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Dissertation

Iterate to Innovate: How Firms Strategize Design Iteration to Navigate the Uneven Landscape in the Global Mobile Application Industry

Pengxiang Zhang[1] [a]

[1] Peking University, China

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Digital firms constantly iterate products to capture innovation opportunities. As digitalization transforms the global marketplace, firms all over the world must strategize iteration across various institutional contexts. My dissertation starts by establishing that firms need to be cautious about introducing iteration given its demand-side costs. Further, I find that frequent iterations enable digital firms to become innovative in uncertain institutional environments compared to stable environments. Moreover, iterating with regular rhythms help firms diversify across platform markets, but not so if firms diversify across heterogeneous country markets. Hence, both institutional conditions and market diversification must be considered when strategizing iteration.

BIG QUESTION

How do firms iterate to innovate in the uneven landscape of the global digital marketplace?

INTRODUCTION

This dissertation explores how firms *iterate to innovate* in the uneven landscape of the global digital marketplace. In traditional markets, firms holding differential positions or valuable resources often gain sustainable competitive advantage. However, in nascent markets (e.g., digital marketplace), where business landscapes are characterized by turbulent changes, the value generated from holding certain positions or resources may decay instantaneously. Under such conditions, superior performance stems from a firm's ability to continuously capture fleeting opportunities (Eisenhardt & Bingham, 2017). Particularly, digital firms often engage with design iterations, through which they test and tune digital product designs based on market feedback (Chen, Wang, Cui, & Li, 2021). For example, Google, at its initial stage, iteratively revamped its search engine to accommodate the evolving needs of advertisers and search users, enabling it to surpass a $1 billion revenue milestone within 48 months (Docherty, 2019). By iterating product designs, firms can rapidly create situation-specific new knowledge and better sense and seize the newly emerged opportunities for innovation. Therefore, I seek to develop and examine the understudied strategic logic of opportunity by focusing on how firms *iterate to innovate* digital products.

While the opportunity logic has received increasing attention from strategy and entrepreneurship scholars, it largely assumes a homogeneous institutional environment in which nascent markets are embedded. Traditionally, nascent markets emerged from advanced economies with similar institutional underpinnings. However, as innovation becomes democratized on a global scale, firms located in heterogeneous institutional contexts can simultaneously partake in the development of nascent markets. Such institutional variation could play a key role in explaining firm innovation in nascent markets. As institutional scholars have drawn on diverse strands of theories to study the role of institutional differences (Kostova et al., 2020; Peng, Wang, & Jiang, 2008), there is increasing appreciation that heterogeneous institutional underpinnings give rise to an uneven opportunity landscape, where flows of opportunities are shaped distinctively across countries. Ignoring such cross-country variation in the theoretical background of the opportunity logic would prevent us from understanding how firms strategize design iteration to pursue distinctive flows of opportunities across different countries. Thus, my focus on the uneven landscape of the global digital market-

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place presents an appealing opportunity to infuse the opportunity logic with the institutional perspective.

Empirically, this dissertation is grounded in the global mobile application marketplace. Nowadays, firms all over the world can develop and release mobile apps through access to global digital platforms such as the iOS system and Apple App Store. SensorTower (2020) reports that global revenue of mobile apps from iOS and Google play exceeded $83 billion in 2019, with an unprecedented growth rate of 17%. Moreover, this nascent market is characterized by a fast-changing, uncertain institutional environment, where regulations and norms regarding the use of mobile apps frequently shift unexpectedly (European Commission, 2014). It has been widely recognized that mobile app publishers competing in this nascent market pay considerable attention to design iteration (e.g., app updates), which collects up-to-date market feedback and revamps extant product designs. Drawing upon various data sources at app, firm, and country levels, I compiled a dataset on the global mobile application industry. The resulting dataset covers 1.5 million mobile apps, 7,600 app publishers, and 58 countries and provides me with variables related to app updates, new app releases, apps' daily active users, firms' international diversification, and country-specific digital-related institutional development. Based on this dataset, I developed three empirical essays.

