Digital Innovation and Socioeconomic Transformation: Mobile Money in Sub-Saharan Africa

Wenxiu (Vince) Nan

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Signature

Committee Member: Dhaval M. Dave
Signature

Committee Member: Linda F. Edelman
Signature

External Reviewer: Ann Majchrzak
Signature

Date: 4/9/2019
Digital Innovation and Socioeconomic Transformation: Mobile Money in Sub-Saharan Africa

Wenxiu (Vince) Nan

A dissertation
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DEDICATION

To my family
To M. Lynne Markus
ACKNOWLEDGEMENTS

I am especially indebted to Professor M. Lynne Markus, who is my advisor during the PhD journey. I would like to extend my deepest appreciation and thanks to Lynne for her unconditional love, support, and guidance, without which this dissertation would not have been possible. Getting to know Lynne and working with her is the best time I have ever had in my entire life. This dissertation as well as my future career in academia is dedicated to Lynne. Also, I would like to thank my committee members, Professor Dhaval Dave, Professor Linda Edelman, and Professor Ann Majchrzak, for their insightful comments and suggestions, which raise my dissertation to another level.

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Nobody has been more important to me in the pursuit of a PhD degree than the members of my family. I wish to thank my family for their unending love and unconditional support, which help me through the PhD journey and everything!
ABSTRACT

Digital Innovation and Socioeconomic Transformation:
Mobile Money in Sub-Saharan Africa

Wenxiu (Vince) Nan

Chair of the Supervisory Committee:
Professor M. Lynne Markus
Information and Process Management Department, Bentley University

Digital innovation enabled by digital technologies has the potential to transform existing socioeconomic practices, processes, and structures. In spite of the transformative potential, the relation between digital innovation and resulting socioeconomic transformation has been underexplored, especially at the societal level in developing countries. To fill this research gap, this dissertation is dedicated to investigating how and why digital innovation leads to socioeconomic transformation, when it does. Drawing on the digital innovation and technological transition literatures, I propose a multilevel theoretical framework that illustrates the processes and mechanisms through which digital innovation enables socioeconomic transformation in developing countries context. This dissertation examines the framework by focusing on a particular instance of digital innovation:
Mobile Money (MM) in Sub-Saharan Africa. MM provides basic financial services to both banked and unbanked population at a convenient, secure, and affordable way via mobile phones. As such, the disruptive mobile-based financial services have been argued to address financial services gap in developing countries and in particular hold the potential to play transformative roles in Sub-Saharan Africa where traditional banking infrastructure remained underdeveloped.

Based on the multilevel theoretical framework, I design and conduct three essays using a mix of qualitative and quantitative research methods to investigate the transformative role of MM at multiple levels of analysis. Overall, the findings show that MM has been transforming the way people conduct financial transactions (i.e., money transfer and storage) and that MM, when widely adopted in a society, can serve as a digital pathway for developing countries to leapfrog the traditional financial services gap and achieve socioeconomic development. This dissertation contributes to the digital innovation by proposing and examining the multilevel framework illustrating how and why digital innovation leads to societal-level transformation. Furthermore, the findings add knowledge to the MM literature by systematically documenting empirical evidence of socioeconomic benefits across multiple levels and the potential unintended consequences. Future research agenda is proposed to further our understanding of the emerging MM phenomenon (i.e., social mechanisms) and more broadly to examine the theoretical and empirical links between digital innovation and socioeconomic transformation.
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CHAPTER I. INTRODUCTION

Embarking on the journey of the dissertation, I would like to start with an opening case, a daily life story that reveals the essence of digital innovation and its disruptive potential, which is the main research subject of this dissertation. The socioeconomic implications of the story inspire me to investigate the dynamic relations between digital innovation and socioeconomic transformation. Following the opening case, I will discuss research motivation, theoretical and empirical background, and provide an overview of the three essays.

Opening Case: M-Pesa in Kenya

M-Pesa, a mobile-based financial service, was launched in March 2007 in Kenya by Safaricom, a subsidiary of the UK-based telecommunication company Vodafone. M-Pesa provides end-to-end digital financial services for the poor to access basic financial services, such as money transfer and payments, at affordable cost (e.g., Jack and Suri, 2014; Aron, 2018; Mbiti and Weil, 2016). The M-Pesa service is made available by digitally reconfiguring the Kenyan telecommunications infrastructure, a network of transactional agents, and the high mobile phone penetration among
Kenyans. Since its inception, M-Pesa has been widely adopted and diffused among over 20 million Kenyans, who made 4.1 billion M-Pesa transactions in 2015.¹

M-Pesa is basically an application installed on the SIM card of a mobile phone. Users can subscribe to the service for free with the aid of a network agent, who is contracted with M-Pesa provider, Safaricom. An agent is authorized to register customers, set up accounts, convert cash or electronic money (e-money) into each other for users. One can deposit cash into his or her virtual M-Pesa account on the phone and withdraw cash from an agent in the neighborhood when they need it. M-Pesa links up users and non-users² through thousands of agents scattered around the country, including urban slums and rural areas. With cash digitalized, users can enjoy basic financial services, especially money transfer and payments, in a quicker, more convenient, safer, and cheaper way, compared with the financial services through traditional banks or informal means (Mas and Radcliffe, 2011; Mbiti and Weil, 2016). As one can imagine, M-Pesa proves a natural fit for the poor who used to live without having access to traditional banking services.

² Money transfer is made possible among M-Pesa users and non-M-Pesa-users as long as both sides have access to mobile money. It is known as over-the-counter (OTC) service. See more details at http://www.cgap.org/blog/mobile-money-otc-versus-wallets
Thanks to M-Pesa, the lives of Mr. Geoffrey Ombati and his family have been transformed, according to a National Public Radio report.\(^3\) The 32-year-old Kenyan grew up in a rural area, the village in which none of commercial banks were available. So, he never had a bank account. He was making a tiny bit of money working in a general store in the village. Since there was no way for him to deposit cash, he carried a piece of salary in his pocket and often frittered it away on snacks for his kids on his way home from work. However, by signing up for M-Pesa, Ombati changed how he dealt with money. His wages were directly deposited to M-Pesa account such that it prevented him from splurging. As he managed to save money, the use of M-Pesa started to disrupt his family livelihood in a positive way.

With money saved, Ombati moved to Nairobi, the capital of Kenya, and found a better paying job in construction. Most of his salary was sent back to his wife in the hometown via M-Pesa. A few months later, he bought two goats for his wife to raise and the number of goats was multiplied as he saved more and sent back more. He and his wife considered selling milk since there was a short supply in the village, which would benefit the family and the community as a whole. M-Pesa made it possible for Ombati to bring about a better future for his kids and to improve the welfare of the household, which would otherwise seem impossible. Not surprisingly, there is a large and increasing number of Mr. Ombatis in Kenya.

\(^3\) This story was covered by National Public Radio. For details, visit the following link: http://www.npr.org/sections/goatsandsoda/2016/12/09/504540392/dial-m-for-money-can-mobile-banking-lift-people-out-of-poverty
Ombati’s experience, however, is no more than the tip of the iceberg. Kenyans have been exploring further benefits of M-Pesa. Parents no longer need to visit schools to pay school tuition for their children; households can avoid time-consuming travel to government agency to pay utility bills; and mobile phone users may reload airtime virtually. Not only this, swift money transfer affords users the ability to address medical emergencies and other challenges (e.g., Morawczynski, 2009; Jack and Suri, 2014). Being able to receive medical care and smooth risks in a timely manner has a number of socioeconomic implications, i.e., M-Pesa users can maintain their consumption level, remain healthy, and get back to their work or school even in the events of negative disturbance. As suggested in the story, the availability of M-Pesa can improve household welfare and consequently help people lift themselves out of poverty.

In addition, M-Pesa enables micro and small sized businesses to deploy new business models, where financial transactions are conducted in a digital way. Such a digital business model has been found to generate economic benefits such as reducing transaction costs, ameliorating supply chain management, and increasing sales revenue (e.g., Kirui and Onyuma, 2015; Wanyonyi and Bwisa, 2013; Bångens and Söderberg, 2011). Overall, M-Pesa is transformative in myriad ways from helping to create financial stability and security among millions of Kenyan households through facilitating production, consumption and trade of goods and
services in business sector toward promoting social welfare and economic growth. It is arguable that M-Pesa unleashes enormous digital possibilities in Kenya.

**Research Motivation**

So, what does the opening case tell us about digital innovation? The anecdotal evidence appears to provide two fundamental lessons. The first is concerned with the defining nature of digital innovation. Mobile money can be regarded an instance of digital innovation enabled by digital technologies. The fundamental innovation is digitalization of physical cash into e-money, which makes traditional financial transactions become digital. The second is about the consequences of digital innovation. The story suggests that a digital innovation, when widely adopted and used, has the potential to produce transformative socioeconomic impacts on individuals, businesses, communities, and society as a whole.

Over the last few decades, increasing transformation of analog signals into digital form and incorporation of digital capabilities into non-digital artifacts makes traditional boundaries of products, processes, organizations more fluid, and connects data, knowledge, physical components that were previously disconnected. Consequently, digital innovation enabled by digital technologies has the potential to transform existing socioeconomic practices, processes, and structures (e.g., Boland et al., 2007; Tilson et al., 2010; Yoo et al., 2012; Kallinikos et al., 2013b). An
increasing number of digital innovations have transformative impacts in various industries, such as ride sharing (e.g., Uber), crowdfunding (e.g., Kickstarter), and mobile money (e.g., M-Pesa). The emerging digital transformation phenomenon has called for scholarly attention to unpacking digital innovation and its socioeconomic impacts.

The emerging digital innovation literature reveals two major research streams: 1) conceptualizing and characterizing digital technologies and digital innovation (e.g., Yoo et al., 2010a; 2010b; Yoo et al., 2012; Fichman et al., 2014; Kallinikos et al., 2013a; Faulkner and Runde, 2013); 2); and organizational implications of digital innovation (e.g., Boland et al., 2007; Barrett et al., 2012; Lyytinen et al., 2016). In particular, the first stream has focused on the properties of digital technologies (see Kallinikos, 2013a for comprehensive literature review), and the convergent and generative characteristics of digital innovation (Yoo et al., 2012). The second sheds light on the organizational impacts of digital innovation, i.e., how digital innovation reconfigures work boundaries (e.g., Barrett et al., 2012), organizing activities within an organization (e.g., Kallinikos et al., 2013b), and relations among organizations (e.g., Boland et al., 2007). In short, the landscape of emerging literature could be summarized by their dominant focus on the digital innovation conceptualization, and socioeconomic implications of digital innovation in the organizational context.

Nonetheless, what has been under-tapped is the link between digital innovation and resulting socioeconomic transformation at the societal level. It is well received in the
literature that digital innovation has the potential to transform existing arrangements of social practices, processes and structures. However, the deepgoing transformations are often glossed over and concealed by the smooth ways through which digitized products and services are daily accessed and consumed on a massive scale (Kallinikos et al., 2013b). Adding to this, Lucas et al. (2013) advocated that the field should pay closer attention to how transformation comes about, especially beyond the organizational level. Surprisingly, few efforts have been directed toward socioeconomic implications of digital innovation at the societal level. In this spirit, this dissertation attempts to address the overarching research question:

*How and why does digital innovation lead to socioeconomic transformation, when it does?*

This research question is tackled in the context of *developing countries*. This is partly because digital innovation is more likely to play a transformative role in developing countries by filling institutional voids and partly because the transformative potential of digital innovation in developing countries has received little scholarly attention. In his comprehensive literature review, Nielsen (2017) identified a significant lack of empirical and theoretical research on digital innovation in developing countries. For instance, whereas digital innovation offers new opportunities for developing countries, a number of studies suggest the reproduction of old barriers and the emergence of new challenges, i.e., digital divide.
(e.g., van Dijk, 2013). Accordingly, Nielsen (2017) queried: "Will digital innovation become the source of yet another digital divide?" (p. 7). Obviously, we need more research to examine not only the positive potential but also the unintended consequences of digital innovation in developing countries (Walsham and Sahay, 2006; Nielsen, 2017).

Specifically, the empirical domain that this dissertation focuses on is mobile money (MM) in Sub-Saharan Africa. MM is considered a digital innovation because it is made possible by digitally rearranging the previously disconnected sociotechnical elements such as telecommunications infrastructure, a network of transactional agents, and banks. A growing body of MM studies shows that the use of MM not only transforms the way households transfer and save money, but brings about socioeconomic benefits (e.g., Jack and Suri, 2014; Islam et al., 2017; Plyler et al., 2010). As MM spreads widely into a society, it is expected that MM precipitates socioeconomic transformation over time. Despite the transformative potential of MM, the emerging MM literature remains somewhat sporadic and the overall empirical evidence pointing to the digital transformation has not yet been systematically synthesized (e.g., Kim et al., 2018).

Motivated by the dual research gap—one in the digital innovation literature (lack of research on digital innovation at the societal level in developing countries) and the other in the MM literature (much less known about the MM phenomenon)—this dissertation examines the multiple dimensions of the MM-enabled socioeconomic
transformation at mixed levels. In what follows, I discuss theoretical background and propose a theory of digital innovation and socioeconomic transformation, based on which three essays are designed and conducted. Next, the empirical background—MM in Sub-Saharan Africa—is described. At the end of this chapter, I provide an overview of the three essays.

