Growing on steroids: rapidly scaling the user base of digital ventures through digital innovation

Article (Accepted Version)

Huang, Jimmy, Henfridsson, Ola, Liu, Martin and Newell, Susan (2017) Growing on steroids: rapidly scaling the user base of digital ventures through digital innovation. MIS Quarterly, 41 (1). pp. 301-314. ISSN 0276-7783

This version is available from Sussex Research Online: <http://sro.sussex.ac.uk/id/eprint/60328/>

This document is made available in accordance with publisher policies and may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the URL above for details on accessing the published version.

Copyright and reuse:

Sussex Research Online is a digital repository of the research output of the University.

Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable, the material made available in SRO has been checked for eligibility before being made available.

Copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

GROWING ON STEROIDS: RAPIDLY SCALING THE USER BASE OF DIGITAL VENTURES THROUGH DIGITAL INNOVATION

Jimmy Huang
Warwick Business School, The University of Warwick
Coventry CV4 7AL UNITED KINGDOM
jimmy.huang@wbs.ac.uk

Ola Henfridsson
Warwick Business School, The University of Warwick
Coventry CV4 7AL UNITED KINGDOM
ola.henfridsson@wbs.ac.uk

Martin J. Liu
Nottingham University Business School China,
The University of Nottingham Ningbo China
Ningbo 315100 CHINA
Martin.Liu@nottingham.edu.cn

Sue Newell
School of Business, Management and Economics
University of Sussex
Brighton BN1 9RH UNITED KINGDOM
Sue.Newell@sussex.ac.uk

About the Authors

Jimmy Huang is Associate Professor (Reader) of Information Systems and Assistant Dean at Warwick Business School, the University of Warwick. His research focuses primarily on organizational, social and strategic issues related to the implementation of information system and capability innovations, and many of these innovations are digitally afforded. Jimmy's research has been published in journals, such as Information & Management, Journal of Strategic Information Systems, IEEE Transactions on Engineering Management and European Journal of Information Systems. He is the Associate Editor of Information & Management.

Ola Henfridsson is a Professor and the Head of the Information Systems and Management Group at Warwick Business School, University of Warwick, United Kingdom. He is also a visiting professor of the Swedish Center for Digital Innovation at University of Gothenburg, Sweden. His research interests relate to the transformative potential of digital technology as it pervades modern business and entrepreneurship. Ola's research has been published in world elite journals such as Information Systems Research, MIS Quarterly, and Organization Science. He is a Senior Editor of Information Systems Research and Journal of Information Technology. He is a former Senior Editor of the MIS Quarterly.

Martin J. Liu is an Associate Professor in Marketing and Innovation, and the Head of the Entrepreneurship, Marketing and Management System Department at Nottingham University Business School China, The University of Nottingham Ningbo China. His research interests are largely in the area of branding and digital marketing innovation. His research has been published in Journals, such as Journal of Business Research, International Journal of Production Research and International Journal of Production Economics.

Sue Newell is Head of the Department of Business and Management and a Professor of Information Systems and Management, at Sussex University. She has most recently worked at Bentley University in the USA and at Warwick University in the UK. She has a BSc and PhD from Cardiff University, UK. Sue's research focuses on understanding the relationships between innovation, knowledge and organizational networking (IKON) - primarily from an organizational theory perspective. She was one of the founding members of IKON, a research center based at Warwick University (<http://www2.warwick.ac.uk/fac/soc/wbs/research/ikon/>). Her research emphasizes a critical, practice-based understanding of the social aspects of innovation, change, knowledge management and inter-firm networked relations. Sue has published over 100 journal articles in the areas of information systems, organization studies and management, as well as numerous books and book chapters.

GROWING ON STEROIDS: RAPIDLY SCALING THE USER BASE OF DIGITAL VENTURES THROUGH DIGITAL INNOVATION

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 (cf. 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-it-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 behavior" (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 (cf. 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 digital ventures' careful attention, 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 (cf. 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. forthcoming; 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.

Rapidly Building the User Base through 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 (cf. 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 existence¹, 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.

Data Sources and Analysis

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.

¹ 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.

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, including 31 phone conversations with the CEO between April and September 2014.

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.

Table 2. Stages of Data Analysis

Stages	Tasks	Outputs
1. Identify the growth of user base	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 conceptualized by prior accounts? 3. Compare the newly generated rapid scaling model with literature in digital 	Conceptual model (Figure 5)

	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.	
--	--	--

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 chorological 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 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.

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 re-energize 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.

Digital Innovation at WeCash

Online Micro-lending Company

In January 2014, WeCash launched an online micro-lending service that was different to 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 3rd position on Baidu's mobile assistant chart in the "personal finance" category), WeCash's user base growth slowed down considerably towards 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 in the management team resulted in a third digital innovation – a credit note service – launched in mid-June 2014. This service was launched to stimulate repeated 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 a 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.