ESSAY 1: GROWING PAINS: THE HIDDEN DARK SIDE OF DESIGN ITERATION ON MOBILE GAMES PERFORMANCE

The first essay in my dissertation challenges the well-accepted perspective that design iteration is mostly beneficial and incurs negligible costs. While strategy research advises firms to capture generative value by continually introducing improvements on their existing products, this paper scrutinizes the performance implications of design iteration and unveils a potential dark side. Consider an app update on Snapchat that caused widespread anger among users. The leading social networking app lost three million daily active users and suffered from a 1.3 million USD loss in market value in the second quarter of 2018, for which its CEO Evan Spiegel blamed the newly released update that redesigns the user interface (Conger, 2018). These arguments and observations suggest considerable heterogeneity in the performance outcomes of design iteration and underscore the need for further investigation given the corresponding implications for firms' competitiveness.

I draw on the demand-side perspective to examine consumers' product adoption following design iteration. Because design iteration brings changes to existing products that are already embedded in consumers' behavioral patterns, I argue that it is likely to cause friction by altering ingrained habits and increasing learning costs for consumers. As a result, I expect that consumers will be more likely to resist design iteration, rather than engage in behavioral adjustment, particularly in the short term. Further, I posit that this negative effect of design iteration will be attenuated when the product has a leading market position and will be amplified when the product has undergone more design iterations.

My empirical analysis utilizes a matched difference-in-differences research design using data from the mobile games industry. This research design helps mitigates the concern that the influence of design iteration on product performance is confounded by other factors. For example, seasonal holidays may breed a spike in product demand, and in response, firms are likely to introduce design iterations in advance. To exclude such alternative explanations, my research design leverages asynchronous updates of multi-homing mobile games (i.e., game apps available on more than one platform). By comparing the change in daily active users of the updated apps (i.e., treatment group) vis-à-vis the same apps that have yet to be updated on the rival platform (i.e., control group), I can minimize the possibility that the result is driven by confounding factors (e.g., developer traits, app characteristics, time effects, etc.).

Based on 1,610 mobile game update events in worldwide markets, I find that mobile games that just experienced an update event have 9.2% fewer daily active users than before the update event, relative to mobile games that do not experience update events. To understand whether this finding is limited to the games category, I investigate this effect across multiple app categories, including social networking, photos and videos, and utilities, and find the negative effects of update events consistently. Given this negative effect, firms need to be cautious about how they introduce design iteration. I next study how firms strategize design iterations over time to be innovative.

ESSAY 2: DESIGN ITERATION, INSTITUTIONAL UNCERTAINTY, AND PRODUCT INNOVATION: EVIDENCE FROM THE GLOBAL MOBILE APPLICATION INDUSTRY

Being one of the first to infuse opportunity logic with the institutional perspective, my second essay theorizes how entrepreneurial firms located in different country contexts capture innovation opportunities. The logic of opportunity suggests that firms often take actions of iterative search to capture fleeting innovation opportunities. While this logic has enhanced our understanding, it largely assumes a homogeneous institutional context in which nascent markets are embedded. However, with the ubiquity of information and communication technologies, firms around the world can "plug and play" in the global competition to foster the emergence of nascent markets in different institutional contexts. Although it is well-accepted that institutional variation can influence firm innovation, little is known about how diverse institutional contexts associated with nascent markets may shape product innovation.

In addressing this question, I investigate how various levels of institutional uncertainty affect firms' product innovation. From the opportunity logic, the more uncertain the external environment, the greater the room for a firm to discover opportunities and innovate new products. Conversely, institutional theorists maintain that firms face

challenges in making long-term commitments under high uncertainty. Combining these contrasting theoretical perspectives, I propose that there is a U-shaped relationship between institutional uncertainty and product innovation in nascent markets. Moreover, I argue that firms undertaking frequent design iterations can better navigate high institutional uncertainty to create product innovations. Design iteration enables firms to engage in experiential learning, and to sense and seize opportunities embedded in an uncertain and fast-changing setting.

Based on a sample of 4,629 firms from 54 countries in the mobile app industry during 2015–2017, I find support for the above arguments and provide practical implications for digital entrepreneurs and policymakers. I highlight that digital practitioners need to consider the institutional contexts in which they are embedded when organizing design iteration. The benefit of design iteration in countries characterized by relatively low uncertainty may not be comparative to iterating product designs under high institutional uncertainty. Further, I also identify the favorable institutional conditions – either high or low levels of institutional uncertainty – that foster digital innovation, which may provide useful information for policymakers who focus on digital regulations.

