8 now in order to increase the speed of big data processing. (General Manager) With our relative low profit margin, we are essentially a volume-oriented business. We have to keep questioning how we can make each transaction more efficient through improving our technology, how to evaluate and improve each algorithm, and how to improve the user experience. (Assistant Operation Manager) One of the most valuable assets for FinTech startups is the actual experience gained from operating their products. Given that most FinTech startups are very young, so that actual experience can be rare but highly meaningful. For instance, our risk control unit, over the years, has accumulated very rich and practical security experience that is important to enable and support our business for security attack and defence. Hundreds of millions of business security rules, as our accumulated experience, can only come from the actual experience in operating our products. (Assistant Manager- Security) Our vaste amount of transaction data feeds into our algorithm via machine learning to support the understanding of our business in all dimensions, i.e. operation, marketing, risk management and so on. This information is very useful also in understanding and support the development of new market opportunities. (Head of Operation) Transaction data is particularly valuable in identifying unknown risks and realizing automatic upgrade based on deep learning related network technology, analysis of operation behavior and relationship graph. It is a good source for finding individual signs, mining group portraits, helping enterprises effectively prevent complex and changeable risks, and implementing the strategy of automatic technology automatic upgrade and renewal. (Data Scientist) **Business analytic tools facilitate the capturing, interpreting and evaluation of experience learned** We have a system of feeding those best performing algorithms and system logic back to our company platform so that we could use them again for future products. That way, it saves us time and efforts, in particular when we reuse these algorithms for different products. (Assistant Manager- Product Design) Nowadays, the core of data processing today is no longer based solely on computing power, of course it is still the basis, but mainly on the intelligent and analytic algorithms. Algorithms are closely related to each business of our company, so we cooperate with each business line to convert and deposit general and stable algorithms into a complete intelligent platform. We believe that the cloudization of infrastructure, the Internetization of core technologies, and the platform and capabilities of superimposing big data plus intelligence on it form a complete framework of our overall capabilities and how we learn from what we do. This is our core competence. (General Manager) After few years of improvement, our platform is very effective in the inflow of data to complete the storage, calculation, and product packaging of massive data. This captures all the experience gained from our operation, constitutes our core data analytics capability and provides support for the customized innovation of product-side data and the continuous evolution of business data feedback. (Data Warehouse Engineer) **Experience learned from designing and operating derivative digital products and venture extension becomes and increases the stock and functionalities of digital templates** With our growing experience in extending our business, we certainly have become better in avoiding some of the costly learning curves. With the experience, we have become far more practical in judging how much scope a new business initiative can grow. How attractive it is for the existing and new users? What is the projected revenue stream? How feasible to reproduce it?... All these practical questions do put you into perspective. (General Manager) Algorithm is based on the large-scale data sampling and data analysis of the target group, mining out the actual nature of a particular problem or objective things and the operating law, using abstract concepts to analyze existing problems or risks, and calculating and deducing to reduce or prevent problems or risks. Algorithm construction is a complex project, which usually requires a few or more than ten professional developers, and can take several months or even six months to complete. Due to limitations in talent, technology, cost and other reasons, we believe that absorbing and converting every experience into the format of corporate-wide templates can help implement faster business expansion, enhance the ability of algorithm	Operational data and experience serve as sources of learning Converting learned experience as digital templates for future reuse	Generalizing

construction, unify business security services and standards, and provide self-service agile capabilities for the business end. (System Development Manager).		

First, generalizing reflects the learning intent in capturing and accumulating two types of experience simultaneously. On the one hand, the derivative digital products in use permitted WeCash to generate product-specific experience for each market segment. For instance, user profiling varies considerably between farming loan customers and cell phone purchase loan customers. On the other hand, because all derivative digital products were created based on common digital templates, WeCash could also generate generic insights to feed into its digital core. The dual mode of learning has made the process of generalizing unique. For instance, even though the digital core encompassed a generic set of over 2,000 expert rules, 4,000 risk-control dimensions, and 7,000 data characteristics, each derivative digital product would have its own weighting and configurations towards these expert rules, risk-control dimensions, and data characteristics. Data collected through operating the derivative digital products was then analyzed to improve expert rules, risk-control dimension and data characteristics, as well as to enhance the experience and precision in setting and adjusting the weighting and configurations for each derivative digital product.

Second, as highlighted in our empirical observations, through the process of generalizing valuable experience gained from operating derivative digital products could be learned to modify and increase existing stock of digital templates. For instance, facial recognition technology was incorporated into the design of cell phone purchase loan to identify users. Given the lack of maturity in such technology, experience gained from using such technology was particularly useful to evaluate the effectiveness of the system's design and performance, and provide useful indicators for subsequent upgrades. Once the facial recognition system was stabilized after several rounds of upgrade, it was then converted into a set of digital templates, which was used in other venture extensions, such as farming loan.