**Theoretical Background**

In this section, I conceptualize digital innovation and discuss the received theory of digital innovation and socioeconomic transformation in the Information Systems (IS) literature. Given the limitation of the received theory, I turn to technological transition literature that provides complementary theoretical building blocks. At the end, bringing together the IS and technological transition literatures, I propose a multilevel theory of digital innovation and socioeconomic transformation.

**Digital Innovation**

As an emerging research topic, digital innovation lacks conceptual clarity. The literature reveals two groups of efforts in conceptualizing digital innovation: 1) defines digital innovation; and 2) identifies characteristics of digital innovation. I discuss each in turn below.

Only a few studies explicitly define the term, digital innovation. Some representative definitions are presented in Table 1.1. The definitions have little in common and are
limited in two aspects. Firstly, it is not clear whether digital innovation refers to process or outcome. Whereas the first definition focuses on the process of creating novel products, which is carrying out of new combinations, the rest definitions give prominence to the outcome of digital innovation as creation of new forms of digitalization such as product, process or business model.

Table 1.1: Definitions of Digital Innovation

<table>
<thead>
<tr>
<th>Study</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoo et al. (2010a, p. 725)</td>
<td>Digital innovation is defined as the carrying out of new combinations of digital and physical components to produce novel products</td>
</tr>
<tr>
<td>Yoo et al. (2010b, p. 6)</td>
<td>Digital innovation is defined as an innovation enabled by digital technologies that leads to the creation of new forms of digitalization. Digitalization refers to transformation of sociotechnical structures that were previously mediated by non-digital artifacts or relationships into ones that are mediated by digitized artifacts and relationships</td>
</tr>
<tr>
<td>Fichman et al. (2014, p. 330)</td>
<td>Digital innovation is defined as a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied or enabled by information technology</td>
</tr>
</tbody>
</table>

Secondly, digital innovation as defined by Yoo et al. (2010b) is confounded with sociotechnical transformation and runs the risk of being tautological. Anecdotal evidence, however, shows that not all digital innovations necessarily lead to transformation. For example, while MM has taken off in such countries as Kenya, Uganda, and Zimbabwe, the similar digital innovation in countries like Haiti, India and South Africa has failed to take off (Evans and Pirchio, 2015). Thus, a conceptual as well as analytical distinction between digital innovation and transformation
needs to be made in order to explore processes or mechanisms standing between a digital innovation and subsequent transformation.

Building on the previous studies, I broadly define digital innovation as an innovation process involving digital technologies and the innovation outcome of that process, such as the creation of a new product, process, or business model. This working definition connotes both process and outcome of digital innovation. As for process, it is characterized by ever-increasing capabilities of digital technologies, embedding digital capabilities into physical components and reconfiguring digital and physical components (Yoo et al., 2010a). The MM story illustrates this point well. As an outcome of digital innovation, MM can be a product, process or business model, characterized by combination of physical and digital components. For example, smart phone, 3D printing, and MM are instances of digital innovation as a product, process and business model, respectively.

Despite the conceptual distinction between process and outcome, a clear line can hardly be drawn. This is mainly because of the flexibility of digital technologies. Compared with immutable or fixed functionalities of traditional information technologies (Yoo et al., 2012), capabilities of digital technologies can be temporarily morphed, adjusted, and augmented (El Sawy, 2003). As a result, artifacts or systems of elements enabled by digital technologies are incomplete and perpetually in the making (Zittrain, 2006; Kallinikos et al., 2013a; Faulkner and Runde, 2013). This suggests that digital innovation is an ongoing dynamic
procedure in which the process and the outcomes of digital innovation are intertwined. The dynamics are further revealed in characteristics of digital innovation, which I discuss below.

A small but growing body of studies is dedicated to characterizing digital innovation. Two characteristics that are said to differentiate digital innovation from traditional IS innovation have been identified: convergence and generativity (Tilson et al., 2010; Yoo et al., 2010a; Yoo et al., 2012; Lyytinen et al., 2016).

**Convergence**

Convergence refers to the ability of a digitized system to bring together previously separate and heterogeneous data, technologies, and functions through the homogenization of digital data. At the product level, Yoo et al. (2010a) proposed that layered modular architecture, a hybrid between a modular architecture and a layered architecture, facilitates digital convergence. In addition to the feature of traditional modular architecture that allows mix and match in a fixed and nested way (Baldwin and Clark, 2000), the layered modular architecture is characterized by the fluid product boundary that enables dynamic, or even temporary, combinations of digitized components or products among different layers (content, services, networks, devices). An illustrative example is the smart phone which is convergent with a wide range of applications as needed, i.e., emails, payments, etc.
In addition, the convergence characteristic is identified at the digital infrastructure level. Digital infrastructure is defined as “the basic information technologies and organizational structures, along with the related services and facilities necessary for an enterprise or industry to function” (Tilson et al., 2010, p. 1). Tilson et al., (2010) maintained that convergence requires and results from dynamic interactions among different layers (physical, logic, content) of digital infrastructure. Specifically, the inherent scalability and flexibility of digital infrastructure (e.g., the Internet) provides an extensive foundation on which heterogeneous resources are brought together to form new service or product, and through which other digital or physical networks are connected. As a result, we could observe digital convergence in many aspects: user experience convergence (e.g., smart phone), device convergence (e.g., digital camera), network convergence (e.g., quadruple play), and market convergence (e.g., banking and telecommunication industry) (Tilson et al., 2010; Yoo et al., 2012).

**Generativity**

Generativity is defined as “a technology’s overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences” (Zittrain, 2006, p. 1980). Similar to convergence, generativity could be perceived as the ability of a digitized system to create and generate new content, structure or behavior that is deviated from original intentions (Tilson et al., 2010). Implying the varied locus and types of innovation, generativity plays out in a number of ways. At the product level,
digital innovation becomes generative through delayed binding of form and function (Zittrain, 2006). One typical example is generative service innovations in Apple and Google’s digital ecosystems (e.g., Tilson et al., 2012; Eaton et al., 2015). At the community level, a wake of innovation by heterogeneous players in a community has been observed due to adoption of 3D representation technology in a construction project (Boland et al., 2007).

Convergence and generativity are also used to characterize process and outcome of digital innovation. Yoo et al. (2010b) argued that digital innovation outcome is featured by convergence as a result of continuous integration of diverse and heterogeneous technologies through the homogenization of digital data. Moreover, process of digital innovation is characterized by generativity, in which a variety of innovations is created by various players, not only product/service providers. However, as noted above there is no clear demarcation between digital innovation process and outcome as convergence and generativity interact and reinforce each other.

Convergence and generativity provide valuable insights into the transformative potential of digital innovation. In particular, as a result of continuous integration of heterogeneous resources, knowledge and technologies, convergence is informative in examining how digital innovation comes about and what is afforded by digital innovation. Generativity, on the other hand, calls attention to investigation of how digital innovation is actually used to produce varied innovations and outcomes at
multiple levels. In short, these characteristics are believed to be crucial pieces that unlock the puzzle of how socioeconomic transformation is enabled by digital innovation. So, what has been said about the links between digital innovation and socioeconomic transformation in the IS field?

**IS View of Digital Innovation and Socioeconomic Transformation**

It is acknowledged in the literature that research on socioeconomic transformation enabled by digital innovation is in its infancy (Lucas et al., 2013; Kallinikos et al., 2013b). Nonetheless, we can spot, at least, two emerging efforts that wrestle with the issue: 1) empirically investigates transformation issues in organization field; and 2) conceptually explores the transformation process and/or outcome.

**Empirical Research**

A growing number of studies empirically examine transformational impacts of digital innovation on work, processes and structures in organizational settings (see Table A.1 in APPENDIX). Within organizations, how work is disrupted by digital innovation and reconfigured over time has been explored. For example, Karanasios and Allen (2014) investigated how implementation of mobile technology changed the nature of policy work. They found that through ongoing contradiction and congruence between mobile technology and established work, the nature—patterns and practices—of policing activities were changed over time. In the similar vein, Barrett et al. (2012) and Dougherty and Dunne (2012) showed that adoption of
robotics innovation in workplace reconfigured boundary relations and created new knowledge boundaries among different occupational groups.

While intra-organizational research places the focus on changes in nature of work, a group of studies examine how organizations reorganize inter-organizational activities and relationships. For instance, Boland et al. (2007) observed that adoption of 3D representation technology by focal firm stimulated a wake of innovation not only in technologies but in work practices and knowledge among players in its project networks. In automobile industry, Lee and Berente (2012) found that OEMs focused on component innovations while suppliers focused on increased architectural innovation activities. This finding was opposite to predictions by well received innovation literature, suggesting the disruptive nature of digital innovation. Selander et al. (2010) documented that digital innovation gradually led to transformation in relationships among platform owners, operators and competitors in mobile device industry.

Research on organizational transformation is a significant piece for portraying a complete picture of socioeconomic transformation. Nevertheless, a major limitation of this effort is that digital innovations have been predominantly considered in organizational settings and from organizational perspectives. The biased focus neglects digital innovations that fulfill societal functions, which is beyond the scope of traditional organizational boundaries. Among others, crowdfunding, MM, and blockchain technology are examples in this respect. The rationale of calling for equal
attention toward such digital innovations is that they are likely to trigger and
generate different process and outcome of transformation, compared with those in
organizational settings. For example, MM story in the opening case implies that
socioeconomic transformation can be multi-dimensional (e.g., user practices,
household well-being) and occur at multiple levels (e.g., household, business,
country level).

**Conceptual Research**

Fortunately, a few conceptual studies start reacting to the limitation. Yoo et al.
(2010b) and Tilson et al. (2010) propose a concept, digitalization, to refer to process
and/or outcome of transformation. According to Yoo et al. (2010b), digitalization
referred to transformation of sociotechnical structures that were previously
mediated by non-digital artifacts or relationships into ones that are mediated by
digitized artifacts and relationships (p. 6). Tilson et al. (2010) used the term to
denote a sociotechnical process of applying digitizing techniques to broader social
and institutional contexts that render digital technologies infrastructural (p. 2). It is,
however, not clear whether digitalization refers to process or outcome of
transformation.

Another conceptual effort was by Lucas et al. (2013) who attempted to identify
dimensions of transformation (see Table 1.2). The study is appreciated because it
jumps out of organization field and identifies multidimensionality and multilevel of
digital transformation. Another valuable insight is concerned with the means to demonstrate transformation; that is, by comparing dimensions at lagged points of time (T1 and T2) under observation and documenting changes. The authors could have developed a better understanding of transformation, but they did not extend their arguments and thus several issues require further consideration. First, dimensions of transformation were confused with transformational impacts (the seventh dimension, disruptive impact). Second, the study did not explicitly consider a multitude of actors involved in transformation process and outcome. Lastly, potential interactions among dimensions and across levels were left out.

Table 1.2: Dimensions of Sociotechnical Transformation

<table>
<thead>
<tr>
<th></th>
<th>Individual</th>
<th>Firm</th>
<th>Economy/Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>A change in a personal process of more than half the steps (e.g., digital photography)</td>
<td>A change in a business process of more than half the steps (e.g., book publishing vs. e-books)</td>
<td>Creation of a new organization with a value of at least $100 million (as in Amazon) or multiple organizations (as in Health Information Exchanges)</td>
</tr>
<tr>
<td>New Organizations</td>
<td>Creation of a new organization with a value of at least $100 million (as in Amazon) or multiple organizations (as in Health Information Exchanges)</td>
<td>Creation of a new organization that changes at least two hours of individual behavior a day (mobile communications and web)</td>
<td>A change affecting at least two hours of individual behavior a day related to social relations (e.g., Facebook)</td>
</tr>
<tr>
<td>Relationships</td>
<td>A change in social relations affecting at least half of one's contacts or doubling the number of contacts (e.g., Facebook)</td>
<td>A change affecting at least half of relationships with other organizations or a doubling of the number of relationships (e.g., e-books for Amazon)</td>
<td>A change affecting at least two hours of individual behavior a day related to social relations (e.g., Facebook)</td>
</tr>
<tr>
<td>User Experience</td>
<td>A change in user experience involving at least 2 hours per day (e.g., Facebook)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Markets</td>
<td>A change in at least half of one's vendors in a particular market (e.g., iTunes vs. CD)</td>
<td>Entering or leaving at least one market served by the firm</td>
<td>Creation of a new market with at least $100 million of transactions a year (e.g.,</td>
</tr>
</tbody>
</table>

4 Lucas et al. (2013, pp. 373)
Upon review of the digital innovation literature, we are now in a position to construct the received theory of digital innovation and socioeconomic transformation in the IS field, as shown in Figure 1.1.

