GROWING ON STEROIDS: RAPIDLY SCALING THE USER BASE OF DIGITAL VENTURES THROUGH DIGITAL INNOVATON[1]

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Digital ventures, start-ups growing by drawing on and adding to digital infrastructures, can scale their business at an unprecedented pace. We view such rapid scaling as a generative process by which a venture's user base increases significantly between two points in time through digital innovation. We studied WeCash, a Chinese digital venture, nearly doubling its user base monthly, to learn more about this generative process. We trace three contingent mechanisms underpinning rapid scaling: data-driven operation, instant release, and swift transformation. We explain these mechanisms and how they interact in the rapid scaling of digital ventures. The research offers an agency perspective on scaling of digital ventures that speaks to the digital innovation literature.

Keywords: Digital innovation, digital ventures, digital technology, user base, rapid scaling, case study

Introduction

Anecdotal evidence suggests that the scaling of digital ventures is qualitatively different from the type of scaling documented by Chandler (1962) in his classic case studies of Du Pont, General Motors, Standard Oil, and Sears. In particular, the leanness with which digital ventures grow by drawing on and adding to digital infrastructures (Brynjolfsson

and McAfee 2014; Henfridsson and Bygstad 2013; Yoo et al. 2010) helps to increase the clockspeed (see Fine 1998). Some of the dominating technology firms such as Amazon and Google quickly reached a scale that took decades for industrial companies to accomplish. Similarly, numerous digital ventures seek to scale their businesses rapidly, typically driven by winner-takes-all perceptions (Eisenmann et al. 2006; Schilling 2002). Importantly, rather than traditional growth measures such as sales levels, profitability, and market share (McKelvie and Wiklund 2010), the user base (Oliva et al. 2003; Prasad et al. 2010; Sun et al. 2004) is at the heart of such rapid scaling. The notion of *user base* differs from *customer base* in that a customer has "past purchase beha-

vior" (Schmittlein and Peterson 1994), which is not necessarily the case for users in the context of digital innovation.

We define rapid scaling as a generative process by which a venture's user base increases significantly between two points in time (Henfridsson and Bygstad 2013; Lee et al. 2006; Leitch et al. 2010). The process is generative in that initial success in building the user base (i.e., the number of people using a digital innovation) increases the likelihood that more users will follow (Arthur 1989; Church and Gandal 1992; Grindley 1995; Hanseth 2000; Song et al. 2009). However, rapid scaling is not eternally generative but requires careful attention by reflective agents to sustain over time (see Garud et al. 2010). In the case of digital ventures, we argue that such attention involves reflective actors engaging in digital innovation to increase the user base. Prior research suggests that the leeway for such engagement is afforded by digital technology's separation of function and form, and separation of contents and medium, respectively (Benkler 2006; Yoo et al. 2010). Yet, little is known about the mechanisms by which digital ventures accomplish rapid scaling of the user base through digital innovation. We therefore address the following research question: *What are the mechanisms by which digital ventures innovate to rapidly scale the user base?*

We undertook an in-depth process study (Langley 1999) of WeCash, a Chinese digital venture in the credit business, which seemed to grow on steroids. Nearly doubling its user base monthly reaching 602,000 in 8 months, we studied how WeCash innovated digitally to initiate and sustain rapid scaling. Our research provides a unique study of how a digital venture mobilizes digital technology as a prime mover to generate/initiate innovation opportunities (Nambisan 2013). We trace three contingent mechanisms: data-driven operation, instant release, and swift transformation. We explain these mechanisms and their interrelationships, and outline implications for research and practice.

Conceptual Basis

Our notion of rapid scaling assumes that sustained generativity requires the careful attention of digital ventures, and that the use of digital technology facilitates such attention. Even though the generativity of an innovation is typically associated with self-reinforcement "without any input from the originator of the system" (Wareham et al. 2014, p. 1195), human actors in digital ventures are reflective agents who are capable of situating themselves in the context of rapid scaling (see Garud and Karnøe 2001; Henfridsson and Yoo 2014). In

other words, they "monitor continuously the flow of their activities and expect others to do the same for their own" (Giddens 1984, p. 5). They attend to the generative process to monitor its progress and determine how it conforms to growth expectations. In other words, they also actively reflect upon possible ways to keep the momentum of the user base growth, or to rejuvenate scaling in decline.

Unlike classic views on scaling where economics of scale is achieved through standardization (Chandler 1962), digital technology offers flexibility (Kallinikos et al. 2013; Svahn et al. 2017; Yoo et al. 2012) that potentially can be leveraged innovatively to rapidly scale the user base of a digital venture. In what follows, we elaborate on such digital innovation.

We define digital innovation as the recombination of digital components in a layered, modular architecture to create new value-in-use to users or potential users of a service (see Lusch and Nambisan 2015; Yoo et al. 2010). This definition manifests the idea that digital innovation is both a process and an outcome. We suggest that the contribution of digital innovation to rapid scaling can be traced to two fundamental aspects of digital technology: the separation of function and form, and the separation of contents and medium.

First, unlike analog technologies, digital technology enables a separation of contents and medium (Yoo et al. 2010). This means that digital contents, whether images, music, or social media profiles, can travel across different media, as long as a standard is followed (such as TCP/IP) so that heterogeneous digital devices can encode the bit stream in the intended way. It also means that, after initial design, ideas are "comparably inexpensive to scale" (Henfridsson et al. 2014, p. 30) as their subsequent reproduction incurs negligible marginal costs (Brynjolfsson and Saunders 2010; Shapiro and Varian 1999). In other words, negligible marginal costs make reproduction costs and capabilities almost irrelevant for the speed by which a digital venture and its reflective agents can scale the user base.

Second, digital technology enables a separation of function and form. Originating in the von Neumann computing architecture and its stored-program concept (Langlois 2007), the independence of the digitally encoded instructions making up functions, and the digital device (form) that allows their execution, makes digital technology flexible (Yoo et al. 2010). For instance, new functionalities can be added to a digital product without a complete overhaul of the existing design (Henfridsson et al. 2014; Kallinikos et al. 2013; Lee and Berente 2012). This makes it possible for agents in digital ventures to reflectively reorient the innovation in search of ways to nurture and rejuvenate the user base growth rate.

In our quest to understand rapid scaling of digital ventures, we respond to previous calls for research on digital innovation (Yoo et al. 2010) and digital infrastructure (Tilson et al. 2010) to carefully examine the nature of generativity of digital technology as it unfolds in the hands of reflective agents. Understanding scaling as a generative process, rather than as a self-referential process, pays heed to the fact that digital technology is typically "designed without fully knowing the 'whole' design" (Yoo 2013, p. 230; see also Garud et al. 2008). Indeed, the flexibility afforded by digital technology (through separations of function–form and contents–medium) suggests the increasingly pivotal role of innovation in nurturing generativity. In our study of WeCash, therefore, we trace the mechanisms that contingently lead to rapid scaling of the user base.