Third, as commented by several funding partners, the abilities to develop good quality digital products and operate them cost-effectively have become "hygiene factors". The differentiation of digital ventures, they commented, emerge from their speed-to-market and abilities to leverage the momentum by continuously expanding the scope of product offerings. In addition, while increasing the stock of digital

templates was paramount, the process of generalizing was also critical for WeCash to enhance the depth and sophistication in reusing the digital core. This was done by effectively applying and combining the generic nature of digital templates with the specific characteristics of each digital product and its relevant market.

DISCUSSION

The value of transforming a core technology for a new business purpose has been recognized for long. Just consider the example of Frigidaire's extension of its cooling technology in the 1930s (Penrose 1995), adding air conditioning to its refrigerator business. Similarly, Uber recently used its match-making technologies for extending into food delivery. Both examples of venture extension involve repurposing of core technologies for growth into new business areas. Yet, we propose that Uber's extension, as a digital venture, is qualitatively different.

Since Yoo et al. (2010) pioneered digital innovation as a research direction that offers a view on this qualitative difference, numerous studies have underlined the importance of the design flexibility and scalability of digital technology (see e.g., Henfridsson et al. 2014; Kallinikos et al. 2013). Yet, prior digital innovation and entrepreneurship literature has little to say about the way by which these attributes of technology come to life in the practice of digital innovation and entrepreneurship. While patterns (Henfridsson et al. 2014), ambivalent ontology (Kallinikos et al. 2013), and ontological reversal (Baskerville et al. 2020) have been proposed as conceptual tools, we still lack a grounded account of the way that digital technology comes into play in the key entrepreneurial processes of productive opportunity creation and opportunity actualization. To this end, we engage with Penrose's work (Lockett et al. 2011; Nason and Viklund 2018; Penrose 1995) to learn from our in-depth study of WeCash.

We propose the notion of templating to denote the digitally-enabled process of generating and using generic solutions across business areas to facilitate and actualize venture extension. Reflecting on the prior literature, the process of templating sheds light on the way that digital core, the versatility of digital technology, and a significant reduction of adjustment costs (Lockett et al. 2011; Penrose 1995)

come together in venture extension. Through our grounded analysis, we unpack and theorize templating by tracing three distinctive yet interrelated processes, namely concepting, porting, and generalizing.

A Process Model of Digital Venture Extension through Templating

We propose a process model (Figure 3) that exhibits templating as a dynamic interplay between the three processes of concepting, porting, and generalizing. In what follows, we discuss them in turn, followed by an elaboration on starting-points of digital venture extension.

Concepting. Shaped by contextual conditions, the process of concepting is grounded in the *digital core*. The digital core offers a set of solutions for entrepreneurial managers to create *productive opportunities*. Such productive opportunities are then vetted through systematic *concept experimentation*, involving simulations, prototyping, and small-scale trial runs. Given that the experimentation invites reuse of the digital core and its digital templates, the cost and time required is considerably less than developing digital products from scratch. Extensive reuse of the digital core also permits the digital venture to run a large volume of experiments to increase the likelihood of finding productive opportunities with growth potential. The process of concepting interrelates the digital core and concept experimentation in a way that amplifies and routinizes the exploration of productive opportunities. As a result, concepting serves as a driving force to allow the venture to remain entrepreneurially proactive and agile.