Figure 1.1: IS View of Digital Innovation and Socioeconomic Transformation

Despite the conceptual efforts exploring transformation processes and outcomes, the received theory is rather limited to the organizational context and remains silent about how digital innovation enables socioeconomic transformation, which potentially involves multiple levels. However, the received theory provides an important insight for current research. Regardless of specific theoretical lenses used,
the common theme concerns the dialectal view of interactions among digital innovation, human actors, and organizational structures. This dynamics in digital innovation and resulting organizational transformation essentially point to the plausibility of using the theory of technology affordances to examine usage and consequences of digital innovation in the societal context.

Technology affordances are defined as "an action potential, that is, to what an individual or organization with a purpose can do with a technology or information systems." (Majchrzak and Markus, 2012, p. 832). Conceptualized as action potentials, technology affordances are perceived as relations between information technologies and actors, rather than inherent properties of information technologies. Technology properties are seen as necessary, but not sufficient, conditions (Markus and Silver, 2008). That is, technology properties cannot be perceived as realized functionalities unless a specified group of actors use digital innovation, given their capabilities and goals.

The technology affordances perspective is particularly useful when it comes to digital innovation. By digitally orchestrating a new set of sociotechnical elements and relationships, a digital innovation provides multiple functionalities (Yoo et al., 2012), which essentially creates multiple affordances for users. Users with different capabilities and purposes may achieve a variety of goals by exploiting and exploring multiple affordances of an innovation (Markus and Silver, 2008). Therefore, this perspective can be applied to examine the generativity of transformative outcomes.
enabled by digital innovation. As will be discussed later, technology affordances perspective serves as an important building block for the proposed theory in the context of developing countries.

Bearing the theoretical insight in mind, I next turn to a relevant literature—technological transition—as an effort to move beyond the organizational level and address socioeconomic transformation that potentially occurs across multiple levels.

**Technological Transition View of Socioeconomic Transformation**

Technological transition literature is instrumental in two aspects. First, the literature provides the foundation to conceptualize socioeconomic transformation; and second, the literature provides a theoretical ingredient, multilevel perspective, which addresses multilevel socioeconomic changes associated with technological transition.

**Socioeconomic Transformation**

Transformation can be seen as a particular type of change that is not temporary but precipitated over time. In the technological transition literature, Geels (2002) suggested transformation as change in seven dimensions of sociotechnical systems: technology, user practices and application domains (or markets), symbolic meaning of technology, infrastructure, industry structure, policy and techno-scientific knowledge. Geels and Kemp (2006, p. 227) define transformation as “change in the
direction of trajectories of technological transition, related to a change in rules that guide innovative action.” Building on Geels (2002) and Geels and Kemp (2006), I broadly define socioeconomic transformation as a thorough or dramatic change, enabled by digital innovation, in elements of sociotechnical systems including, but not limited to, technology, user practice, organization, market, infrastructure and regulation.

Socioeconomic transformation is perceived as both process and outcome across multiple levels. By process, I mean the emergence of newly arranged elements and activities, which is enabled or triggered by digital innovation. By outcome, I mean resulting change in, or impact on, particular elements of sociotechnical systems during a finite observation period. Let’s recall the opening story. The process involves adoption and diffusion of M-Pesa; and the outcome includes the impact on household welfare. As for dynamics between process and outcome, it is worth noting that there is no clear demarcation that tears them apart as socioeconomic transformation occurs through a gradual process of reconfiguration of associated elements and activities over time (Geels, 2002; Kallinikos et al., 2013b).

Multilevel Perspective of Technological Transition

The multilevel perspective (MLP) is a multilevel framework that describes and analyzes technological transition and the associated changes in technology as well as elements involved such as market structure, rules and institutions and human
actors (Rip and Kemp, 1998; Geels, 2002; 2004; Geels and Schot, 2007).

Technological transition is defined as “major, long-term technological changes in the way societal functions are fulfilled” (Geels, 2002, p. 1257). The central tenet of the perspective is that technological transition comes about as the outcome of interaction among technological niches, sociotechnical regimes, and sociotechnical landscape (Rip and Kemp, 1998; Geels, 2002; 2004; Geels and Schot, 2007) (see Figure 1.2).

Figure 1.2: Multilevel Perspective of Technological Transition

Technological niches analytically located at micro level accounts for the generation and development of varied yet related radical innovations (Kemp et al., 2001; Geels, 2002).

Source: Geels (2002, pp. 1263)
Sociotechnical regimes at meso level represent highly institutionalized, yet semi-coherent set of rules that shape and are shaped by actor groups such as user groups, suppliers, producer network, public authorities, etc (Geels, 2002). The regimes, therefore, account for stability (or rigidity) of existing sociotechnical elements that co-evolve and align with each other over time, which only allows for innovations of incremental nature (Geels, 2004). Sociotechnical landscape, the wider exogenous environment at macro level, consists of heterogeneous sociotechnical development and structure such as political coalitions, cultural and normative values, sociotechnical infrastructure, and environmental problems, etc. Change of landscape is harder and slower than that of regimes (Rip and Kemp, 1998; Geels, 2002; 2004).

According to MLP, while radical innovations are continuously developed in technological niches, whether or not the innovations arise out of the niches depends on the ongoing processes at the levels of sociotechnical regimes and landscape (Geels, 2002; 2004; Geels and Schot, 2007). It is argued that internal dynamics within the regimes may result into misalignments and weak linkages among the elements, which creates ‘tensions’ (short diverging arrows in Figure 1.2). Not only this, developments at the landscape may put pressure on the regimes, exacerbating the tensions. As a result, the tensions create ‘window of opportunity’ for radical innovations to break through the technological niches and trigger sociotechnical
changes in the regimes and landscape over time, leading to the occurrence of sociotechnical transitions (Geels, 2002; 2004).

As shown above, MLP essentially provides top-down and bottom-up account for technological transition. In particular, the top-down view (e.g., tensions in regimes and landscape) is applied to explain whether or not a technological innovation can arise out of the niches. However, emergence of technological innovations is beyond the scope of this dissertation. What is more interesting and relevant is the bottom-up view of technological transition. According to MLP, as technological innovation evolves over time in a society, it triggers changes not only in the niches, but in the sociotechnical regimes and landscape. In this spirit, it is arguable that as a digital innovation diffuses widely in a society, it is likely to be associated with socioeconomic changes at the micro, meso, and macro level, and precipitate transformation over time.

Whereas technological transition literature offers lessons regarding multilevel changes, it is limited in the sense that technology is treated as a collective term and a black-box such that sociotechnical features are often glossed over. For example, the exemplary transition in the literature is the hygienic transition from cesspools to sewer systems in the domain of waste management. Yet, as discussed above, digital innovation literature supplements this weakness by unpacking sociotechnical features, i.e., convergence and generativity. Therefore, digital innovation and technological transition literatures complement each other as the former provides
insights into the dynamics between sociotechnical features of technology and users, and the latter addresses socioeconomic changes at multiple levels.

Toward A Theory of Digital Innovation and Socioeconomic Transformation

Bringing together insights from the IS and technological transition literatures, I propose a multilevel theoretical framework that is intended to illustrate how and why digital innovation leads to socioeconomic transformation at the societal level. The framework is depicted in Figure 1.3.

Figure 1.3: A Multilevel Theory of Digital Innovation and Socioeconomic Transformation
The fundamental of digital technologies is the transformation of analog signals into ubiquitous digital form. Such transformation enables decoupling or loose coupling among digital data, technologies used to process, store and transmit data, and physical components that are empowered with digital capabilities (Tilson et al., 2010; Yoo et al., 2010a). As such, digital innovation is made possible by digitally rearranging resources, knowledge and physical components that were previously inaccessible and disconnected. The underlying benefits of using a digital innovation lie in digitalization of elements and/or relationships, which provides users with new action potentials as well as enables users to circumvent traditional time-space constraints that are associated with physicality of previous physical elements and/or relationships.

In the spirit of the technology affordances perspective, digital innovation affords users the ability to perform socioeconomic activities in a more efficient and effective way by actualizing the new action potentials and by avoiding traditional frictions (e.g., Markus and Silver, 2008). For example, as the opening case suggests, M-Pesa users are able to transfer money to friends and family members or keep temporary savings via their mobile phones anytime and anywhere. Once a digital innovation is perceived advantageous over existing alternatives or to providing additional value-added services, the digital innovation is likely to be adopted and used by individuals and households (Strong et al., 2014). Since the availability of digital innovation unleashes new opportunities for users to access and use socioeconomic resources in
a more productive way, a set of socioeconomic benefits could be engendered. For instance, M-Pesa enables users to accumulate capital to start family businesses.

As the knowledge of inherent advantages of a digital innovation and the associated socioeconomic benefits go viral among members of a similar social system (i.e., the financially excluded in rural areas) over a period of time (Rogers, 2010), the digital innovation is likely to ignite and take off exponentially in a society. This means that affordances of a digital innovation could be realized on a massive scale. It should be noted that I am not arguing for the monolithic socioeconomic benefits that equally apply to all users. As Majcharzak and Markus (2012) suggests, consequences of using a digital innovation depends on purposes and capabilities varying across users. For example, one might use M-Pesa to save money for starting a business, but others may simply use it as a money transfer method. Therefore, a variety of socioeconomic benefits are expected to result from the massive use of a digital innovation by different population segments at the micro level.

The widespread use of a digital innovation not only generates immediate socioeconomic benefits at the micro level, but creates enabling, stimulating, and releasing conditions for subsequent higher-level affordances that are likely to be triggered and actualized to produce far-reaching socioeconomic impacts (Volkoff and Strong, 2013). Arguably, as a digital innovation diffuses widely into a society, it is likely to evolve from an innovative product/service toward a fundamental digital infrastructure, which facilitates operation of an enterprise, community, and society
as a whole (Tilson et al., 2010). For example, the considerable M-Pesa user base creates the enabling condition for business users to incorporate the disruptive mobile-based financial services into their businesses as a means to receive payment from customers and make payment to suppliers. As such, M-Pesa affords business users not only the ability to improve their operational efficiency but the opportunity to develop a digital business model to expand their businesses.

In addition, collective use of a digital innovation might produce socioeconomic impacts at a higher level. This is plausible because widespread use of a digital innovation might produce spillover and ripple effects, which benefit not only users but also non-users. Again, as the opening story suggests, the availability of M-Pesa facilitates inflow and accumulation of capital in villages where the left-behind are afforded the ability to start family businesses, i.e., growing goats and selling milk. The increasing capability to access and leverage on socioeconomic resources arguably contributes to local socioeconomic development through economic expansion, productivity gains, and employment opportunities.

Given socioeconomic impacts at the micro and meso level and the increasing diffusion of a digital innovation, it is conjectured that affordances of the digital innovation, once actualized on a massive scale, may generate aggregate socioeconomic implications at the macro level. Therefore, the framework proposes that socioeconomic benefits afforded by a digital innovation at each level may interact, build on, and reinforce each other, igniting a spiral of socioeconomic
transformation. Prior research in the IS literature provides suggestive evidence in this regard. For example, mobile phone development and growth has been argued to make significant contribution to market efficiency, output and employment growth, capital accumulation, and economic externalities (e.g., Andrianaivo and Kpodar, 2012).

It is worth noting that socioeconomic context is an important theoretical construct in the proposed framework. The importance of socioeconomic context is rather profound when it comes to IS research in developing countries. Context is often cited as the underlying reason of IS implementation failure, scalability failure, and sustainability failure in developing countries (e.g., Avgerou, 2008). Not only this, (de)activation of associated causal mechanisms, how they play out, and the way different mechanisms interact might be contingent on socioeconomic context. Related to the above point, the proposed framework can also provide theoretical accounts of causal mechanisms through which digital innovation leads to socioeconomic transformation. Identifying such causal mechanisms is of extreme importance to advance our understanding of how and why information technology is changing the world (Markus and Rowe, 2018).

Despite the significance of socioeconomic context and causal mechanisms, this dissertation aims to examine the validity of the proposed theory by mainly focusing on socioeconomic benefits of a digital innovation across multiple levels. Before
proceeding to the overview of the three essays, I will introduce the case of MM in Sub-Saharan Africa in the following paragraphs.

**Empirical Background: Mobile Money in Sub-Saharan Africa**

This sub-section outlines the general background of MM by describing how MM works, conceptualizing MM, and presenting its dramatic diffusion in Sub-Saharan Africa. First of all, it is necessary to explain why MM in Sub-Saharan Africa is selected as the empirical case.

The case of MM is selected due to the theoretical and empirical consideration. In theory, the sociotechnical features of MM make it possible to play transformative roles in Sub-Saharan Africa. On the one hand, a majority of population in the Sub-Saharan African countries were left unbanked mainly because of the underdeveloped formal financial infrastructure (e.g., concentrated distribution of bank branches and ATMs in metropolitan areas) (Triki and Faye, 2013; Evans and Pirchio, 2015). Although informal financial services options (e.g., hiding cash at home) are found to do their jobs, they often come with risks and costs (e.g., money loss) (e.g., Mas, 2010). Therefore, developing countries in this area often suffer from the financial services gap that is attributable to the poor formal financial infrastructure and deficient informal financial services options.
On the other hand, the defining nature that distinguishes MM from other mobile-based financial services is that users can enjoy the disruptive financial services even if they do not have bank accounts. Moreover, by digitizing cash into e-money, MM is perceived advantageous over the existing formal and informal financial services because MM provides basic financial services (e.g., money transfer, payments) in a convenient, secure, and affordable way (Jack and Suri, 2014; Aron, 2018). Taken together, it is theoretically plausible that MM can fill the financial services gap by offering value-added services to the already banked, but more importantly providing basic financial services to those who were financially excluded.