Methods

We conducted an in-depth case study at a Chinese credit rating digital venture called WeCash. At the end of our study, WeCash had approximately 76 employees and a monthly turnover of 24 million RMB. Despite its short existence,[2] WeCash has been recognized for its digital innovations, receiving awards such as Baidu's Best Apps Award in the design category, and named as a World Top 50 Financial Service Innovation company jointly by AWI Venture Australia, PWC, and Financial Services Council.

WeCash was an extreme case. Extreme cases are "paradigmatic of some phenomenon of interest" (Gerring 2007, p. 101), and are useful for generating theory because of their high values on the variables in focus. First, attracting some 600,000 users after only 8 months of operation, the firm offered an excellent venue for studying rapid scaling of the user base. Second, WeCash was an exemplar digital venture in that its use of digital technology for credit rating both drew on and added to existing layers of digital infrastructure.

We collected extensive data on WeCash's rapid scaling of its user base through digital innovation using four methods (Table 1): interviews, participant observation, archival data, and informal dialogue.

[2]WeCash was founded in December 2013 as a spin-off from its holding company, Beijing Jiufu Era Investment Consultant Co. WeCash was a stand-alone business, and the scaling of the user base was independent of the parent company's user base. We thank one of the anonymous reviewers for pointing out the need to clarify this fact.

In particular, we conducted 57 semi-structured interviews with WeCash staff at different levels. We first interviewed the CEO and the five members of the management team responsible for credit, marketing, products, operations, and technology development/algorithms respectively. We then interviewed employees in the areas of online user service, user experience, product improvement, user interface design, risk control, credit assessment, artificial verification, and business development. All interviews were recorded, and yielded 653 pages of transcription.

The data analysis was a four-step, grounded, iterative process (Langley 1999; Strauss and Corbin 1998), as shown in Table 2, to derive the three scaling mechanisms.

First, we mapped the monthly user base and changes in growth rate (Figure 1) to elaborate WeCash's growth trajectory between January and August 2014. This mapping helped uncover specific periods of rapid growth and slow-down, which were used as a chronological backbone to the case narrative. We crosschecked the user base, growth rates, and slow-downs with the CEO.

Second, we identified and used three digital innovations as analytical filters to furrow and categorize concepts identified through open coding (Strauss and Corbin 1998). We focused on identifying each innovation's distinctive features, enabling digital technology, contributions to the user base, and significant organizational and strategic outcomes. These emerging findings were compared with Figure 1 to construct detailed case narratives.

The third stage of analysis was based on the principle of axial coding (Strauss and Corbin 1998), as the emerging concepts were iterated with the textual evidence and relevant literature. Central to this stage of analysis was clustering and differentiating the emergent concepts to further abstract their characteristics and empirical substance to derive the mechanisms of scaling. We derived three mechanisms and labeled them according to their empirical characteristics as *data-driven operation, instant release,* and *swift transformation* (as shown later in Figures 2, 3, and 4).

Finally, we focused on generating a model of rapid scaling through digital innovation (Figure 5). We conducted selective coding (Strauss and Corbin 1998) to flesh out how different scaling mechanisms interplay throughout the unfolding of the three digital innovations. The outcome resulting from this stage of data analysis was a conceptual model of rapid scaling of the user base through digital innovation.

Table 1. Data Collection	
Data Sources	**Total and Breakdown**
Interviews	57 interviews (mean length: 61 minutes) with 48 respondents generated word count of 680,000 (in Mandarin)
Participant observation	17 occasions, with average length of 45 minutes, include 6 project meetings, 3 workshops, 3 gate review meetings and 5 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 specifications
Informal dialogue	With the CEO and four out of the five members of the management team during our field visits, inclduing 31 phone conversations with the CEO between April and September 2014.