Figure 2. The Mechanism of Data-driven Operation

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 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 towards 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 multi-dimensional 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 needs to periodically transform the digital venture to reflect what they did and who they were, which is detailed in the following mechanism.

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 through *contextualizing core digital technology*, which refers to the activities of conceptualizing 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 functioning of data-driven operations.

Another concept, termed *projecting novel value-in-use*, captures 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 winner-take-it-all perceptions (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 (cf. 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 user base as it played out at WeCash². 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; Nambisan 2013; Lusch and Nambisan 2015; Svahn et al. forthcoming; 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.

² 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 re-energize user growth.

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 exists 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, crosscheck, 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.

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.	<ul style="list-style-type: none"> - User profiling: The utilization of user data to identify and explore uncharted areas, such as new user segments, as to identify innovation opportunities. - 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 comprehend 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-responsive service trialing and modification.	<ul style="list-style-type: none"> - Launching: The activities that digital ventures undertake to prioritize, consolidate, and channel internal resources towards fueling the launch of innovation. - Concurrent trialing: The activities of testing different services and service versions in parallel to enable multi-dimensional user feedback. - Reactive modification: The immediate changes undertaken by a digital venture to an established service in view of users' reactions and feedback.
Swift transformation	The mechanism by which digital technology is effortlessly contextualized to create new value-in-use and new venturing identity.	<ul style="list-style-type: none"> - Contextualizing core digital technology: The activities of rethinking a core in-house digital technology for a new business context. - Projecting novel value-in-use: To anticipate and manifest new benefits of a digital innovation to attract and engage existing and new users. - (Re)defining identity: Digital ventures' recurring definition of what they do and who they are.

Figure 5. The Mechanisms of Rapid Scaling through Digital Innovation

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 re-contextualization 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 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 re-contextualize 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 costs 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 their 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 who 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. In times when digital technology is embedded in physical products like cars though, both rhythms (the rhythm of the physical and 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 pre-condition 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 mitigate 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 considerable amount of effort to grow their user base, but also needs 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 the 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.

REFERENCES

- Arthur, W.B. 1989. "Competing Technologies, Increasing Returns, and Lock-in by Historical Events," *The Economic Journal* (99:394), pp. 116-131.
- Benkler, Y. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven, CT: Yale University Press.
- Boland, R. Jr., and Collopy, F. 2004. "Toward a Design Vocabulary for Management," in: *Managing as Designing*, R. Jr. Boland and F. Collopy (eds.). Redwood City, CA: Standard University Press, pp. 265-276.
- Brynjolfsson, E., and McAfee, A. 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: Norton.
- Brynjolfsson, E., and Saunders, A. 2010. *Wired for Innovation: How Information Technology Is Reshaping the Economy*. Cambridge, MA: The MIT Press.
- Chandler, A.D. 1962. *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*. Cambridge, MA: Massachusetts Institute of Technology.
- Church, J., and Gandal, N. 1992. "Network Effects, Software Provision, and Standardization," *Journal of Industrial Economics* (40:1), PP. 85–103.
- Eisenmann, T., Parker, G., and Van Alstyne, M. 2006. "Strategies for Two-sided Markets," *Harvard Business Review* (84:10), pp. 92-101.
- Fine, C.H. 1998. *Clockspeed: Winning Industry Control in the Age of Temporary Advantage*. Reading, MA: Perseus Books.
- Garud, R., and Karnøe, P. 2001. "Path Creation as a Process of Mindful Deviation," in: *Path Dependence and Creation*, R. Garud and P. Karnøe (eds.). Mahwah, New Jersey: Lawrence Erlbaum Associates, pp. 1-38.
- Garud, R., Kumaraswamy, A., and Karnøe, P. 2010. "Path Dependence or Path Creation?" *Journal of Management Studies* (47:4), pp. 760-774.
- Garud, R., Jain, S., and Tuertscher, P. 2008. "Incomplete by Design and Designing for Incompleteness," *Organization Studies* (29:3), pp. 351-371.
- Gerring, J. 2007. *Case Study Research: Principles and Practices*. Cambridge: Cambridge University Press.
- Giddens, A. 1984. *The Constitution of Society - Outline of the Theory of Structuration*. Cambridge: Polity Press.
- Grindley, P. 1995. *Standards, Strategy, and Policy: Cases and Stories*. Oxford: Oxford University Press.
- Hanseth, O. 2000. "The Economics of Standards," in: *From Control to Drift - the Dynamics of Corporate Information Infrastructures*, C. Ciborra, K. Braa, A. Cordella, B. Dahlbom, A. Failla, O. Hanseth, V. Hespø, J. Ljungberg, E. Monteiro and K.A. Simon (eds.). Oxford: Oxford University Press, pp. 56-70.
- Henfridsson, O., and Bygstad, B. 2013. "The Generative Mechanisms of Digital Infrastructure Evolution," *MIS Quarterly* (37:3), pp. 907-931.
- Henfridsson, O., Mathiassen, L., and Svahn, F. 2014. "Managing Technological Change in the Digital Age: The Role of Architectural Frames," *Journal of Information Technology* (29:1), pp. 27-43.
- Henfridsson, O., and Yoo, Y. 2014. "The Liminality of Trajectory Shifts in Institutional Entrepreneurship," *Organization Science* (25:3), pp. 932-950.
- Kallinikos, J., Aaltonen, A., and Marton, A. 2013. "The Ambivalent Ontology of Digital Artifacts," *MIS Quarterly* (37:2), pp. 357-370.
- Langley, A. 1999. "Strategies for Theorizing from Process Data," *Academy of Management Review*, (24:4): 691-710.