Empirically speaking, the transformative implications of MM are observable only when it is widely adopted. Sub-Saharan Africa has been the central stage for MM over the past decade. As of 2016, 39 countries in this area have introduced MM services, accounting for more than 50% of global MM deployments (GSMA, 2015). Several countries, such as Kenya, Uganda, and Tanzania, have seen dramatic adoption rate in just a few years since the first launch of MM. With its explosive growth, MM has been of interest to scholars and subsequently a growing body of literature has been established, which provides theoretical and empirical foundation for this dissertation. In short, the case is selected because MM in Sub-Saharan Africa represents a compelling research setting where socioeconomic transformation enabled by digital innovation becomes theoretically plausible and empirically observable.
How Mobile Money Works

To understand how MM works, we first need to be aware of two key actors involved in this digital financial services ecosystem: mobile network operator (MNO) and transactional agents. First, MNO herein refers to a telecommunication corporation (e.g., Safaricom) who delivers MM services via its own infrastructure (e.g., mobile cellular subscriptions, airtime retailers, wholesalers, etc.). As for the business model of MM, MNOs may or may not partner with banks, other financial institutions, or third parties in providing the digital financial services. The importance of MNOs lies in the fact that MM cannot be deployed in the absence of MNOs and their infrastructure because MM is essentially an application installed into a SIM card of a mobile phone.

The second key player is a network of transactional agents, which constitute the boundary between digital and physical world. An agent could be a person or business that is contracted with MNOs to provide touch points with end users. Agents play three key functions: registration, cash-in/cash-out, and over-the-counter (OTC) service. First, agents provide instructions for MM registration. In addition to registration, agents also have other front-line customer services, i.e., coaching new users to initiate transactions on their phones. Second, agents play a

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7 Typically, agents have their own businesses in addition to MM, i.e., small-scale traders, convenience stores, etc. In some cases, microfinance institutions and bank branches can also serve as agents.
facilitating role in cash-in and cash-out; that is, loading e-money into MM account upon receipt of cash from end users (cash-in), and converting the balance of the MM account into cash for users (cash-out). Third, agents also offer the OTC service—in some cases, both MM users and non-users may use agents’ MM accounts to enjoy financial services, i.e., money transfer, payments.

To use MM services, the initial step for a prospective user is to travel to a “brick-and-mortar” agent to create a MM account under instruction. Once registered, a user needs to start cash-in process—converting cash into e-money stored in MM account. With value stored, the user may initiate a range of financial transactions, such as person-to-person (P2P) money transfer, bill payment, airtime top-up. In the case of receiving e-money from individuals, merchants, or institutions, the recipient can exchange e-money for cash at an agent, which is cash-out process.

Table 1.3\(^8\) summarizes the typical set of financial services provided by MM. It is worth noting that among others, MM is overwhelmingly used for P2P money transfer, followed by airtime top-up. In line with other academic research (e.g., Mbiti and Weil, 2016; Aron, 2018), industry white papers, GSMA (2014) and GSMA (2015), reported that domestic P2P money transfer accounted for 72.8% (and 71.5%) of total transaction value processed by MM as of 2014 (and 2015) in the world.

Table 1.3: Mobile Money Services

<table>
<thead>
<tr>
<th>Services</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2P transfer (domestic)</td>
<td>A transfer made from one person to another person</td>
</tr>
<tr>
<td>Bill payment</td>
<td>A payment made by a person from either their mobile money account or over-the-counter to a biller or a billing organization via a mobile money platform in exchange for services provided</td>
</tr>
<tr>
<td>G2P payment</td>
<td>A payment made by a government to a person’s mobile money account</td>
</tr>
<tr>
<td>Other bulk payment</td>
<td>A payment made by an organization via a mobile money platform to a person’s mobile money account</td>
</tr>
<tr>
<td>Airtime top-up</td>
<td>Purchase of airtime via mobile money, funded from a mobile money account</td>
</tr>
<tr>
<td>Merchant payment</td>
<td>A payment made from a mobile money account via a mobile money platform to a retail or online merchant in exchange for goods or services</td>
</tr>
<tr>
<td>International remittance</td>
<td>Cross-border fund transfer from one person to another person. This transaction can be a direct mobile money remittance, or can be completed through the use of an intermediary organization such as Western Union</td>
</tr>
<tr>
<td>Cash-in</td>
<td>The process by which a customer credits his account with cash. This is usually via an agent who takes the cash and credits the customer’s mobile money account with the same amount of e-money</td>
</tr>
<tr>
<td>Cash-out</td>
<td>The process by which a customer deducts cash from his mobile money account. This is usually via an agent who gives the customer cash in exchange for a transfer of e-money from the customer’s mobile money account</td>
</tr>
<tr>
<td>Mobile microinsurance</td>
<td>Mobile insurance uses the mobile phone to provide microinsurance services to the underserved</td>
</tr>
<tr>
<td>Loan disbursement or repayment</td>
<td>Customers and/or organizations can receive their loan disbursements and repay loans via a mobile money platform</td>
</tr>
</tbody>
</table>
Link to other banking products | Payment is possible from a mobile wallet to other banking products, such as savings, bank transfers and loan repayments (in real time or in batches)

Conceptualizing Mobile Money

As an emerging phenomenon, there is no universal definition of MM. Yet, a growing number of studies seem to agree with the functional view of MM. For instance, Jack and Suri (2014, p. 183) maintained that “this financial innovation has allowed individuals to transfer purchasing power by simple short messaging service (SMS) technology and has dramatically reduced the cost of sending money across large distances.” Similarly, Munyegera and Matsumoto (2016, p. 127) argued that “mobile money allows users to deposit and transfer funds as well as purchase a range of goods and services using their mobile phone.” Although those functional definitions work well for their research purposes, a shared limitation is their failure to conceptually differentiate MM from other mobile-based financial services.

Often, MM is interchangeably used and therefore confused with other terms such as mobile financial services, mobile banking, and mobile payment (e.g., Kirui and Onyuma, 2015; Sekantsi and Motelle, 2016). Although these terms invariably refer to financial services accessed and delivered over mobile phone, there are fundamental differences that distinguish MM from other mobile-based financial services. Table 1.4 compares and contrasts MM with mobile banking and mobile payment along a number of service dimensions.
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Mobile Money</th>
<th>Mobile Banking</th>
<th>Mobile Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary focus</td>
<td>To provide basic financial services via mobile phone</td>
<td>To deliver existing banking services via mobile phone</td>
<td>To provide portable payment services via mobile phone</td>
</tr>
<tr>
<td>Deployed mainly in</td>
<td>Developing countries</td>
<td>Developed countries</td>
<td>Developed countries</td>
</tr>
<tr>
<td>Target customer base</td>
<td>Both banked and unbanked</td>
<td>Only banked</td>
<td>Only banked</td>
</tr>
<tr>
<td>Services provided</td>
<td>Remittance, payment, very few credit provision</td>
<td>Deposit, payment, and credit services</td>
<td>Deposit and payment services</td>
</tr>
</tbody>
</table>

Based on the comparison and preceding sub-section (how MM works), three defining characteristics of MM can be identified: 1) users can sign up for MM service even if they do not own a bank account; 2) users get cash into and out of MM account by going to a network of transactional agents, which are outside of traditional financial institutions; and 3) MM, as opposed to mobile banking and mobile payment, is mainly deployed in developing countries. Building on this, I provide the following working definition of MM:

*Mobile Money (MM) refers to the use of mobile telecommunication technologies and non-bank retail channels to expand the reach and breath of basic financial services (i.e., money transfer and payment) to customers, especially those who were excluded from traditional banking services in developing countries.*

As MM operates with e-money and involves cash to a minimum level, the digital financial tool is favored over traditional banking and informal financial services in at
least three aspects. First, MM is *convenient*. The use of electronic money enables users to avoid the traditional physical and spatial constraints. For example, users are not constrained by operation hours as in the case of banks, or users can access to or use the MM services anywhere via their phones. Second, MM is *secure*. The physicality of cash requires physical transport or movement, which is often associated with risks and costs, i.e., money loss, misuse, theft. However, MM may allow users to avoid these problems as transfer of electronic money is conducted in a digital way. Finally, MM is *affordable*. One of the financial barriers of traditional banking services is the prohibitive cost for users, i.e., minimum balance requirement, high transaction fees, considerable transportation fees to get to banks. Yet, studies (e.g., Mbiti and Weil, 2016) have compared the cost structure of MM with that of other financial means provided by commercial banking, post offices, or other microfinance institutions, and concluded that the use of MM incurs less cost for users. These benefits may explain the popularity of MM in Sub-Saharan Africa, which I turn to next.

**Diffusion of Mobile Money in Sub-Saharan Africa**

Since its inception in the mid-2000s, MM has been widely deployed and adopted in emerging economies, especially among Sub-Saharan African countries (Triki and Faye, 2013; Evans and Pirchio, 2015). As of 2015, MM was available in 93 countries via 271 deployments. In 2015, 37 economies had ten times more registered agents than bank branches, and registered customer accounts grew 31% to reach a total of
411 million registered accounts globally. In terms of transaction volume, mobile money processed over a billion transactions in December 2015, which was more than double what PayPal processed globally. In addition, active mobile money users conducted an average of 11.2 transactions per month in 2015 and maintained a median account balance of US$ 4.70, both increased from 2014 (GSMA, 2015).

The following figures⁹ depict ignition and explosive growth of MM in several Sub-Saharan African countries since 2007, suggesting its ever-increasing role in three aspects: adoption, usage, and consequences. First, Figure 1.4 shows the dramatic MM adoption rate (per 1,000 adults) over the years. Several countries witness universal access to MM—in general 800 out of 1,000 adults own a MM account in a few years since the first launch of MM. This remarkable figure sheds light on the financial inclusion implication of MM; that is, the digital financial services tool expands its reach to the previously unbanked in addition to the banked. Second, it appears that MM is not only widely adopted, but also intensively used over time. Figure 1.5 and Figure 1.6, respectively, shows the increasing frequency and monetary value of MM usage, suggesting that MM has been deeply incorporated into users’ daily lives.

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⁹ Source: International Monetary Fund Financial Access Survey.
Figure 1.4: Number of Registered Mobile Money Accounts

Figure 1.5: Number of Mobile Money Transactions (per 1,000 adults)
Finally, given the dramatic adoption and collective use of MM in a society, it is arguable that MM has become an important socioeconomic tool that addresses the long-standing financial exclusion issue and meanwhile facilitate active participation of users in the mainstream socioeconomic activities. According to the financial development theory (e.g., Levine, 2005), the widespread use of MM is expected to bring about far-reaching socioeconomic benefits for households, businesses, and society as a whole. In particular, given the unaddressed financial services gap, the transformative potential of MM seems plausible in Sub-Saharan Africa. To investigate socioeconomic transformation enabled by MM in this area, three essays are conducted, which I turn to next.
Overview of Three Essays

In the preceding sections, I proposed a multilevel theoretical framework that addresses the overarching research question in the context of MM in Sub-Saharan Africa. To examine the validity and plausibility of the framework, three essays are conducted, using mixed research methods and addressing multiple levels of analysis. Figure 1.7 maps the three essays into the theoretical framework.

Figure 1.7: Mapping of the Three Essays into the Proposed Theory

According to the proposed theoretical framework, a digital innovation, once widely adopted in a society, might generate socioeconomic impacts at the micro, meso, and
macro level. In this spirit, Essay 1 is dedicated to examining whether there are multilevel socioeconomic benefits enabled by MM in Sub-Saharan Africa. Also, the proposed framework posits that widespread use of a digital innovation is associated with macro-level socioeconomic indicators, which is examined in Essay 2. Finally, although a digital innovation is expected to transform micro-level socioeconomic practices and provide opportunities for users to reap socioeconomic benefits, the emergence of a digital innovation is conjectured to introduce challenges for users and society as a whole. In this regard, Essay 3 is designed to investigate the potential unintended consequences by focusing on the digital divide issue regarding MM.

Since this dissertation mainly focuses on usage and socioeconomic consequences of MM, other issues, i.e., adoption, legal, business model of MM, are beyond the scope of current research. The overview of three essays is summarized in Table 1.5. Below I provide more details of each essay.