| Table 2. Stages of Data Analysis		
Stages	**Tasks**	**Outputs**
1. Identify the growth of user base	1. Map the monthly user base and growth rate to construct WeCash's growth trajectory over an 8-month period. 2. Cross-check the user base, growth rate, and slow-downs with the CEO.	Measures of monthly user base and growth rate (Figure 1)
2. Construct case narrative	1. Identify and use specific digital innovations to filter and categorize concepts from open coding (Strauss and Corbin 1998) by focusing on depicting each innovation's main features, enabling IT artifacts, contributions towards user base growth, and outcomes. 2. Develop a case storyline to depict the recursive pattern of how each innovation helped to generate, re-energize, and sustain rapid growth of user base. 3. Ensure trustworthiness and reliability of open coding by establishing theoretical saturation.	3 distinctive digital innovations at WeCash
3. Identify scaling mechanisms through axial coding	1. Conduct axial coding (Strauss and Corbin 1998) to identify mechanisms and sensitize the emerging findings in view of case evidence and relevant literature. 2. Consider how each mechanism relates to, yet differs from, the other mechanisms, querying: Are the three mechanisms distinctive conceptually and empirically? How do they relate to each other? 3. Derive three mechanisms and each mechanism's relevant components. 4. Enhance trustworthiness and reliability of axial coding by establishing theoretical saturation.	3 scaling mechanisms (Figures 2, 3 and 4)
4. Generate model of rapid scaling	1. Build on findings emerging from Stages 2 and 3 to examine how the analytically distinctive but interrelated mechanisms work over time to enable rapid scaling. 2. Iteratively compare the emerging conceptual model with case evidence and existing literature related to growth, digital technology and innovation, querying: Is the conceptual model capable of capturing the unfolding of digital innovation at WeCash? Have these mechanisms been concep-tualized by prior accounts? 3. Compare the newly generated rapid scaling model with literature in digital innovation, digital technology and growth. 4. Further enhance trustworthiness and reliability of findings by obtaining feedback from the case organization's CEO and a member of its management team.	Conceptual model (Figure 5)
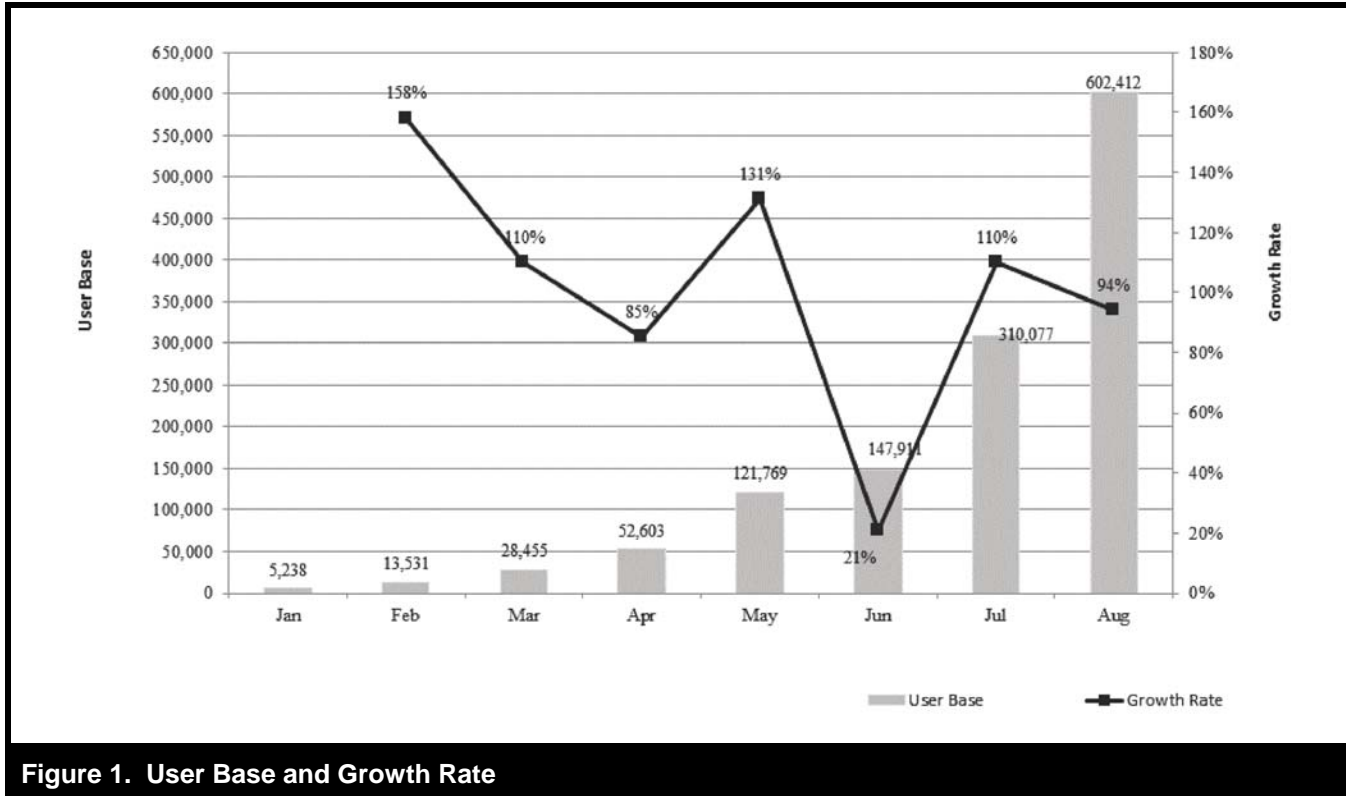
Figure 1. User Base and Growth Rate

Eight Months of Scaling at WeCash ■■■

WeCash reached over 600,000 users in the 8 months following its establishment in December 2013, doubling its user base almost every month (see Figure 1). As a digital venture in the credit business, WeCash constantly focused on how to scale the user base. However, its rapid scaling was not a smooth exponential process.

It was punctuated by two short yet distinctive slow-downs in April and June 2014 (Figure 1), when the growth rate fell compared to previous months. In response to each slow-down, WeCash managed to reenergize user growth through digital innovation. In what follows, we present WeCash's rapid scaling, and use the case findings to trace how it is contingently caused by three mechanisms: data-driven operation, instant release, and swift transformation.

Online Micro-Lending Company

In January 2014, WeCash launched an online micro-lending service that was different from other micro-lending services in China. The service constructed a user's credit profile and rating primarily based on her social media usage and online

presence. This took only 20 minutes. Such an improvement in waiting time (the industry norm was 3 to 4 working days) was enabled by radical changes to the information used and the way loan applications were processed.

WeCash's online service crawled and used more than 6,000 sources of data, including social media data (user-provided) and online behavior data (sourced from over 40 organizations, such as mobile operators and Internet service providers) to construct users' credit profiles and rating. Rather than using traditional measures such as income, assets, and spending patterns, the service used an algorithm including 11 weighted variables, such as occupation, position, residence, qualifications, habit, social media usage pattern, social media influence, social network, purchase power, and online bills/ receipts. In doing this, WeCash focused on users' *willingness to repay*, instead of solely on *ability to repay* as most other vendors.

There were at least two ways that made the service stand out. First, WeCash provided micro-loans to users who did not have a credit history and were unable to produce documents required to construct conventional credit profiles. Second, moving away from scanned documents and paperwork, WeCash made speedy application processing into a unique selling point. As the Operations Manager explained,

> Taking 3 or 4 days to approve a loan is pretty much the standard in this market. When you consider how long it will take banks to make a decision, we are talking an even longer time frame....I suppose the most uncomfortable part for the users is the wait. It is the uncertainty and anxiety that really put people off....We were thinking "why don't we change that?"

WeCash's micro-lending service grew rapidly in the first three months. However, April 2014 saw a significant slow-down in growth (see Figure 1). Managers, who continuously monitored the user growth, were alarmed and felt that they needed to reshape the service to reinstate growth. After considering multiple options, WeCash decided to leverage its credit rating technology by launching an online credit rating service that targeted what they referred to as "2+5" users (people in the range of 2 years before, and 5 years after, university graduation). WeCash reasoned that such users would have strong incentives to build their credit histories.

Online Credit Rating Service

In mid-April 2014, just days after recognizing the need for transformation, WeCash launched its online credit rating service. Users of the new service needed to submit their personal and social media accounts information, and would in return obtain a free credit rating report including interpretational guidance and suggestions on how to improve the credit rating. A micro-loan would then be offered if a positive credit rating was completed. The service was launched as the management team was increasingly obsessed with having a large user base. As the CEO pointed out,

> Interestingly, most of the successful e-commerce companies in China do not make money out of their core business, but other services derived from their core. Nevertheless, key to this rather unusual way of operation is a large user base. Hence, how to grow and retain users is undoubtedly our most important agenda.

Consistent with this view, the online service was free, in order to generate as large a volume of user data as possible. The management's idea was that a larger user database would enable effective machine learning and the ability to improve the credit rating and risk assessment algorithm. In addition, large volumes of user data were seen as useful when exploring ventures with existing and future data suppliers, such as mobile service providers. Furthermore, the data could help improve the user experience. As the Chief Data Officer noted,

> We hope that through the more and more powerful background information support, we can allow our users to provide as little information as possible. If their information is already in our database, there is less need for our users to enter information. This could enhance the user experience.