- Langlois, R.N. 2007. *The Dynamics of Industrial Capitalism: Schumpeter, Chandler, and the New Economy*. London and New York: Routledge.
- Lee, J., and Berente, N. 2012. "Digital Innovation and the Division of Innovative Labor: Digital Controls in the Automotive Industry," *Organization Science* (23:5), pp. 1428-1447.
- Lee, E., Lee, J., and Lee, J. 2006. "Reconsideration of the Winner-Take-All Hypothesis: Complex Networks and Local Bias," *Management Science* (52:12), pp. 1838-1848.
- Leitch, C., Hill, F., and Neergaard, H. 2010. "Entrepreneurial and Business Growth and the Quest for a 'Comprehensive Theory': Tilting at Windmills?" *Entrepreneurship: Theory & Practice* (34:2), pp. 249-260.
- Lusch, R., and Nambisan, S. 2015. "Service Innovation: A Service-Dominant Logic Perspective," *MIS Quarterly* (39:1), pp. 155-176.
- McKelvie, A. and Wiklund, J. 2010. "Advancing Firm Growth Research: A Focus on Growth Mode Instead of Growth Rate," *Entrepreneurship: Theory & Practice* (34:2), pp. 261-288.
- Nambisan, S. 2013. "Information Technology and Product/Service Innovation: A Brief Assessment and Some Suggestions for Future Research," *Journal of the Association for Information Systems* (14:4), pp. 215-226.
- Oliva, R., Sterman, J., and Giese, M. 2003. "Limits to Growth in the New Economy: Exploring the 'Get Big Fast' Strategy in E-commerce," *System Dynamics Review* (19:2), pp. 83-117.
- Prasad, A., Venkatesh, R., and Mahajan, V. 2010. "Optimal Bundling of Technological Products with Network Externality," *Management Science* (56:12), pp. 2224-2236.
- Porter, M.E. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.
- Schilling, M.A. 2002. "Technology Success and Failure in Winner-Take-All Markets: The Impact of Learning Orientation, Timing, and Network Externalities," *Academy of Management Journal* (45:2), pp. 387-398.
- Schmittlein, D.C., and Peterson, R.A. 1994. "Customer Base Analysis: An Industrial Purchase Process Application," *Marketing Science* (13:1), pp. 41-67.
- Shapiro, C., and Varian, H.R. 1999. *Information Rules - a Strategic Guide to the Network Economy*. Boston, MA: Harvard Business School Press.
- Song, M., Parry, M.E., and Kawakami, T. 2009. "Incorporating Network Externalities into the Technology Acceptance Model," *Journal of Product Innovation Management* (26:3), pp. 291-307.
- Strauss, A.C., and Corbin, J. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. London: Sage.
- Sun, B., Xie, J., and Cao, H. 2004. "Product Strategy for Innovators in Markets with Network Effects," *Marketing Science* (23:2), pp. 243-254.
- Svahn, F., Mathiassen, L., and Lindgren, R. forthcoming. "Embracing Digital Innovation in Incumbent Firms: How Volvo Cars Managed Competing Concerns," *MIS Quarterly*.
- Tilson, D., Lyytinen, K., and Sorensen, C. 2010. "Digital Infrastructures: The Missing IS Research Agenda," *Information Systems Research* (21:4), pp. 748-759.
- Tripsas, M. 2009. "Technology, Identity, and Inertia through the Lens of 'the Digital Photography Company'," *Organization Science* (20:2), pp. 441-460.
- Verganti, R. 2009. *Design-Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean*. Boston, MA: Harvard Business Press.
- Wareham, J., Fox, P.B., and Cano Giner, J.L. 2014. "Technology Ecosystem Governance," *Organization Science* (25:4), pp. 1195-1215.
- Yoo, Y. 2013. "The Tables Have Turned: How Can the Information Systems Field Contribute to Technology and Innovation Management Research," *Journal of the Association for Information Systems* (14:Special Issue), pp. 227-236.
- Yoo, Y., Boland, R.J., Lyytinen, K., and Majchrzak, A. 2012. "Organizing for Innovation in the Digitized World," *Organization Science* (23:5), pp. 1398-1408.
- Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010. "The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research," *Information Systems Research* (21:4), pp. 724-735.