Table 1.5: Overview of Three Essays

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td>Sub-Saharan Africa</td>
<td>Sub-Saharan Africa</td>
<td>Kenya</td>
</tr>
<tr>
<td>Research Type</td>
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<td>Quantitative</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Research Method</td>
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<td>Difference-in-Differences</td>
<td>Discriminant analysis</td>
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</tbody>
</table>
Essay 1, co-authored with M. Lynne Markus and Xiaolin (Christina) Zhu, aims to survey the emerging MM literature by examining what we know and what we do not know about the socioeconomic transformation. To this end, I conducted a focused yet systematic literature review. The analytical synthesis of 63 selected studies reveals that MM, when widely used in a country, enables a variety of socioeconomic benefits at multiple levels: household welfare (e.g., risk sharing), business benefits for micro and small enterprises (e.g., reduced transaction costs), community development (e.g., local economic expansion), financial sector development (e.g., financial deepening), and country well-being (e.g., poverty reduction). In addition, this essay identifies multifaceted research gaps with respect to themes (e.g., unintended consequences), theory (e.g., under-theorized mechanisms), methodology (e.g., lack of qualitative research), and research location (e.g., highly concentrated to a specific set of countries).

Essay 2, sole-authored, zooms out from the MM-enabled digital transformation by examining the cross-country macroeconomic implications of MM in Sub-Saharan
Africa. In particular, this essay, drawing on the theory of affordances, examines the theoretical and empirical link between MM and socioeconomic development. As discussed above, the digital financial services tool allows users to circumvent traditional financial barriers and conflicts associated with the physicality of cash. As such, what MM brings about is essentially a set of new affordances (e.g., instant transfer of purchasing power) for users to actualize, which engenders socioeconomic benefits. This essay hypothesizes that the affordances of MM, once realized on a massive scale, generate not only immediate socioeconomic benefits, but the conditions for subsequent affordances that are likely to be triggered and actualized to produce far-reaching socioeconomic impacts at a higher level. Results of Difference-in-Differences analysis show that widespread adoption of MM has a positive effect on a country’s economic growth, rather than being a consequence of it. The positive effect increases as the service spreads into a greater number of population over time.

Essay 3, co-authored with M. Lynne Markus, zooms into the MM-enabled digital transformation by investigating the digital divide in MM usage in a particular country. Kenya serves as a compelling research setting to examine this issue because the number of MM accounts exceeded Kenyan adult population in just six years after the launch of M-Pesa, the first MM service, in 2007. The widespread adoption might appear to suggest the closure of the digital divide among the “haves” and “not-haves” in Kenya. However, the universal access to MM informs little about
how the service is used by different population segments. That is, even if there is the closed gap in adoption, the digital divide might still exist in usage (e.g., breadth of services used). This essay examines the digital inequality in MM usage, along with socioeconomic differences that discriminate among usage levels and types. The findings show that whereas the digital divide in usage frequency has decreased over time, the gap in the usage scope persists. Also, this essay notably finds that structural socioeconomic differences, i.e., bank account ownership, financial literacy, invariably separate active users from non-active users, regardless of the divide being analyzed in terms of frequency or scope and regardless of diffusion phases. Finally, the findings reveal dynamics in the structural socioeconomic differences—some factors, i.e., bank account ownership, are more influential in explaining the divide in the earlier diffusion phase, but others, i.e., income and financial literacy, emerge as more influential factors in the later phase.

The remainder of this dissertation is organized as follows. Chapter II, III, and IV, respectively, presents Essay 1, 2, and 3. In Chapter V, I summarize the major findings and discuss theoretical implications and contributions of this dissertation.
CHAPTER II. SOCIOECONOMIC IMPACTS OF MOBILE MONEY

This essay is co-authored with M. Lynne Markus and Xiaolin (Christina) Zhu.

Xiaolin (Christina) Zhu is a visiting PhD student from Remin University, Beijing, China. She helped with screening studies and coding the selected studies.

Abstract

In Sub-Saharan Africa, Mobile Money (MM) is geared toward addressing financial services gap resulted from limited formal and informal financial services infrastructure. Given its accessibility, security, and affordability, MM has been increasingly argued to be a promising digital solution to the stumbled socioeconomic development in this area. Despite the potentially disruptive impacts, the research on MM is in its infancy. To examine the landscape of current MM literature, this systematic review research analyzed 63 academic empirical studies mainly focusing on socioeconomic impacts. The analytical synthesis of the evidence shows that MM, when widely used in a country, enables a variety of socioeconomic
benefits at multiple levels, i.e., household welfare, business benefits for micro and small enterprises, community development, financial development, and country well-being. Upon the systematic scan of the literature, this essay also discusses multifaceted research gaps and proposes future research directions.

**Keywords:** Digital Innovation, Socioeconomic Development, Mobile Money (MM), Sub-Saharan Africa
Introduction

Digital innovations have the potential to transform existing sociotechnical practices, processes, and structures by embedding computing capacity into physical components and by digitally incorporating data, knowledge, and resources that were previously disconnected (e.g., Boland et al., 2007; Tilson et al., 2010; Yoo et al., 2012; Kallinikos et al., 2013). The resulting digitalized services and goods can be easily accessed and consumed on a massive scale because they give users the ability to circumvent costs and risks that are associated with physical components and relationships. With the advent of nomadic computing era (Lyytinen and Yoo, 2002), we have witnessed a growing number of digital innovations, such as peer-to-peer ride sharing, home automation, and crowdfunding, which disrupt traditional industries and transform the way we live and work. Among those, this essay is particularly interested in mobile money and examining its potential transformative socioeconomic impacts in developing countries.

Mobile money (MM) refers to the use of information and communication technologies and non-bank retail channels to extend the delivery of basic financial services to people, especially the low-income population, who are marginalized from formal financial services (GSMA, 2015). MM has been argued to be transformative in developing countries because the disruptive mobile financial services can fill the financial services gap, which is mainly due to the poor formal
financial infrastructure and limited informal financial services approaches (Mas, 2010; Evans and Pirchio, 2015; Aron, 2018). As widely diffused into the society over time, the potential socioeconomic transformation enabled by MM has been of great interest to scholars (e.g., Mbiti and Weil, 2016; Jack and Suri, 2014; Sekabira and Qaim, 2017). However, the emerging literature remains somewhat sporadic (Kim et al., 2018) and our understanding of the transformative impacts of MM has so far been limited (Aron, 2018). To fill the knowledge gap, this essay addresses the following research questions:

1) *What do we know about the socioeconomic development enabled by MM?*

2) *What are the gaps in the current MM literature?*

Those questions are addressed based on a systemic literature review (Rowe, 2014). There are at least three reasons to believe that such a descriptive and analytical review is of extreme importance. First, the resulting synthesis of the evidence will sharpen our understanding of multidimensional transformative impacts enabled by MM including, but not limited to, financial inclusion, poverty reduction, and household welfare (Aron, 2018). Second, in theory, the systematic documentation of a particular instance of digital transformation warrants the investigation of the social mechanisms addressing digital innovations and the associated socioeconomic transformation (Lucas et al., 2013; Markus and Rowe, 2018). In addition, rigorous mapping of the existing MM landscape enables us to critically examine contributions
of past research and identify the under-tapped territory that informs future scholarly efforts (Rowe, 2014). Finally, in practice, the results will offer insightful lessons for a multitude of practitioners, i.e., service providers, entrepreneurs, and policymakers, to further explore new alternatives of MM to achieve inclusive socioeconomic development in developing countries.

Like others, this systematic literature review is not without boundaries. This study exclusively reviews the prior research on socioeconomic implications of MM in Sub-Saharan Africa. This area is selected due to theoretical consideration. Sub-Saharan Africa is mainly composed of developing countries, with a majority of population living below the poverty line and without access to traditional banking services (Alexandre et al., 2011; Lwanga and Adong, 2016) at the time of MM deployment. The lack of quality financial services engendered institutional voids (Mair and Marti, 2009), which made it possible for MM to fill in and therefore to precipitate socioeconomic transformation. This area has been the center of MM phenomenon in the past decade. As of 2016, 39 countries have introduced MM services, accounting for more than 50% of global MM deployments (GSMA, 2015). Not only this, several countries in this area, i.e., Kenya, have been applauded for the success MM story, with remarkable adoption level (Evans and Pirchio, 2015). As such, Sub-Saharan Africa represents a compelling research setting where the MM-enabled socioeconomic transformation becomes theoretically plausible and empirically observable.
The remainder of this essay is organized as follows. In Section 2, we discuss the basics of MM and its potential to enable socioeconomic transformation. Section 3 details the literature search and approaches used to examine the prior research. In Section 4, we present descriptive analysis and analytical synthesis of the literature. Section 5 closes this essay with the discussion of research gaps and suggestions for future research.

Background

In this section, we first conceptualize MM as a digital innovation and describe how it works. We move on to explore how and why MM could enable socioeconomic transformation in Sub-Saharan Africa. Finally, we critically examine prior literature review studies on MM and justify the current research.

Mobile Money: A Digital Innovation in Sub-Saharan Africa

MM is considered a digital innovation because the disruptive financial services are made possible by digitalizing cash into electronic money (e-money) and by digitally reconfiguring a variety of physical sociotechnical components that were previously disconnected (Tilson et al., 2010; Yoo et al., 2012). MM providers orchestrate telecommunication infrastructure, a network of transactional agents, mobile phones, and cash to establish an end-to-end digital financial services ecosystem. By visiting an authorized “brick-and-mortar” transactional agent (e.g., convenience store),
prospective users can create MM accounts and start cash-in process—converting cash into e-money stored in MM accounts. With e-value stored on their mobile phones, users are able to conduct a range of financial transactions, i.e., person-to-person money transfer, bill payment, airtime top-up, regardless of time and space. In the case of receiving e-money from their social networks via phones, the recipients can exchange e-money for cash at an agent—the cash-out process. As such, a mobile phone, empowered with a sizable function of financial services, serves as “a bank branch in the pocket.” Likewise, a transactional agent, that would have otherwise little to do with banking services, now functions as “a bank branch in the neighborhood.”

The defining nature that distinguishes MM from other mobile-based financial services (e.g., mobile banking in developed countries) is twofold: 1) users can sign up for the services even without bank accounts (as opposed to the case that use of mobile banking often requires a pre-existing bank account); and 2) transactional agents, often existing small businesses, are contracted with MM service providers to offer registration, cash-in and cash-out services to users. The agents, outside the sphere of traditional financial institutions, are scattered across a country providing ubiquitous touch points for users, especially those excluded from traditional banking services. This makes MM a promising digital financial services tool to broaden reach and coverage of basic financial services into population, especially those who would otherwise be excluded from traditional banking services (GSMA,
Since its inception, MM has been widely adopted in emerging economies, especially Sub-Saharan Africa. However, it should be noted that MM has only taken off in a few countries and floundered in others (Evans and Pirchio, 2015). Figure 2.1 depicts the dramatic number of MM transactions (per 1,000 adults) and value of the transactions (% of GDP) in select Sub-Saharan African countries with successful MM deployments. The remarkable figures provide suggestive evidence that MM stimulates active participation of users in socioeconomic activities and makes considerable contribution to socioeconomic development, pointing to the transformative potential of MM in Sub-Saharan Africa.

Figure 2.1: Number and Value of MM Transactions

**Mobile Money and Socioeconomic Transformation**

To examine socioeconomic transformation enabled by MM, it is imperative to discuss the financial services landscape in Sub-Saharan Africa. A majority of

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10 The data were collected from IMF Financial Access Survey 2017.
countries in this area have poor formal financial infrastructure, with bank branches and ATMs highly concentrated in metropolitan areas (Triki and Faye, 2013; Evans and Pirchio, 2015). In addition to geographic limitation, financial barriers such as affordability (i.e., minimum opening balance) and ineligibility (i.e., heavy bureaucratic processes) further marginalize the rural, poor households from accessing traditional banking services (Beck et al., 2008). It is therefore not surprising that households turn to a variety of informal financial services options including transferring money via bus driver, hiding cash at home, keeping livestock, saving or borrowing with ROSCAs and ASCAs. However, those informal financial services are associated with costs and risks, such as geographic constraints, limited liquidity, money loss, theft, etc. (Mas, 2010; Karlan et al., 2014). Still, households’ financial needs were far from being satisfied and accordingly the financial services gap remained unaddressed.

The root of inefficient provision of formal and informal financial services and the resulting financial services gap is partly due to excessive immersion in cash (Radcliffe and Voorhies, 2012). By contrast, operating mainly with e-money and involving cash to a minimum level, MM enables users to circumvent traditional financial barriers and frictions. In particular, use of MM alleviates a variety of transactions costs including costs of money transfer, transport costs of travel to a

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11 ROSCAs refer to groups that regularly collect money from each member and give it to one person in turn; ASCAs refer to groups that regularly collect money from members, and lend to its members or other people with interest.
bank or government office, coordination costs between consumers and goods/services providers, and opportunity costs such as money loss (Aron, 2018). Whereas MM is considered additive for the already banked, it could be transformational for the financially excluded—often the rural, poor households accounting for a considerable portion of population in Sub-Saharan Africa—because MM affords them the ability to leapfrog weak and costly conventional financial services infrastructure and obtain necessary financial resources to actively participate in mainstream socioeconomic activities. That is, MM provides a promising digital channel for both the rich and the Bottom of the Pyramid of a society to achieve redistribution as well as growth effects.