As witnessed by WeCash's management, the free online credit rating service proved to be effective in growing the user base in two different ways. First, the service helped to attract users curious about credit ratings but without immediate financial needs. Second, there was a sharp increase in sharing across users' social networks, in particular among the "2+5" segment, which benefited WeCash from online word-of-mouth for new user recruitment.

Despite the popularity (manifested in the third position on Baidu's mobile assistant chart in the "personal finance" category), WeCash's user base growth slowed down considerably toward the end of June 2014. The management team was again alerted, and intensified its tinkering with new designs that would help them reach the targeted user base of 1 million by the end of 2014.

Credit Note Service

Ongoing tinkering with its technology and corresponding reflection by the management team resulted in a third digital innovation—a credit note service—launched in mid-June 2014. This service was launched to stimulate repeat use, so that WeCash could retain users more effectively. Moreover, this innovation was deemed to help reach larger market segments, as nearly 500 million Internet and mobile users did not have credit history for accessing conventional loans and credit cards.

The new credit note service enabled users to quickly set up credit of up to 5,000 RMB (about $800), usable for online shopping, various offline payments, and deposits. Users could purchase goods through online and affiliated offline organizations by providing account details or QR code based on the agreed credit limit. The service was a personal loan, except users did not receive any cash, but had WeCash as the paying agent for their transactions.

This digital innovation surfaced one technological challenge, which was to significantly minimize the time required for generating credit ratings. Initially, the 20-minute process for loan decisions was an unthinkable breakthrough in China's credit industry. However, for the credit note service, 20 minutes were deemed too long, since it could easily disrupt

the flow of an online transaction. As the product manager explained, users had significantly different expectations for the credit note service, and "waiting for 20 minutes was simply not part of it." WeCash therefore continuously released new versions reflecting improvements in technology including their algorithm. While the CEO had five minutes, or even one minute, in mind for the future, in July 2014, the average credit assessment was down to 15 minutes.

In our research, we studied a remarkable phenomenon of rapid scaling over 8 months. Our analysis yielded a number of recursive patterns in how rapid scaling of WeCash's user base was accomplished through digital innovation. In what follows, we elaborate these patterns in the form of three generative mechanisms.

Three Mechanisms

Data-Driven Operation

Our data analysis revealed a distinct ability of WeCash to generate digital innovations addressing seemingly untapped areas of the credit market. The starting-point of such innovation was the vast amounts of data captured through user submission, in-house and common digital infrastructures, as well as data sourced externally (e.g., National Statistic Bureau, mobile operators, and e-commerce sites). This was done both to generate and frame something entirely new, and to upgrade and refine what already existed. We refer to this ability as the mechanism of *data-driven operation*. It depicts the process by which digital ventures frame, hedge, and monitor innovation opportunities and risks through analyzing significant volumes of data.

This mechanism was imperative for the ways by which WeCash challenged conventional industry norms, including the emphasis on willingness to repay, social media-based credit profiles and ratings, and credit note services. It stimulated WeCash to periodically reflect and transform its venture identity.

WeCash's data-driven operation should be comprehended in view of a credit industry where user data was, as described by the CDO, "highly unstructured, largely paper-based and failed to capture and reflect the majority of the market." WeCash viewed these inherent market inefficiencies and infrastructural constraints as unique innovation and growth opportunities. The mechanism involves at least three distinctive sets of data-driven activities (see Figure 2). First, *user profiling* helps identify innovation opportunities that can be progressed and

subsequently launched. It refers to the utilization of user data to identify and explore uncharted areas such as new user segments. The second activity involves *decision hedging*, which refers to the activities by which digital ventures use established and novel data types for assessing the risk of its innovation. The third activity involves *fine-grained monitoring* of the user base data including growth/decline rates, usage patterns, new applications, cash flow, and systems performance. At WeCash, a digital dashboard, using green to indicate normal operation, red to alert bugs, amber to signpost queues, and grey to show items-in-waiting, supplied real-time information for weekly company meetings intended to devise actions for maintaining rapid scaling.

Instant Release

Our data analysis showed a significant ability of WeCash to promptly materialize and launch innovations. This ability was not merely reflected in the distinct breakthrough innovations reported here, but also in the sheer amount and rapid actualization of new versions, upgrades, and added functionalities. We refer to this mechanism as *instant release* to denote the ability by which digital ventures minimizes the time gap between service idea and deployment by concurrently running user-responsive service trialing and modification. The significance of this mechanism needs to be understood within a market where users move on very quickly as they become attracted by other innovations. As WeCash's Marketing Manager explained, "there is a strong craving for cool things and high tolerance of imperfection." Understandably, in such a context, how innovation resources were prioritized to launch innovations was key.