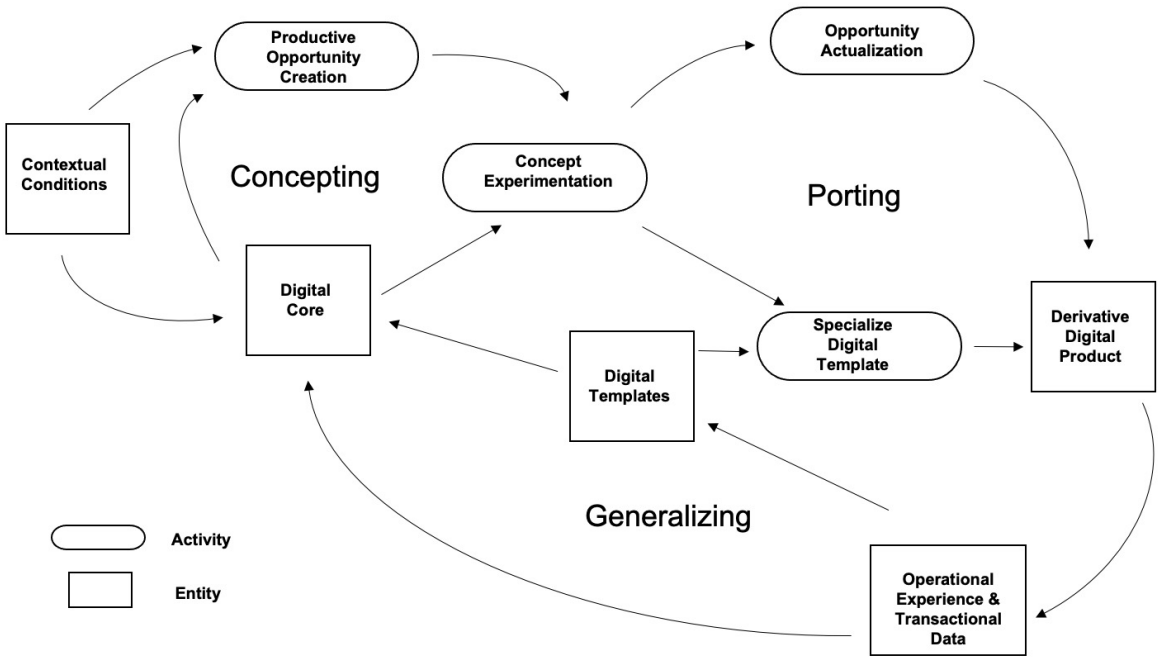

Figure 3. A Process Model of Venture Extension through Templating

Process	Definition
Templating	The digitally-enabled process of generating and using generic solutions across business areas.
Concepting	The use of the digital core in designing and experimenting business concepts for new ventures.
Porting	The specialization of a venture's digital templates to actualize productive opportunities with minimal adjustment costs.
Generalizing	The creation of general solutions for specific sub-problems that can be reused and adapted in the development of derivative digital products.

Porting. Along with the progression of concepting, actions are taken to prioritize promising product concepts to *actualize opportunities* by specifying *derivative digital products*. In view of extensive *concept experimentation*, generic solutions for new digital products, including their supporting technology, data, and business processes, exist in the format of *digital templates*. Concepts are then actualized by *specializing digital templates*, that is, to adapt generic digital templates for specific purposes. The process of porting significantly reduces the amount of time and resources (adjustment costs) required to launch a new digital product.

Generalizing. The process of generalizing involves the creation of general solutions from existing digital products to be reused in future development of derivative digital products. Specifically, with reuse

of digital templates, derivative digital products bear high degree of resemblance in their underling business, data, and technology architecture. This generates synergetic benefits in multiple areas as the products are operated. For instance, the operation of derivative digital products generates *operational experience and transaction data* that can add to the digital core as digital templates. Transaction data crystalizes the performance of the digital products and enables, in many cases, assessment of the effectiveness of digital templates in terms of, for instance, application operation, risk management, and fraud detection.

Where does digital venture extension start? Our account suggests several starting-points of digital venture extension including *contextual conditions*, *concept experimentation*, and *digital templates*. Contextual conditions are often a reflection of demands and market conditions, which agile entrepreneurs can convert into productive opportunities. Even though the potential of certain conditions might be spotted by multiple digital ventures at the same time, those with the most versatile digital core can typically take the most advantage by templating existing solutions. Concept experimentation can also serve as a starting-point of venture extension, as digital ventures typically run large volumes of experimentation. Understandably, few experimented product concepts materialize as new ventures for various reasons, such as, the market's readiness and the product's commercialization potential. The body of semi-ready product concepts, together with their pre-fabricated supporting process, data, and technology nevertheless allow digital ventures to reactivate experimented projects without necessarily going through the process of concepting once again. Interestingly, digital templates, and their ongoing refinement, can also incept the process of venture extension. This is because the architecture of digital products consists of a set of intricately connected digital templates. When digital templates get updated and renewed, the results can be applied directly to refine existing digital products, and in some cases to create new product variants, often modeled as different specifications, levels, or packages, to meet diverse demands. In other words, as our process model illustrates, new variants of derivative digital products can be created through renewing digital templates, bypassing the process of concepting.

Implications

Our research contributes to the emerging digital innovation and entrepreneurship literature (see e.g., Henfridsson et al. 2018; Nambisan 2017: Nambisan et al. 2019; Steininger 2018; Yoo et al. 2010) and beyond. First, we develop a process model that explains templating as a process by which a digital venture engages its digital core in generating and using generic solutions across business areas. Responding to Nambisan's (2017) call for more research on how digital technology allows for "scope creep" and "greater levels of flexibility in opportunity enactment" (p. 1041), the process model unpacks templating as the three inter-related processes of concepting, porting, and generalizing. Each process adds to the understanding on how the digital core, as a digital artifact at the core of the business offering (von Briel et al. 2018), makes venture extension possible. Prior work examines the importance of digital innovation for growing a digital venture (Huang et al. 2017), as well as how entrepreneurial processes and outcomes are less bounded when related to products and/or services are anchored in digital technology (Nambisan 2017; von Briel et al. 2018). While this research speaks to the idea of digital venture extension, they do not specifically examine the underlying process by which ventures move into new business areas.