Along these lines, as MM spreads into a society in a more inclusive way, it can widen and deepen financial connectedness through frictionless, instant transfer and allocation of financial resources and capability. The increased financial connectedness at the societal level can facilitate capital accumulation, optimize capital and human resource allocation, and therefore allow for more efficient investment decisions within households and businesses (Ramada-Sarasola, 2012; Jack et al., 2013; Suri, 2017). More in this point, Jack et al., (2010) suggested the ripple and spillover effects by arguing that improved financial connectedness enabled by MM leads to job creation and employment, labor specialization, stimulates consumption and output of goods and services, and increases trade volume and velocity. Given the fundamental role of financial services in
socioeconomic development (Levine, 2005), it is arguable that MM, once widely used in a society, may disruptive traditional financial behaviors and transform the way socioeconomic development is achieved.

**Prior Literature Review Studies on Mobile Money**

Over the past decade, the transformative potential of MM has attracted scholarly attention and accordingly a number of literature review studies have been conducted. One of the earliest scholarly efforts is Diniz et al. (2011), which reviewed 196 academic and non-academic studies on MM and mobile payment around the world. Diniz et al. (2011) provided detailed descriptive analysis of the research themes (e.g., consumer adoption, obstacles to implementation, etc.), methods (e.g., case study, survey, experiment, etc.), and locations (USA/Europe, Africa, Latin America, etc.). However, the transformative socioeconomic implications of MM are less systematically documented because 1) MM in developing countries was not conceptually distinguished from mobile payment in developed countries; 2) relatedly, the review scope included research conducted in both developed and developing countries; and 3) most importantly, the timeline, 2001—2011, did not capture proliferation of studies on MM in the late 2010s.\(^\text{12}\)

More recently, a few review studies managed to overcome the aforementioned three concerns to some extent. Suri (2017) conducted a focused review of the emerging

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\(^{12}\)Roughly, three quarters of the 271 MM services were launched after mid-2010 (GSMA, 2015).
research on M-Pesa, the MM service, in Kenya. The study highlighted reduction in transaction costs as the potential mechanism by which MM enables socioeconomic impacts such as risk sharing, household income, consumption, savings, and poverty reduction among others. In the similar vein, Aron (2018) offered an excellent theoretical and empirical account for economics of MM. The review study explored the theoretical channels of economic influence of MM at both the micro (e.g., transactions costs reduction, risk and insurance, etc.) and macro level (e.g., money supply, inflation, etc). Nonetheless, the review by Suri (2017) or Aron (2018) is hardly systematic partly because they only looked into a few selected empirical studies and partly because they were focused on the micro and macro level, leaving meso-level unaddressed (e.g., implications for businesses).

Different from the prior review research, Rea and Nelms (2017) examined the impacts of MM from a sociocultural perspective. Based on the analysis of a specific repository of studies funded by IMTFI\textsuperscript{13}, the authors summarized insights with respect to space and time, gender, kinship, religion and ritual among others, shedding light on the contextual sociocultural complexities involved in the usage and consequences of MM. Another relevant study is Alampay and Moshi (2018), which reviewed in depth 10 quantitative studies at the household level. The authors concluded that use of MM has a statistically positive impact on money remittance, household savings, consumption, income, and livelihood. Finally, Kim et al. (2018)

\textsuperscript{13}IMTFI (Institute for Money, Technology and Financial Inclusion). https://www.imtfi.uci.edu/
conducted a systematic review of 54 academic studies; yet, the review study was somewhat confined to “financial inclusion” frame. Again, by using the term, mobile financial services, the authors did not consider the nuanced conceptual differences between MM and mobile banking.

Whereas prior literature review studies help advance our understanding of the MM phenomenon, they reveal three important dimensions of the knowledge gap. First, exclusive conceptual focus on MM: As mentioned above, MM differs conceptually from other mobile-based financial services because the former, but not the latter, has the potential to financially include previously excluded people who did not own traditional bank accounts. As this defining nature may contribute to the transformative potential of MM, a literature review exclusively focusing on MM is needed (cf. Diniz et al., 2011; Kim et al., 2018). Second and related to the above point, research context. While the foci of some studies are too specific—a few developing countries (Suri, 2017; Alampay and Moshi, 2018), others are too broad—both developing and developed countries (Diniz et al., 2011; Kim et al., 2018). As a result, there is a risk of polarizing, either under-estimating or over-estimating, the generalizability with respect to MM-enabled transformation. Third, level of analysis. It appears that MM studies at the individual/household level dominate the emerging literature, with macroeconomic research catching up (Rea and Nelms, 2017; Aron, 2018). However, little is known about the role of MM at the meso level, i.e., small businesses, community.
Admittedly, the purpose of the current review is not to present a comprehensive survey of all aspects of MM; instead, in response to the knowledge gap, we attempt to provide a focused yet systematic synthesis of empirical evidence, pointing to the transformative role of MM in developing countries. It is focused because we are solely interested in MM (as opposed to mobile banking) in a particular area—Sub-Saharan Africa; and it is systematic because we review all available empirical studies on the socioeconomic impacts of MM, regardless of level of analysis.

Methodology

This section discusses the approaches used for the systematic review. First, we searched a number of academic databases to identify the potentially relevant studies. Next, inclusion and exclusion criteria were developed and applied to screen the studies. Finally, we developed a coding framework to code and analyze the selected studies. Figure 2.2 outlines the procedure of literature search.
We adopted a systematic literature review approach (e.g., Okoli and Schabram, 2010; Dahlberg et al., 2015) to ensure a methodologically rigorous scan of the MM literature. We searched the following academic databases: ACM Digital Library, AIS eLibrary (major IS conferences), EBSCO, Elsevier (ScienceDirect), Goolge Scholar, and ProQuest Central. It is worth noting that as MM is an emerging phenomenon, a considerable number of studies are yet to be published in leading journals or conferences. Therefore, in addition to the traditional academic databases that collect major journal articles and conference proceedings, we included Google Scholar to
capture other studies that appear in the niche research outlets as well as in the grey literature (e.g., NBER, SSRN).

The search period was set from January 2008 to December 2018 mainly due to the fact that studies on MM have ignited dramatically since the tremendous success of M-Pesa in Kenya, which was launched in March 2007. In searching the databases, we used the following descriptors: “mobile money” and “mobile financ*”. The descriptors were applied to the fields of title, abstract, and keywords. One may argue that searching with the two search phrases might omit some studies using terms such as mobile payment, mobile banking, m-money, etc. To alleviate the concern and ensure the systematic scan, we also implemented backward and forward search (Levy and Ellis, 2006).

**Screening: Inclusion and Exclusion Criteria**

Given the present purpose, the inclusion criteria were geared toward including *empirical research on the socioeconomic implications of MM in Sub-Saharan Africa*. That is, the current research is interested in examining the contribution of prior research *with empirical evidence*. Accordingly, the following exclusion criteria were developed to filter the relevant studies:

- Exclude studies if the major research subject is not MM (e.g., mobile banking/payment)
- Exclude studies if the major focus is on the sociocultural impacts of MM\(^\text{14}\)
- Exclude studies if they are not conducted in Sub-Saharan Africa area
- Exclude studies if they are only concerned with feasibility, potential, or conceptual issues of MM
- Exclude studies if they are mainly focused on issues like adoption, regulation, business model, etc.

In applying the exclusion criteria, we manually undertook a double-screening procedure. In the first round, the criteria were applied to titles and abstracts of 1047 studies returned from database searching, which generated 170 relevant articles (see Figure 2.2). Building on these studies, we performed backward and forward reference search, and identified additional studies from the authors’ repository, which together yielded another 23 relevant articles. A second round of screening then was conducted to assess in-depth the relevancy of full text of the 193 articles. As a result, upon removal of duplicate research, 63 studies were selected to analyze. The list of the selected studies is shown in Table A.2 in APPENDIX.

**Analysis: Coding Framework and Thematic Coding**

Following prior literature review research (Alampay and Moshi, 2018; Apanasevic et al., 2018), we developed a coding framework to analyze the selected studies. The coding framework consists of five dimensions, as shown in Table 2.1.

\(^{14}\)See Rea and Nelms (2017) for the detailed review of sociocultural dimensions of MM phenomenon.
Table 2.1: Coding Framework

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Items</th>
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<tbody>
<tr>
<td>Bibliographic</td>
<td>Authors, title of the article, publication year/outlet, research type, level of analysis, etc.</td>
</tr>
<tr>
<td>Details</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>Research questions/objectives, context (e.g., in which context MM was used), theoretical perspective, research location (e.g., urban vs. rural), country, etc.</td>
</tr>
<tr>
<td>Research Backgrounds</td>
<td></td>
</tr>
<tr>
<td>MM</td>
<td>Definition, the specific MM studied (e.g., M-Pesa), features/services provided by the MM, MM usage, etc.</td>
</tr>
<tr>
<td>Research Methods</td>
<td>Data type/source, data collection period, sample size, socioeconomic characteristics of the research sample, specific analytic techniques applied,</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Socioeconomic impacts of MM</td>
</tr>
</tbody>
</table>

The analysis was carried out in two steps. First, we used the coding framework to capture those dimensions of each selected study. Second, the Outcomes dimension was further coded in an inductive way based on the thematic coding approach (Braun and Clarke, 2006) in order to identify the themes concerning the socioeconomic impacts of MM.

### Results

In this section, we first describe the landscape of the MM literature. Then, we move on to discuss the analytical synthesis of socioeconomic impacts from the micro to macro level.
Descriptive Analysis of the Literature

The landscape of the MM literature is described in three aspects: research expansion, research classification, and research location. In what follows, we turn to each in detail.

Research Expansion

Figure 2.3 plots the increasing trend of empirical research on MM in the past 10 years. Indeed, the trajectory of research expansion coincides with the rollout and explosive growth of MM in Sub-Saharan Africa. According to the GSMA Mobile Money Development Tracker\(^{15}\), MM had been intensively deployed in this area during the period between 2008 and 2010. In addition, Evan and Pirchio (2015) empirically showed that for the countries with tremendous MM penetration, it often takes 2 to 4 years for MM to ignite and grow explosively. Therefore, it is not surprising to observe that the research has dramatically expanded since 2013, which also signals the socioeconomic development enabled by MM as it spreads into the society.

\(^{15}\) https://www.gsma.com/mobilefordevelopment/m4d-tracker/mobile-money-deployment-tracker/
Research Classification

As for the research type, quantitative research (76%) seems to dominate the existing literature, whereas very few studies (5%) adopted mixed methods to examine the dynamics of MM (see Table 2.2). Among others, Difference-in-Differences, multivariate regression, and econometrics analysis are common techniques used in the quantitative studies. In the case of qualitative research, field study (ethnography), semi-structured interviews, and focus group discussion are frequently used. Despite the bias in the research type, the type of data used in the literature is somewhat balanced. 54% and 38% of the selected studies used primary (e.g., self-developed survey) and secondary data (e.g., survey data collected by third party), respectively, with the rest (8%) using both.
Table 2.2: Research and Data Type

<table>
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<th>Primary</th>
<th>Secondary</th>
<th>Both</th>
<th>Total</th>
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<td>Quantitative</td>
<td>24</td>
<td>22</td>
<td>2</td>
<td>48</td>
<td>(76%)</td>
</tr>
<tr>
<td>Qualitative</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>12</td>
<td>(19%)</td>
</tr>
<tr>
<td>Both</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>(5%)</td>
</tr>
<tr>
<td>Total</td>
<td>34 (54%)</td>
<td>24 (38%)</td>
<td>5 (8%)</td>
<td>63 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

In addition to research and data type, level of analysis is of great interest to scholars. The current MM literature addresses socioeconomic impacts at the micro (household), meso (business and community), and macro (financial sector and country) level. In particular, the literature features dominance of studies at the household level (34), followed by studies at the business level (18), country level (14), and community level (3). Such skewed focus is expected given the fact that MM has so far been mainly used by individuals for person-to-person money transfer (e.g., Mbiti and Weil, 2016; Aron, 2018). As MM spreads into a greater population in society, we may anticipate a growing body of studies at other levels. However, as Figure 2.4 shows, the situation barely changes over the past few years. Instead, household-level studies continue to take the lead since the introduction of MM, with relatively little research looking into socioeconomic implications of MM at other levels.
Research Location

Although Sub-Saharan Africa is the center stage for MM deployments, not all countries in that area have seen the ignition and growth of MM services (Evans and Pirchio, 2015). One of the first, most successful, and widely covered MM to date is M-Pesa in Kenya. Accordingly, 36 out of 63 selected studies were conducted in the context of Kenya, followed by the context of Uganda (14) and Tanzania (10) (see Figure 2.5). As suggested in Figure 1, other countries in this area such as Ghana, Zambia, Zimbabwe, Mozambique, and Namibia, following the success of M-Pesa in Kenya, have started to see dramatic adoption of MM. Nonetheless, those countries have not received as much attention as in Kenya, Uganda or Tanzania, which suggests geographic gaps in the current MM literature.
Another important dimension of research location concerns the specific research setting: urban vs. rural (see Figure 2.6). Overall, whereas 22% and 29% of the selected studies were conducted in urban and rural areas, respectively, the rest, 49%, were conducted without distinguishing those two areas. It appears that equal attention has been given to urban and rural areas. Since the dominant use of MM involves person-to-person money transfer between urban migrant workers and their family in rural areas (e.g., Morawczynski and Pickens, 2009; Mbiti and Weil, 2016), it is expected to observe the overall balanced distribution of scholarly attention among urban and rural areas. However, if we exclude studies at the community and country level that necessarily include both areas, a hidden side of MM story is revealed. At the household level, rural households have received greater attention (rural (44%) vs. urban (6%)), while studies concerned with business benefits were mainly conducted in urban areas (urban (61%) vs. rural (17%)).
bias may indicate another geographic research gap. Future research is needed to look into the socioeconomic impacts of MM on urban households and businesses located in rural areas. This point will be revisited shortly in the Discussion section.