We found three activities supporting the functioning of instant release (see Figure 3). First, instant release involves *launching*, which depicts the activities that digital ventures undertake to consolidate and channel internal resources and prioritize data-driven operations toward fueling the launch of innovations. Second, instant release is also enabled by *concurrent trialing*. Such trialing involves activities of testing different services and service versions in parallel to enable multidimensional user feedback. Based on the feedback, ongoing modifications of the innovations were expected and realized. We also traced a third activity, which we term *reactive modification*, that involves the immediate changes undertaken by a digital venture to an established service in view of users' reactions and feedback. In addition, continuous changes accumulated the need to periodically transform the digital venture to reflect what they did and who they were, which is detailed in the following mechanism.
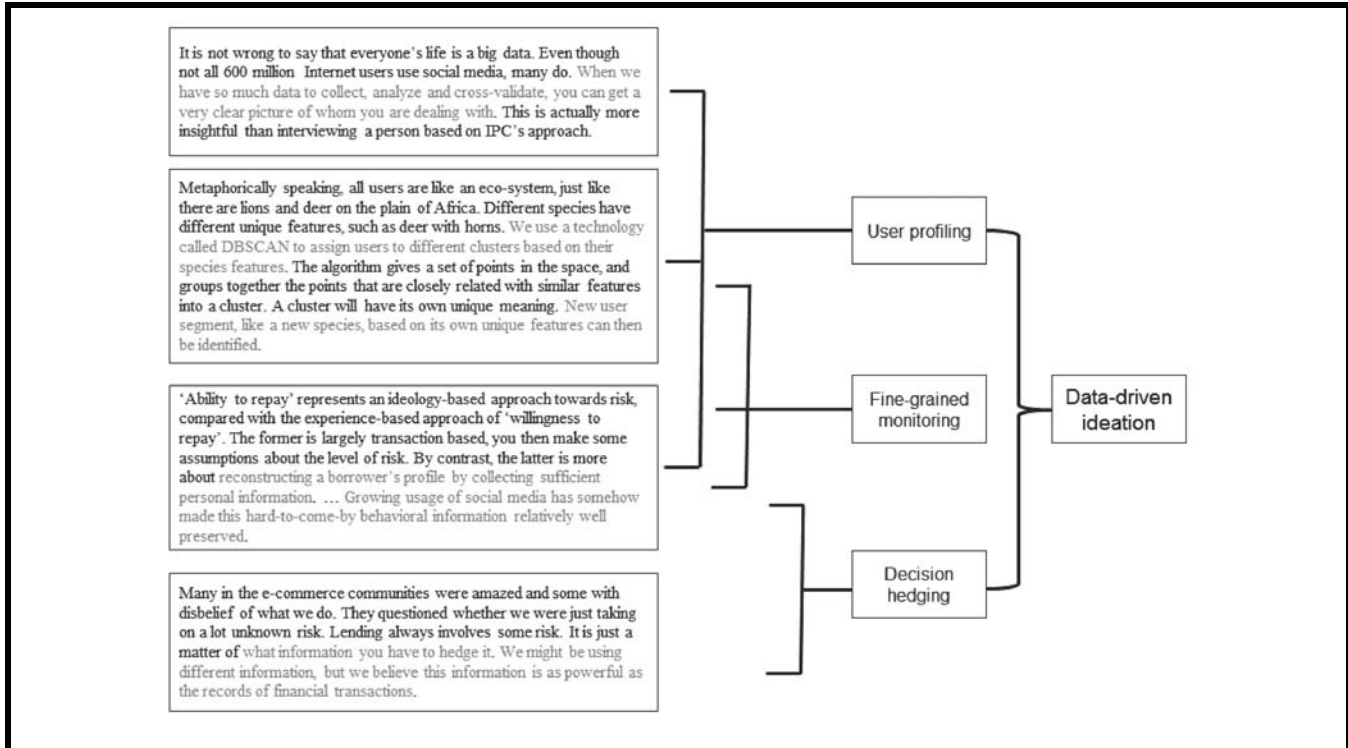
It is not wrong to say that everyone's life is a big data. Even though not all 600 million Internet users use social media, many do. When we have so much data to collect, analyze and cross-validate, you can get a very clear picture of whom you are dealing with. This is actually more insightful than interviewing a person based on IPC's approach.

Metaphorically speaking, all users are like an eco-system, just like there are lions and deer on the plain of Africa. Different species have different unique features, such as deer with horns. We use a technology called DBSCAN to assign users to different clusters based on their species features. The algorithm gives a set of points in the space, and groups together the points that are closely related with similar features into a cluster. A cluster will have its own unique meaning. New user segment, like a new species, based on its own unique features can then be identified.

'Ability to repay' represents an ideology-based approach towards risk, compared with the experience-based approach of 'willingness to repay'. The former is largely transaction based, you then make some assumptions about the level of risk. By contrast, the latter is more about reconstructing a borrower's profile by collecting sufficient personal information. … Growing usage of social media has somehow made this hard-to-come-by behavioral information relatively well preserved.

Many in the e-commerce communities were amazed and some with disbelief of what we do. They questioned whether we were just taking on a lot unknown risk. Lending always involves some risk. It is just a matter of what information you have to hedge it. We might be using different information, but we believe this information is as powerful as the records of financial transactions.

User profiling

Fine-grained monitoring

Decision hedging

Data-driven ideation

Figure 2. The Mechanism of Data-Driven Operation

This is a very user volume- and traffic-sensitive business. Our way of working is pretty much centered around finding out what makes our users tick… We do have a unique technology which allows us to keep coming up with creative services to wow our users. We know that if we don't come up with new tricks, users will not see the need of coming back to us anymore.

User feedback has been used extensively to design our new version and modify our existing services. When the time to release a new version is scheduled, we will commit all our resources to make sure that we get it out on time… For the major release, we will involve actual users for testing. Otherwise, we will just test it internally.

We are growing and serving very different segments of users with distinctive preferences and usage habits. To make sure that we satisfy as many users in each segment as possible, we have different versions for each service we run… Each version is trialed, released and modified in parallel to others. Basically, we don't want to fix things that are working, but we change our services extremely quickly, as all know that this is a market where 'one size does not fit all.'

We do make some adjustments, even after a version is launched. From each adjustment, we go on to analyze users' data, such as, has the conversion rate improved? Has the number of active users increased? If not, we will withdraw the APP in a couple of days and replace it with an alternative immediately. If yes, we would continue.

The 2+5 users are constantly using different sites all the time. They are very used to a certain style of interface. If the user interface was not something they are familiar with, they can feel it rather quickly.