ESSAY 3: LIKE CLOCKWORK? DESIGN ITERATION RHYTHMS AND THE STRATEGY OF DIGITAL STARTUPS

My third essay explores how digital startups strategize design iteration when competing simultaneously in multiple markets. Specifically, I focus on the extent to which digital startups iterate products with regular rhythms. By regular rhythms, I mean consistent time intervals between the occurrences of design iterations (e.g., a one-week interval between every two iterations). Extant literature suggests that keeping such regular rhythms helps facilitate coordination and enables firms to be more focused. Moreover, some very successful digital startups (e.g., SpaceApe) have attributed their extreme growth to the use of rhythm-related business practices, and have strongly encouraged the approach of fixed time intervals for each cycle of design iteration (Batchelor, 2017). Despite the potential benefits, little consideration has been given to whether and under what conditions digital startups utilize regular rhythms to organize design iteration.

To address this gap, I first examine whether digital startups generally do use regular rhythms to design iteration. Based on parametric event history analysis of a sample of 110 mobile game startups, I find that supportive evidence that digital startups tend to iterate product designs with regular rhythms. The basic argument is that regular rhythms help reduce coordination costs when firms are frequently engaged in design iteration. Further, I examine the boundary conditions of using regular rhythms, i.e., the conditions under which digital startups prefer to employ regular rhythms rather than rapidly respond to market changes. Specifically, I investigate how competing in diverse markets may influence digital startups' adherence to rhythmic design iterations. I find that international diversification hinders regular design iteration rhythms while platform diversification facilitates the use of regular rhythms. This is mostly because competing simultaneously in multiple country markets requires firms to be responsive to external market events, whereas competing in multiple platform markets emphasizes strong internal coordination to overcome the differences in platform technologies. A key takeaway from this essay is that, while digital startups generally iterate product designs with regular rhythms, they may configure design iteration rhythms depending on their diversification conditions.

In sum, my dissertation offers timely insights into the digital innovation phenomenon for policymakers and managers. I identify favorable institutional conditions at the country level that foster digital innovation. While most attention is on the strength of digital regulation, I find that the dynamics of institutional environments, i.e., how digital regulation changes, exert influence on digital innovation. This finding may have implications for global digital transformation. As we are currently situated in the flux of diverse digital regulatory standards, countries, whether developed or developing, are actively experimenting and shifting among these alternative digital-related institutions to find what works for them. The induced institutional dynamics throughout this experimentation process may influence digital innovation and determine the competitiveness of countries in the digital sector. My study directs more attention from the level of institutional development to the changing trajectory of these institutions.

Furthermore, my focus on design iteration may inform practices about digital innovation management. Recently, there has been an ongoing discussion among entrepreneurs regarding agile development,[1] which emphasizes the importance of iteration-related activities to digital product development. However, iteration is not the panacea for innovation. It is reported to incur considerable financial costs and employee stress. Thus, digital entrepreneurs pay substantial attention to how they schedule each round of iteration so that they could develop innovative products with high efficiency and low costs. I highlight two important factors for entrepreneurs' consideration: the institutional contexts in which they are embedded, and their diversification strategies. The benefit of design iteration in countries characterized by relatively low uncertainty may not be comparable to iterating under high institutional uncertainty. In addition, rhythmic iteration does not tend to help international diversification as much as platform diversification. Therefore, my findings offer valuable insights for firms to

1 Agile development is an iterative and adaptive software-development methodology which increasingly replaces the waterfall method that critics described as overly regulated and planned (Rigby, Sutherland, & Takeuchi, 2016).

customize their arrangement of iteration activities in different country markets.

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ABOUT THE AUTHOR

Pengxiang Zhang (zhangpx@gsm.pku.edu.cn) is an Assistant Professor in Organization and Strategic Management Department, Guanghua School of Management, Peking University. His research focuses on digital innovation, strategic rhythms, and global strategy. He has published papers in *Strategic Management Journal, Journal of Management, Journal of Management Studies*. His research has received several award nominations including *Alan M. Rugman Most Promising Scholar Award, Buckley & Casson AIB Dissertation Award* and *Best Paper Award in Emerging Economies Research*.

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