![Figure 2.6: Research Setting: Urban vs. Rural vs. Both](image)

**Analytical Synthesis of the Literature**

In what follows, we discuss the emerging themes concerned with socioeconomic benefits enabled by MM. In particular, we synthesize the empirical evidence, following level of analysis from micro through meso toward macro.

**MM and Micro-level Benefits: Household Welfare**

It is widely accepted that MM is perceived as a disruptive monetary transfer, payment, and storage tool (e.g., Morawczynski and Pickens, 2009; Mbiti and Weil, 2016; Aron, 2018). Before the advent of MM, households, especially those who did not have access to formal banking services, relied on informal financial services approaches to transfer and save money. The most common methods to send and
receive money were through friends, bus drivers, or post office; and households often used informal savings mechanisms such as hiding cash under mattress, keeping livestock, saving or borrowing with ROSCAs and ASCAs (e.g., Mas, 2010; Karlan et al., 2014). As discussed above, the major limitation, risk, and cost (i.e., money loss, theft, misuse, etc.) concern with the physicality of cash that requires time and cost to move it around. With cash and financial transaction processes digitalized, the introduction of MM has been argued to disrupt the way individuals and households enjoy basic financial services.

The literature has come to the consensus regarding the transformative role of MM in money transfer. Jack et al. (2013), based on the primary panel survey data in 2008 and 2009 in Kenya, showed that households with at least one M-Pesa user are more likely to receive and send remittances and more likely to receive and send greater amounts in the aggregate within their social networks than nonuser households. Mbiti and Weil (2016) compared two survey data of Kenya FinAccess Household Survey 2006 (before M-Pesa) and 2009 (after M-Pesa), and the results revealed the similar changing trend that M-Pesa use increases the chance of receiving and sending money and meanwhile decreases the use of informal money transfer methods. Unlike the previous studies examining average population, Waweru and Kamou (2017) solely focused on low-income households in Kenya. The findings consistently point to the transformative role of MM as expected. The authors found that due to the introduction of MM, money transfer by courier is not practiced.
anymore, with transfer methods via friends or post office dramatically reduced. Such an emerging transformation in terms of money transfer is also documented in Uganda (e.g., Munyegera and Matsumoto, 2016), Tanzania (e.g., Riley, 2018), and Mozambique (e.g., Batista and Vincente, 2013).

In addition to money transfer, MM is also used for savings, especially depositing small amount of money for short-term necessities and future use. However, unlike the universal transformative role of MM in money transfer, the role of MM in facilitating savings is somewhat limited and heterogeneous across countries. Whereas saving via MM is not found as a common practice in Ghana (Aker and Wilson, 2013), Uganda (Lwanga and Adong, 2016), and Zimbabwe (Thulani et al., 2014), the monetary storage function of MM is widely used in Kenya (Jack and Suri, 2014) and Tanzania (Riley, 2018). Despite the variations across countries, there have been two findings in common. First, use of convenient and secure digital savings tool appears to be associated with the reduced use of informal savings approaches such as hiding cash in secret places (Mbiti and Weil, 2016; Waweru and Kamau, 2017). Second, the availability of MM is found to increase the likelihood of saving via a variety of approaches including MM, banks, and informal savings groups (Jack and Suri, 2011; Batista et al., 2015; Lwanga and Adong 2016; Munyegera and Matsumoto, 2018). Not only the savings tendency, MM use is also positively associated with greater amount of money saved (Ouma et al., 2017; Munyegera and Matsumoto, 2018).
As households are afforded the ability to circumvent the temporal and spatial constraints that were traditionally associated with the dominant use of cash, it has been observed that use of MM has significantly contributed to improved household welfare by facilitating accumulation and allocation of financial resources and capabilities within and across their social networks. In particular, closer review of the literature reveals three interrelated dimensions of household welfare that is attributable to the availability of MM, namely, 1) risk sharing in the event of emergency; 2) household income and consumption; and 3) family business. In the following paragraphs, we turn to each in depth.

Risk Sharing

One of the major research themes concerns the improved households’ ability to combat a variety of risks. It has been shown that through instant, frictionless e-money transfer, households are able to smooth negative disturbance arising from events such as drought, disease, and school dropout, to which households would otherwise have been susceptible. Jack and Suri (2014) found that while negative income shocks reduce consumption by 7% for non-users, the consumption of user households is not affected. They further showed that the consumption effect is partly attributable to the fact that households using MM are more likely to receive remittances as well as a larger amount from a wider network of sources and a larger fraction of their network in response to a negative shock. Adding to this, Geng et al. (2018) showed that in the event of uninsured health emergency, be it severe or mild,
MM users in Kenya do not experience decrease in food expenditures as they are able to withdraw more savings and receive more informal transfers from their social networks.

Unlike the preceding studies focusing on self-reported endogenous disturbance such as illness in Kenya (Jack and Suri, 2014; Geng et al., 2018), Riley (2018) and Abiona and Koppensteiner (2018) examined the role of MM in hedging against exogenous aggregate shocks, namely, rainfall shocks, in Tanzania. Consistent with previous findings, both studies found the consumption smoothing effect enabled by MM. In particular, Riley (2018) showed that when a rainfall shock occurs, household MM users no longer experience a drop in consumption and may even get a slight increase in consumption. Moreover, Abiona and Koppensteiner (2018) found that per capita food expenditure is particularly smoothed for the poorest of households using MM during periods of rainfall shocks, preventing these households from sliding into transient poverty. These findings, together, point to the disruptive role of MM, which affords households the ability to solicit emergency funds from a wider scope of their social networks and therefore shield themselves from negative shocks and even poverty, be it endogenous and exogenous risk.

*Household Income and Consumption*

It appears that the mechanism of MM facilitating money transfer and storage also comes to work even in the absence of negative shocks. A number of studies provide
empirical evidence regarding the agreed-upon positive role of MM on promoting household income and consumption. For example, low-income households in rural areas in Kenya (Morawczynski, 2009; Macharia, 2013) and in Zimbabwe (Thulani et al., 2014) reported that they experience increase in income due to money transfers from their social networks in urban areas. With increased disposable income, it is arguable that household consumption, especially food expenditure, is likely to improve. In their randomized experiment in Niger, Aker et al. (2016) documented that rural households using MM are able to buy more diverse types of good and more likely to purchase protein and energy rich foods, resulting in a 9%–16% improvement in diet diversity. Similarly, the positive impact of MM use on household food consumption is also established in the context of rural Uganda (Murendo and Wollni, 2016). In particular, the study found that both frequency and volume of money transfer are positively associated with increase in food expenditure as well as decrease in household food insecurity.

Nonetheless, the benefit of MM seems to go beyond the improved food expenditure and extend toward other dimension of household consumption. Again, for rural Ugandan households using MM, Munyegera and Matsumoto (2016) found the positive effect of MM use on household welfare including per capita food consumption, non-food household basics (i.e., health, education), and social contributions (i.e., ROSCAs). It is worth noting that the preceding studies mainly focus on the income and consumption implications of MM for rural households, with
the impact on urban households or the average population under-explored. Dunne and Kasekende (2017) is one of the few studies filling that research gap. Consistent with the previous findings, the study found positive impact of remittances via MM on household income. However, as for the consumption pattern, Dunne and Kasekende (2017) showed that MM users are less likely to use their disposable income for the necessities such as food or clothing; rather, they are likely to spend more on the goods such as housing and transport items. In short, these findings together suggest that compared with non-users, household MM users are more likely to improve household welfare not only by satisfying the basic demands such as food, but by efficiently allocating their expenditure on other well-being commodities.

**Family Business**

Another research stream concerns the positive role of MM in improving family business. This body of research is closely intertwined with previous studies. Arguably, in cases when income and consumption effect of MM helps bring households out of poverty and negative shocks, the beneficiaries are afforded the opportunity to invest more in their family businesses, which would ultimately improve income and consumption as well as the ability to hedge against negative shocks. However, this research stream differs from prior research in terms of the suggested mechanisms. Whereas the studies on risk sharing and household income and consumption highlight the underlying mechanism of instant e-money transfer
(e.g., Jack and Suri, 2014; Murendo and Wollni, 2016), the current research stream sheds light on another two channels through which MM contributes to household welfare: the role of MM in *facilitating saving for future investment* and *improving small farm business*.

A few studies showed that the availability of MM savings function not only disrupts the traditional savings habits, but enables households, especially those financially excluded, to save for future investment. In their study on the nexus of network pressure, agricultural savings, and investment in rural Mozambique, Batista et al. (2015) noted that one barrier limits smallholder farmers’ savings is social pressure from their networks to share resources, i.e., lend them money. The study notably found that the presence of digital savings account can counteract such a social pressure and allow the farmers to reduce day-to-day expenditures, which leads to a higher level of investment in agricultural inputs such as fertilizer. More generally, Yenkey et al. (2015) established the positive relation between the use of savings function of MM and future investment in Kenya. The results showed that MM users have 1.37 times greater odds than non-users of investing in assets that may generate revenue in the future, such as purchase of livestock, agricultural implements, and starting up a micro business. Interestingly, the result is mainly driven by the financially excluded Kenyans: MM users in the financially excluded category are much more likely to invest in productive assets than non-users. It therefore seems that in addition to money transfer, MM in some countries also
serves as a digital savings tool for users, be them financially included or excluded, to accumulate capital for future investment, which contributes to household welfare.

As for the second channel, the use of MM is found to improve productivity of small farm business. In many developing countries, smallholder framers often suffer from poor infrastructure and market imperfection, which results in high transactions costs in accessing agricultural inputs and commercializing outputs in a timely manner (Shifewar et al., 2011). However, a growing number of studies point out that the introduction of MM has alleviated this situation. Yao and Shanoyan (2018) examined market participation of smallholder framers in Cote d’Ivoire and Tanzania and the authors showed that MM users are more likely to participate in distant yet more profitable markets due to reduced search costs (through the enhanced marketing capabilities) and transactions costs (through the instant MM payments).

In this spirit, Kirui et al. (2013) and Kikulwe et al. (2014) investigated the facilitating role of MM for both agricultural inputs as well as commercialization of farming outputs in rural Kenya. Both studies revealed that access to MM is positively associated with higher spending for agricultural inputs such as hired labor, organic fertilizer, and chemical pesticides. In addition, the level of harvest commercialization is significantly higher among MM users than non-users, which in turn contributes to the improved household disposable income and consumption, and accordingly to the future agricultural investment. Extending the previous two studies highlighting the direct link between MM use and improved agricultural
inputs and outputs, Sekabira and Qaim (2017) examined the indirect pathway through which MM engenders positive repercussions for agricultural production and marketing in rural Uganda. The study found that in addition to regular farm activities, smallholder farmers are found to gain additional revenue from off-farm businesses such as retail shops, trade in forest products, or transport services, which is made possible by the instant payment via MM. Taken together, these studies suggest that smallholder farmers may benefit from using MM in a number of ways that reinforce each other, including instant money transfer within their social networks, convenient access to savings account, off-farm businesses, access to more profitable distant markets, and productive use of agricultural inputs.

**MM and Meso-leve Benefits: Business Benefits for MSEs**

From business point of view, MM can be considered a fundamental monetary payment and storage tool. Therefore, it is not surprising to observe prevalent integration of the digital financial services in daily business activities. The current literature shows that the dominant businesses MM users are urban micro and small enterprises (MSEs)\(^\text{16}\) in the informal (unregistered) services and retail sector (e.g., Higgins et al., 2012; Horne et al., 2015; Masocha and Dzomonda, 2018), with relatively slow and low penetration among medium and large enterprises in the formal (registered) sector (Mas and Ng’weno, 2012). In their study on the business

\(^{16}\) MSEs refer to the sole proprietorships, family businesses, or those employing less than 50 workers (Mead and Morrison, 1996).
use pattern of MM, Higgins et al. (2012) sampled 865 small and medium sized enterprises in Kenya. The authors found that 99% of the businesses reportedly have at least one active MM account, where the average number of employees per business is 14 with the median of 5. Although MSEs often make unimpressive small-scale transactions and mainly operate in the informal sector (Kirui and Onyuma, 2015), they constitute a vast majority of the business community in Sub-Saharan Africa (Mead and Liedholm, 1998) and make far-reaching contribution to developing economies, i.e., income generation, employment creation, poverty reduction (e.g., Mead and Liedholm, 1998; Beck et al., 2005). Hence, review of the impact of MM on MSEs becomes an important building block in investigating the MM-enabled socioeconomic transformation.