Launching

Concurrent trialing

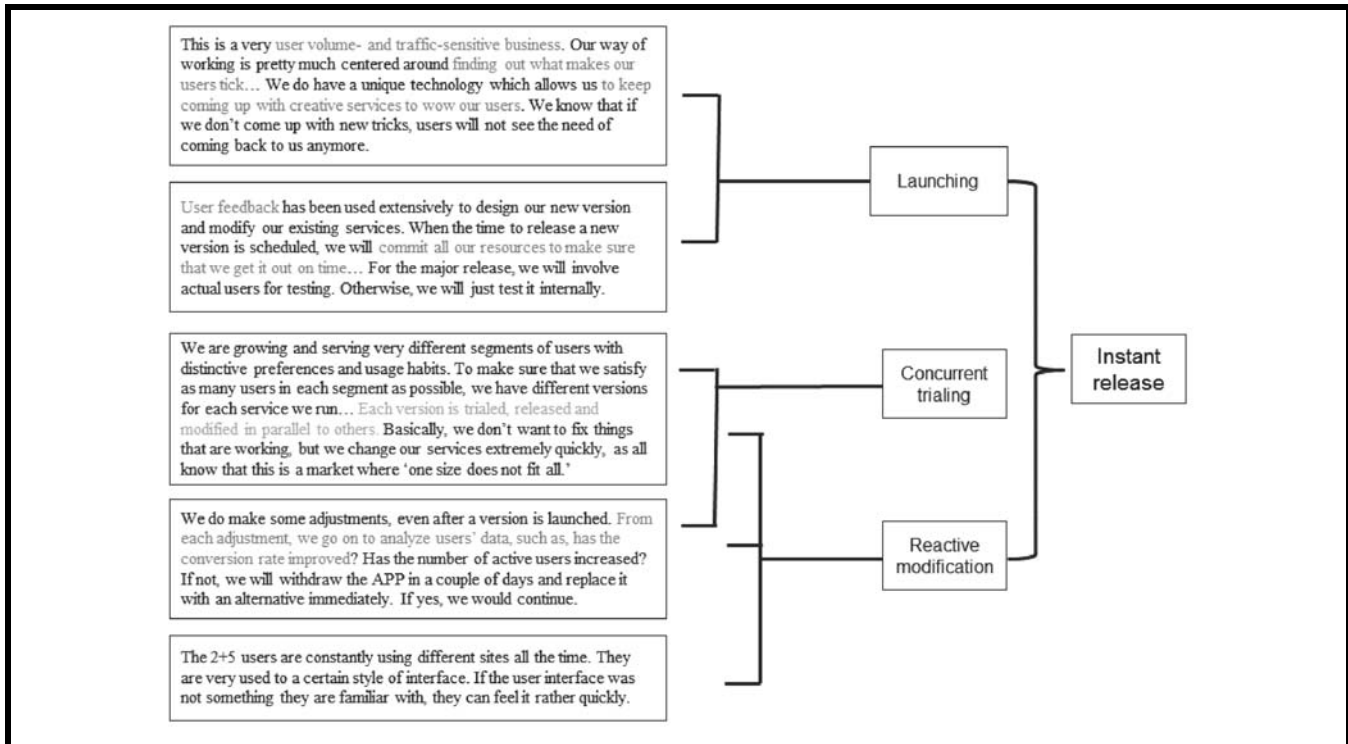Reactive modification

Instant release

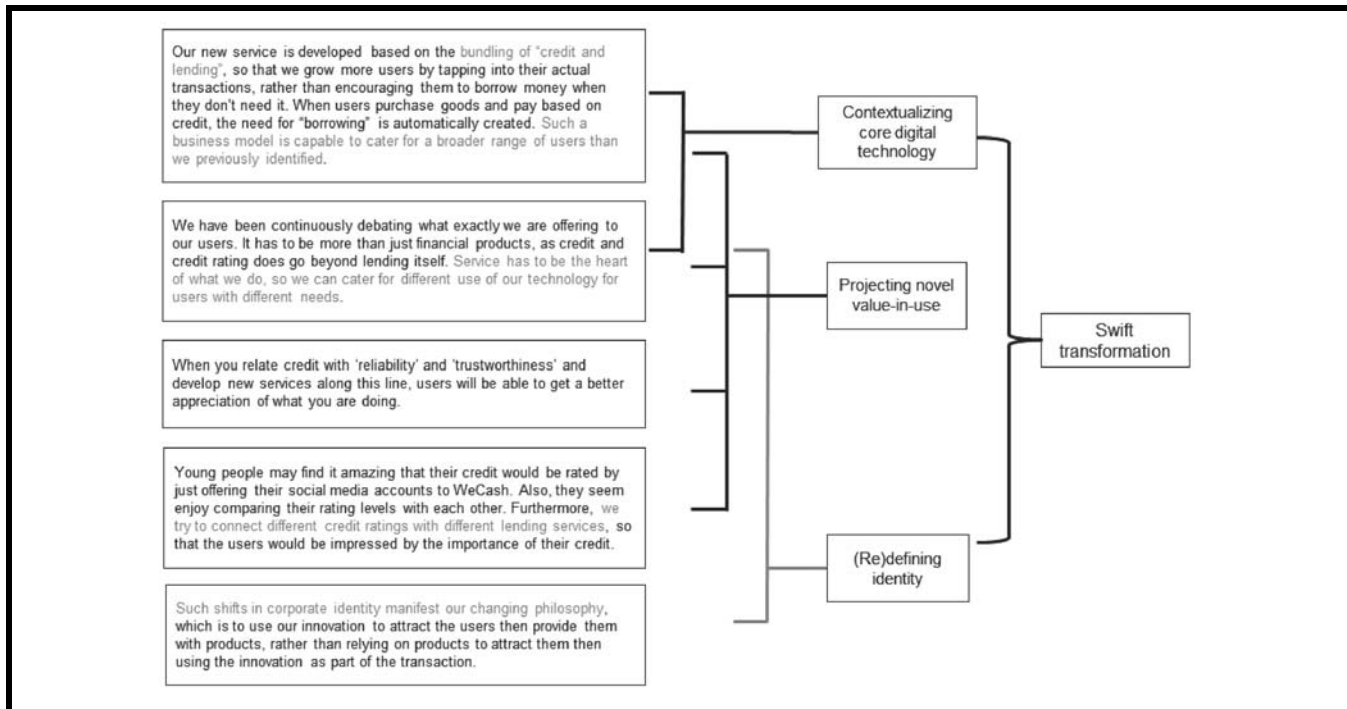**Figure 3. The Mechanism of Instant Release**

Figure 4. The Mechanism of Swift Transformation

Swift Transformation

Our data analysis surfaced another interesting phenomenon, which was how WeCash managed to effectively construct what the digital venture did three times over the 8-month study period. We refer to this mechanism as *swift transformation*, elaborated in Figure 4, to describe the ability by which a digital technology is effortlessly contextualized to project new value-in-use and new venturing identity. Compared with data-driven operation and instant release, the mechanism of swift transformation occurs less frequently, and is triggered only when a distinct effort to generate a new wave of rapid scaling of the user base is initiated by the digital venture.

The functioning of this mechanism is supported by three concepts. First, it is supported through *contextualizing core digital technology*, which refers to the activities of concep-tualizing core digital technology for a new business context. Even though each innovation at WeCash was distinctive in its design, all were based on the core in-house digital technology whose architecture remained largely unchanged over the 8-month period. For instance, the credit-rating technology, used for supporting micro-lending decisions, was foregrounded to become a service on its own, then subsequently used to enable the credit note service. Leveraged by the contextualization of

core digital technology into different services, managers were able to quickly come up with new values through using the services and to make adjustments in governing the func-tioning of data-driven operations.

Another concept, termed *projecting novel value-in-use,* cap-tures how managers anticipate and manifest novel benefits of a digital innovation to attract and engage existing and new users. These activities were found to be valuable for WeCash's managers to continuously rationalize their launched innovations. Third, (*re)defining identity* represents digital ventures' recurring definition of what they do and who they are. The continuous shifts in WeCash's overall direction transformed its venturing identity. For instance, starting as an online micro-lending company (December 2013), WeCash then repositioned itself as an online credit rating company (May 2014), and then subsequently to a new financial service company (July 2014).