Second, since its first elaboration in Penrose's (1995) growth theory of the firm, the notion of resource versatility has been lately embraced in the entrepreneurship literature (Lockett et al. 2011; Nanson and Wiklund 2018). We introduce the notion of versatility to the information systems audience with the specific intention to extend the digital innovation and entrepreneurship literature and its conceptualization of attributes of digital technology (Henfridsson et al. 2014; Kallinikos et al. 2013; Nambisam et al. 2017). We surmise that digital ventures contingently enjoy a "difference-in-kind" versatility as they draw on their digital core for extending into new business areas. In making the connection between attributes of digital technology and entrepreneurial processes, our process model solidifies some of the promsises raised in the literature. Each one of these three processes manifests how attributes of technology such as programmability (Yoo et al. 2010), editability (Kallinikos et al. 2013), and scalability (Henfridsson et al. 2014) afford digital ventures to grow and extend their business. We

also recognize that the degree of versatility can reach a threshold or a tipping point, allowing the venture to engage in templating and take on flexible ways to carry out venture extension.

Third, our research speaks to recent observations in entrepreneurship, where scholars, such as Nanson and Wiklund (2019), question the underlying logic of the resource-based view and its notion of resources. Rather than being valuable, rare, inimitable, and non-substitutable (Barney 1991), digital resources tend to be easily reused, reprogrammed, and repurposed, stressing that capabilities to engage these resources are central. Our notion of templating and its manifestation in the process model paves the way for thinking about the redefined role of resources in digital innovation and entrepreneurship.

Finally, our findings also relate to the ongoing debate between problem-driven (Choi and Shepherd 2004; Mitchell and Shepherd 2010) and solution-driven (Hsieh et al. 2007; Sarasvathy 2001) approaches of entrepreneurial reasoning. Our process model in general, and the process of concepting in particular, indicates that these two approaches of entrepreneurial reasoning may occur concurrently as the venture draws on its digital core to evaluate emerging productive opportunities prior to concept experimentation. In fact, the digital core as the accumulative experience of a digital venture serves as (a) a sense-making device and (b) a generic solution for the creation of productive opportunities. The versatility of the digital core is the key to explain how solutions and problems can co-exist that would not necessarily be possible with resources studied by Penrose (1995). This qualitative difference is crucial in the practice of digital entrepreneurship, where the novelty of each new application requires entrepreneurial managers to explore how to best repurpose the digital core through constantly evaluating and fine-tuning productive opportunities at the same time.

CONCLUDING REMARKS AND FUTURE RESEARCH

Penrose's (1995) work, originally published some 60 years ago, serves as our backbone for developing a grounded understanding of digital venture extension. Reflecting on our application of Penrose's work, the theory of the growth of the firm remains strong in terms of its conceptualization of the core entrepreneurship processes of productive opportunity creation and opportunity actualization. Yet,

digital technology offers a different level of versatility to resources deployed in these core processes. In turn, this offers an opportunity to update our thinking about growth and business extension. Our process model of digital venture extension represents an attempt to such an update.

There exist a number of themes for future research. First, prior studies focus on the size of the user base (e.g., Afuah 2013; Huang et al. 2017; Parker et al. 2016) to address scaling expectations (Ramadan et al. 2016). In winner-take-all markets (Eisenmann et al. 2006; Schilling 2002), network effects are indeed important. Just like recent studies of artificial intelligence and data network effects (Gregory et al. 2021b), our research shows that the learning enabled by digital technology, in this case through templating, can pave the way for new forms of network effects. The more digital templates created and added to the digital core, the more valuable each service, drawing on the digital core, will become for each user. A promising topic for furture research would be to examine the relationship between templating and such value creation for each user.

Another important question relates to the role of resources in the world of digital ventures. Significant work on IT-resources and firm performance largely embraces the resource-based view on resrouces (cf. Bharadwaj 2000; Nevo and Wade 2010; Rai et al. 2010; Ray et al. 2005). Our research indicates that it would be useful to return to this early and influential work to review its tenets in view of resource versatility. This could stimulate work on developing new approaches to business value of digital technology.

Finally, it would be useful to examine how digital ventures can achieve greater performance and venture extension outcomes by developing their business models. The specifics of the business model, in conjunction with the digital core, can create disruptive effects in the market. Even though our study did not engage the business model literature (Collis 2016; Kavadias et al. 2016), we believe that future attempts to examine business model questions in relation to venture extension would be valuable. Given the relative ease of imitating a successful business model in digital venturing, future research can shed light on the interaction between the digital core and business models as digital ventures sustain their competitiveness.

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