Implications and Conclusions

A defining feature of scaling in digital ventures is the speed by which the user base grows. The starting-point of such speed is the winner-take-all perception (Eisenmann et al. 2006; Schilling 2002) materialized in an entrepreneurial spirit

and attentiveness to slow-downs in growth rate among reflective actors actively seeking to keep the momentum going (see Garud et al. 2010). This is imperative as digital ventures compete head-to-head with heterogeneous and distributed actors seeking to make their way on top of the same, or overlapping, infrastructure (Tilson et al. 2010; Yoo et al. 2012). Our research, summarized in Figure 5, offers a substantive look at the mechanisms underpinning attempts to rapidly scale the user base as it played out at WeCash.[3] In what follows, we discuss the implications for research and practice.

Research Implications

Our research contributes to the emerging digital innovation literature (Kallinikos et al. 2013; Lusch and Nambisan 2015; Nambisan 2013; Svahn et al. 2017; Tilson et al. 2010; Yoo et al. 2010, 2012) by providing three mechanisms (data-driven operation, instant release, and swift transformation) by which digital ventures innovate to rapidly scale their user base. Recognizing "the new organizing logic of digital innovation" (Yoo et al. 2010), prior literature underlines the malleability by which digital technology can be redesigned to cater for new circumstances (Kallinikos et al. 2013; Yoo et al. 2012), and the inclusiveness of the innovation process as digital technology's inexpensiveness as production technology allows many people to participate (Benkler 2006). With these aspects in mind, it has been suggested that digital ventures can attract new users rapidly as generative processes kick in (Tilson et al. 2010; Yoo et al. 2010). However, there exist few, if any, attempts to zoom in on the mechanisms underpinning such scaling and how reflective agents put these mechanisms in action.

In what follows, we develop propositions that express the relationships between the mechanisms and provide directions for future research.

Data-Driven Operation

Recall that data-driven operation refers to the mechanism by which digital ventures frame, hedge, and monitor innovation

opportunities and risks through analyzing significant volumes of data. Enabled by the malleability of digital technology and the separation of contents and medium (Yoo et al. 2010), the digital venture can then continuously monitor, cross check, and probe user reactions to aspects related to the innovation. Through data-driven operation, multiple data sources can be pooled and processed almost on a real-time basis to frame new market segments and to manage and mitigate risks and uncertainties associated with digital innovation. This helps create an abundance of options in a given time period. In this regard, data-driven operation affects instant release by influencing the frequency through which options for innovation can be generated and progressed.

> *Proposition 1a*: Data-driven operation will generate more options for innovation and subsequent launch than operations that do not rely on data generated through digital infrastructures.
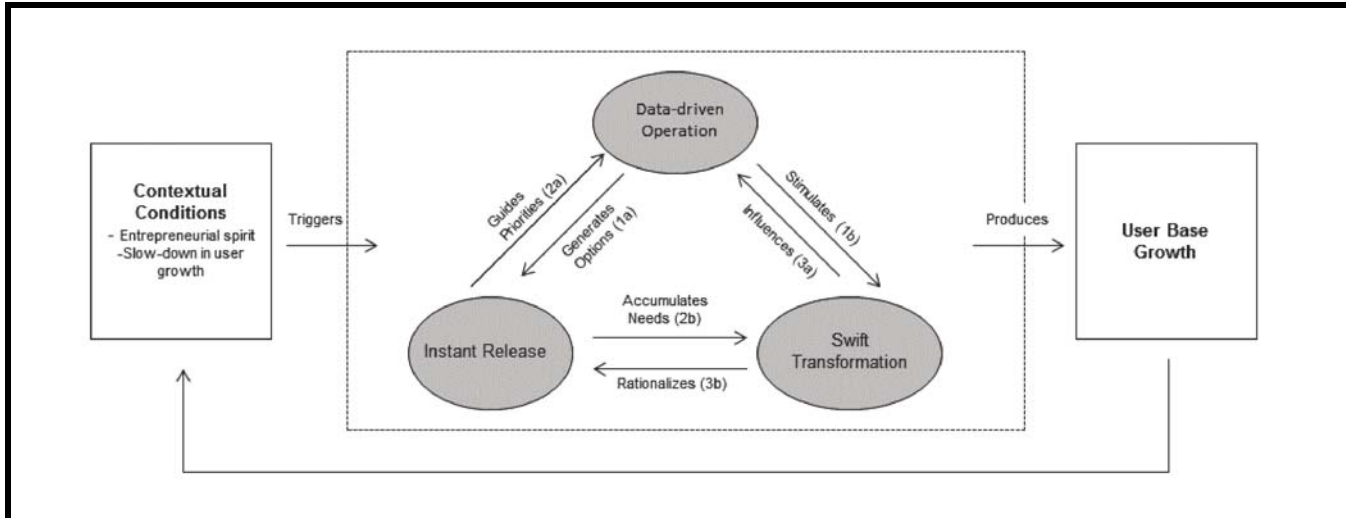
Another important aspect of data-driven operation is how the mechanism involves the continuous deployment of user data to frame new areas, where, if targeted, the digital venture hypothesizes that additional user base can be scaled. Framing of new areas will potentially stimulate reflective agents to look into the heart of their activities and to what extent they are compatible with how they view and present themselves, as detailed in the case of WeCash. This implies that data-driven operations may stimulate the mechanism of swift transformation, specifically initiatives to transform the digital venture.

> *Proposition 1b*: Data-driven operation will stimulate swift transformation based on recontextualization of core technology, projection of novel value-in-use, and new venturing identity to a greater extent than operations that do not rely on data generated through digital infrastructures.

Data-driven operation is a powerful mechanism in its production of raw material for the scaling of digital ventures. The raw material is a host of data, clusters, algorithms, and analyzing practices. In fact, this difference in inputs suggests a qualitatively different starting-point of value-creation than Porter's (1985) classic value chain, inviting future research on the role of data-driven operation for the creation of business value within the frame of the digital venture.

Instant Release

Our research demonstrates the abilities of digital ventures to minimize the time gap between service idea and deployment by concurrently running user-responsive service trialing and

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[3]One of the anonymous reviewers rightfully pointed out that marketing efforts by WeCash could have contributed to the increase of the user base. We do recognize that marketing can be a necessary component in growing a user base. In response to this potential confounder in our study, however, we reconnected with the CEO of WeCash to learn that, during the 8 months studied, there was no specific marketing intervention, as in the form of increased marketing budget and/or changed channels, designed to reenergize user growth.

Mechanisms	Definition	Components
Data-driven operation	The mechanism by which digital ventures frame, hedge, and monitor innovation opportunities and risks through analyzing significant volumes of data.	• ***User profiling***: The utilization of user data to identify and explore uncharted areas, such as new user segments, so as to identify innovation opportunties. • ***Decision hedging***: The activities by which digital ventures use established and novel data forms for assessing the risk of its innovation. • ***Fine-grained monitoring***: The activities that managers enact to comrehend innovation performance by collecting, analyzing, and evaluating usage data such as growth rates, use patterns, new applications, cash flow, and systems performance.
Instant release	The mechanism by which digital ventures minimize the time gap between service idea and deployment by concurrently running user-response service trialing and modification.	• ***Launching***: The activities that digital ventures undertake to prioritize, consoli-date, and channel internal resources toward fueling the launch of innovation. • ***Concurrent trialing***: The activities of testing different services and service versions in parallel to enable multidimensional user feedback. • ***Reactive modification***: The immediate changes undertaken by a digital ven-ture to an established service in view of users' reactions and feedback.
Swift transformation	The mechanism by which digital technology is effort-lessly contextualized to create new value-in-use and new venturing identity.	• ***Contextualizing core digital technology***: The activities of rethinking a core in-house digital technology for a new business context. • ***(Re)defining identity***: Digital venture's recurring definition of what it does and what it is.

Figure 5. The Mechanisms of Rapid Scaling Through Digital Innovation

modification. Because of the separation between the function (e.g., credit rating service) and the form (e.g., smartphone), and that contents can be reproduced at virtually no cost (Brynjolfsson and Saunders 2006; Shapiro and Varian 1999), digital ventures, such as WeCash, can afford tinkering with multiple services, often in parallel, and enable user-responsive modification quickly.

Since instant release is dependent on user data, the relative success of the services instantly released will reflect back on the ways by which data is generated. Reflective actors, as the management team of WeCash elaborated earlier, will learn from releases and prioritize activities of data-driven operation.

Proposition 2a: Instant release will guide short-term priorities of data-driven operation in terms of user profiling, decision hedging, and fine-grained monitoring.

Concurrent trialing of different services will create numerous cases where anomalies are created. As reflected in the case narrative, anomalies can serve as the source of innovation and a rethinking of the identity of a business. This implies that releasing new services will trigger reflective actors to construct new meanings of a business, as it is manifested in technology, value, and identity.

Proposition 2b: Instant release will accumulate needs for a digital venture to recontextualize its core technology, project novel value-in-use, and transform its venturing identity.

Prior research points out how information goods offer negligible marginal costs (Benkler 2006; Shapiro and Varian 1999), providing great potential for design scalability (Henfridsson et al. 2014). Our research adds to this research by explicating instant release as a mechanism that describes how negligible marginal cost drives rapid scaling as it minimizes the time needed to move a service idea into the market.

Swift Transformation

This mechanism denotes the digital venture's abilities to effortlessly contextualize its core digital technology for creating new value-in-use and new venturing identities, when dedicated attempts to rapidly scale the user base are initiated. As in any innovation, meaning-making is key, as it is integral to the articulation of new value-in-use (Boland and Collopy 2004; Lusch and Nambisan 2015; Verganti 2009). However, what is distinctive to the context of digital ventures is that the meaning-making process is interwoven with their core technology. For instance, the business idea of WeCash could not be separated from the algorithm and technology that mediated it.

The idea of what a digital venture does and what it is provides a frame for which data is relevant and how it should be collected. For instance, as WeCash started to view itself as an online credit rating service focusing on "2+5" users, data-driven operation shifted toward young people with limited credit records, which reshuffled priorities in data collection. This indicates that the mechanism of swift transformation will influence the operations of the data-intensive digital venture by providing cognitive directions.

Proposition 3a: The results of swift transformation will influence the way by which digital ventures frame their innovation opportunities, hedge their innovation decisions, and monitor the performance of their innovation.

Similarly, changes in the cognitive basis for how to create new value-in-use and for interpreting their core technology will also provide new means for thinking about instant release. Instant release requires ways to rationalize what should be released, since agility feeds on programmed behavior where little reflection is needed.

Proposition 3b: The results of swift transformation will impact the ways digital ventures rationalize their efforts in launching, concurrent trialing, and reactive modification of innovations to achieve programmed behavior.

Swift transformation complements prior research on identity shifts in the context of digital transformation (e.g., Tripsas 2009) with a perspective on how identity change can come about quickly. The mechanism suggests a qualitative difference in pace between the digital ventures and incumbent firms. However, in times when digital technology is embedded in physical products like cars, both rhythms (the rhythm of the physical and the rhythm of the digital) must be handled within the same innovation process, and future research on this topic would be useful.

Practical Implications

Our research comes with a number of practical implications. First, it underlines how firms in the digital era view the user base as a precondition for creating a customer base. While users do not directly contribute to the revenue of a digital venture, a significant amount of users is a necessary condition for making a commercially successful firm. This fact calls for managerial interventions to maintain a focus on the way by which innovation is managed to generate rapid scaling of the user base. With a large user base in place, the space of possible ways to monetize the digital innovation will be greater. Second, our research shows that slow-downs in user growth may serve as excellent starting-points for reinvention. Managers should, therefore, consider how to best put in place capabilities to detect changes in growth rate. Third, firms engaged in digital innovation are in a useful position to explore uncharted territory by synthesizing user data in conjunction with other data sources for managing the market uncertainty and mitigating the risk. The mechanism of data-driven operation reveals how digital ventures can effectively manage this through improved data analytical skills and machine learning. Fourth, firms invest a considerable amount of effort to grow their user base, but also need to generate "stickiness" to ensure that users perceive the need to reuse the service. Activities such as launching, concurrent trailing, and reactive modifications can be introduced and nurtured in fostering and leveraging such generation. Finally, even though the malleability of digital technology sometimes is taken for granted, managers rarely consider how to make the organization equally malleable. Our findings suggest that digital ventures need to be capable of transforming themselves, and of constructing a venturing identity that matches their service offering.

Limitations and Conclusions

There are limitations inherent to our research. First, while WeCash serves as a great example of scaling the user base through digital innovation, we recognize the relevance of marketing and venture capital in stimulating and sustaining user growth. There certainly exist digital ventures where innovation is complemented with significant marketing efforts funded through venture capital. In future research, it would be useful to closely study the interactions between data-driven operation, instant release, swift transformation, and such marketing efforts. Second, our study did not specifically study how the mechanisms can individually influence a digital venture along its scaling trajectory. We did note how all mechanisms were at play with reference to all three digital innovations. Clearly, future research could comprehensively look into the sequences of scaling to better understand how the mechanisms configure across time.

Despite the limitations, though, we believe that our research on scaling the user base of digital ventures helps break new ground in the study of growth and innovation in an era of digitalization. We suggest that traditional measures of firm growth should be revisited. We also propose that innovation is imperative for scale, a proposition unheard of at the great industrial enterprises rigorously documented by Chandler (1962). We hope that our research can stimulate further work in the area and provide a foundation for theory development.

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