In order to examine the transformative role of MM, we need to first look into the obstacles that hinder MSEs from growing and expanding. As opposed to the formal large enterprises whose businesses are well supported by banking services (Mas and Ng’weno, 2012), MSEs in the informal sector often operate in an environment characterized by bottlenecks such as lack of access to working capital, limited liquidity, inefficient debt collection, credit imperfections, and risk of theft (Bangens and Soderberg, 2011; Chale and Mbamba, 2015; Beck et al., 2018). Those growth constraints are partly attributable to the limited access to financial services. A majority of MSEs in Sub-Saharan Africa are marginalized from traditional banking services and arguably the financial exclusion makes them vulnerable to the cash-
related frictions and costs, i.e., theft (Beck et al., 2005). However, MM can alleviate this situation because it, operating with e-money, affords MSEs the ability to overcome the temporal and spatial challenges associated with cash and the opportunity to access and use basic financial services even without bank accounts.

The literature agrees that MM has been increasingly perceived by MSEs as a convenient, secure, and affordable way of money transfer and storage in their business transactions (e.g., Bangens and Soderberg, 2011; Horne et al., 2015; Masocha and Dzomonda, 2018). MSEs have incorporated MM into a variety of transactions such as paying suppliers, paying utility bills, receiving payment from customers, paying employees, and saving money. However, it should be noted that there is heterogeneity across the use of MM. Studies show that MM is mainly used to collect payment from customers, pay suppliers, and save money, while it is less used for paying employees, borrowing, and paying loans (e.g., Wanyonyi and Bwisa, 2013; Ngaruiya et al., 2014; Chale and Mbamba, 2015; Horne et al., 2015).

In addition to the breadth of MM use, an equally important inquiry concerns the extent to which MM disrupts the way MSEs do business. The depth of MM use is scarcely explored; yet, Islam et al., (2017) is one of the very few offering suggestive evidence in this regard. The study considered the intensity of MM use by measuring the proportion of MM use in inputs and outputs by small and medium sized enterprises (SMEs) in Kenya, Uganda, and Tanzania. The results showed that the percentage of total labor cost, raw material cost, utility bill, and annual sales paid or
received using MM is, on average, 3.44%, 3.74%, 6.64%, and 5.47%, respectively. Despite the seemingly trivial figures, there are at least three reasons to believe that the disruptive potential of MM was under-estimated. First, the data used in that study referred to fiscal year of 2012, which merely reflects the early phase of MM diffusion among SMEs. Second, the study only considered formal private SMEs with 5 or more employees and hence omitted MSEs in the informal sector, which represents a vast majority of business user community. Third, since the numbers above were the average intensity of MM use across SMEs, more intensive use can be expected if the sample could have been limited to MSEs. In short, it is arguable that MM could be more deeply embedded in MSEs’ transactions than suggested by Islam et al. (2017).

Although not explicitly examined in the literature, closer review of the relevant studies reveals a number of interrelated pathways through which use of MM contributes to MSEs performance and growth. The major benefit is concerned with reduced transaction costs (e.g., Higgins et al., 2012; Mwangi, 2016; Aron, 2018). MM enables MSEs to minimize a variety of transaction costs, i.e., costs of money transfer, transport costs of travel to a bank or government office to pay bills, and coordination costs between consumers and goods/services providers. Relatedly, MM also ensures secured financial transactions (e.g., Aron, 2018; Beck et al., 2018; Islam et al., 2017). According to the World Bank’s Enterprise Survey 2013, risk reduction in transactions is one of the most widely cited reasons for MSEs in Kenya,
Uganda, and Tanzania to adopt MM. In this vein, Beck et al. (2018), based on a
dynamic general equilibrium model, showed that the availability of MM significantly
reduces the incidence of theft and hence output losses.

The reduced transactions and opportunity costs then contribute to the improved
liquidity and working capital management (e.g., Bangens and Soderberg, 2011;
Ngaruiya et al., 2014; Beck et al., 2018). MM enables MSEs to conduct more
affordable and secured money transfer with customers and suppliers compared
with other means, especially when transactions involve long distance. Moreover,
MSEs are afforded the ability to save daily earnings into their MM accounts, keeping
themselves away from the temptation to splurge (Banerjee and Duflo, 2007), and
the opportunity to solicit emergency funds from friends and business partners. With
sufficient working capital at hand, MSEs are likely to fulfill their commitment to
credit payment, which avoids the potential discontinuation of access to trade credit
and increases valuation of trade credit (Beck et al., 2018). Therefore, the availability
of MM improves MSEs’ ability to manage working capital by optimizing capital
accumulation and allocation in the trade vis-à-vis customers and suppliers.

Taken together, MSEs using MM are able to achieve the increased operational
efficiency (e.g., Higgins et al., 2012; Chale and Mbamba, 2015; Horne et al., 2015).
The fundamental bottlenecks that limit the sustainability and growth of MSEs are
partly attributable to cash as it remains as the king for all types of transactions
(Higgins et al., 2012). However, the genesis of MM has been disrupting the situation
by alleviating the physicality of cash that requires significant time and costs for its movement (Horne et al., 2015). With transactions and operations becoming digital, MSEs are able to run businesses with efficient flow of capital, materials, and resources, speeding up the turnover from capital to inventory to receivables and back to capital for future reinvestment. The improved cycle of procurement, production, and fulfillment processes are then believed to contribute to MSEs performance as discussed below.

A growing body of studies, especially quantitative research, has explored the link between MM and the positive repercussions for MSEs performance. But, the current research is highly concentrated in Kenya and Tanzania. In addition, the research methods employed in a majority of studies are far from being robust, mainly based on descriptive analysis of survey data. For example, a moderate amount of studies showed that the majority of respondents reported that they experienced increase in sales revenue and profits (e.g., Ngaruiya et al., 2014; Nyaga and Okonga, 2014; Akyoo and Sife, 2015). Moreover, several studies found the positive correlation between use of MM and MSEs growth (e.g., Chale and Mbamba, 2015; Bosire and Ntale, 2018; Masocha and Dzomonda, 2018), sales turnover (e.g., Wanyonyi and Bwisa, 2013; Kirui and Onyuma, 2015), and number of employees hired (Horne et al., 2015). Unfortunately, the common issue with those studies is that the details of how the dependent variable, MSEs growth or sales turnover, was operationalized
and measured were not provided such that we should take these results with a pinch of salt.

Islam et al. (2017) is one of the few employing rigorous research methods. Based on the World Bank’s Enterprise Survey 2013, the study examined whether firm adoption of MM as well as intensity of MM use (as discussed above) is positively associated with firm investment, proxied by the purchase of fixed assets, in Kenya, Uganda, and Tanzania. The authors showed that controlling for other factors such as firms’ technology use, access to finance, and bank density, firms using MM is 16.7% more likely to invest in fixed assets. Additionally, the significantly positive relation between the intensity of MM use and firm investment is established. Most interestingly, examination of heterogeneous effects revealed that the results are mainly driven by SMEs, but not by large firms with more than 100 employees. As opposed to the dominant quantitative research, Bangens and Soderberg (2011) and Higgins et al. (2012) are the only two qualitative studies using case analysis. Whereas the two studies shed more light on the examination of MM use by MSEs, they agreed with a number of facilitating roles MM plays in stimulating MSEs growth, which are generally in line with the major findings of quantitative research.

**MM and Meso-level Benefits: Community Development**

Building upon the benefits observed at the household and business level, it is arguable that MM, once widely used in a community, may also have considerable
impacts on socioeconomic development at the community level. In this regard, Ramada-Sarasola (2012) developed a conceptual framework and proposed that as MM lowers transaction costs and enables secure and affordable monetary inflow and outflow of a community, use of MM is likely to have indirect impact on local development such as accumulation and optimized allocation of capital, improving efficiency of local traditional financial market, boosting investment on local infrastructure, stimulating the need for local innovation, and increasing labor demand. Despite the plausible MM benefits for local communities, very few studies have so far been directed at this issue.

Based on interviews, surveys, focus group discussions, and case studies, Plyler et al. (2010) empirically examined the community-level socioeconomic effects of MM in Kibera (urban slum), Muranga and Kitui (two rural districts), Kenya. The results revealed direct as well as spillover and ripple effects; that is, both M-Pesa users and non-users benefit from the widespread penetration of M-Pesa through the four overarching socioeconomic effects, along with 11 sub-effects, namely, 1) local economic expansion (money circulation, expansion of businesses, and employment opportunities), 2) security (money, food, and physical security), 3) capital accumulation (human, social, and financial capital accumulation) and 4) business environment (transactions ease and quality control). For example, the authors shed light on the link between use of M-Pesa and improved food security. Through lowering transaction costs and circulating money in an instant, secure, and
frictionless way, M-Pesa appears to increase the likelihood of a farmer being able to perform productive agricultural activities, such as spending more time in the fields, planting the fields fully and timely, hiring casual labor when needed most, and therefore improving agriculture productivity and food security, which will, in turn, benefit the community as a whole.

Quite recently, Yokossi (2017) showed robust empirical results concerning the economic impact of MM on sub-locations\(^{17}\) in Kenya. Using light density as a proxy for local economic activity, the study found that access to M-Pesa in a sub-location is associated with 7.1% increase in average light density during the period of 2007—2013. Interestingly, the main result holds unchanged even when the sample is restricted to the under-grid sub-locations before M-Pesa, which rules out the confounding effect of change in electrification and hence lends support to the potential causal link between MM and local economic performance. As expected, the local effect is found stronger when the aggregate access to M-Pesa increases (the density of M-Pesa agents in a sub-location), pointing to local network externalities as a greater number of users are involved with MM over time. Moreover, the study found greater economic effect of MM on sub-locations, which are initially richer, urban, and equipped with better road and traditional banking infrastructure. This suggests that access to MM serves as a complementary to, rather than a substitute

\(^{17}\) Sub-location is the lowest administrative in Kenya, following province, district, division, and location. In 1999, there were 6,612 sub-locations in Kenya. See details at http://www.cartesia.org/geodoc/icc2005/pdf/oral/TEMA26/Session%203/ODHIAMBO%20E.A.pdf
for, the existing alternatives that enable people to connect, trade, and allocate financial resources.

**MM and Macro-level Benefits: Financial Development**

The preceding paragraphs synthesize the outcomes of MM by highlighting its key role in lowering transaction costs and promoting efficiency of resource exchanges and money transfer as well as in extending basic financial services to households, businesses and communities, especially those marginalized from traditional banking services. In this sub-section, we zoom out and outline the socioeconomic impacts at the sector level, namely, financial development. This is of theoretical and practical significance mainly because, based on the theory of finance and growth (e.g., Levine, 2005), the contribution of MM to financial development could be arguably identified as one of the mechanisms explaining how and why MM enables socioeconomic transformation at the macro level, when it does.

The literature suggests dual pathways by which MM facilitates financial development: financial inclusion and financial deepening. There is a consensus among scholars that financial inclusion plays a pivotal role in facilitating poverty reduction and inclusive socioeconomic development (e.g., Ashraf et al., 2006; Sahay et al., 2015). As discussed above, a considerable population in Sub-Saharan Africa remained financially excluded (e.g., Triki and Faye, 2013), not only because of the lack of access to banking services in rural areas but also because of the presence of
financial barriers such as affordability and ineligibility (Beck et al., 2008). However, introduction of MM, as a convenient, cheap, and secure way of money transfer, savings, and bill payments has alleviated the situation by expanding the breadth and reach of basic financial services into those underserved areas (e.g., Jenkins, 2008; Morawczynski and Pickens, 2009; Jack and Suri, 2014; Aron, 2018).

The evidence of deepened financial inclusion in Sub-Saharan Africa has been widely documented in the literature. For example, the series of reports by GSMA (e.g., GSMA, 2015) and World Bank (e.g., Demirguc-Kunt et al., 2018) have been regularly keeping track of dramatic progress toward financial inclusion enabled by MM. As mentioned above, Kim et al., (2018) conducted systematic literature review with exclusive focus on the financial inclusion issue. Additionally, in their cross-country study, Fanta et al. (2016) reviewed the expansion of financial inclusion in SADC. In particular, the study found that MM is also useful in countries where financial inclusion was not very low, i.e., Botswana and Zimbabwe. This finding suggests that in addition to MM filling the institutional voids of financial services gap, the mobile financial services also complement the established formal financial system.

Although the financial inclusion implication of MM in this area seems to be straightforward and self-evident, the research examining causal relation between

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18 SADC stands for Southern African Development Community including 16 southern African countries.
MM and short- and long-run financial inclusion remains scant, with Sekantsi and Motelle (2016) in Lesotho as an exception.

Another benefit of the rise of MM is concerned with its contribution to financial deepening. As in the case of financial inclusion, the growing consensus is that financial deepening propels socioeconomic development through rapid capital accumulation and productivity growth (e.g., Levine, 2005; Rousseau and Wachtel, 2011). More in this point, financial deepening has greater macroeconomic implications in developing countries than in industrial countries (Calderon and Liu, 2002). It is important to note that cash deposited in (and therefore the e-money balance stored in and transacted via) MM account is ultimately held in trust accounts administrated by banks. Therefore, as MM rapidly penetrates into the unbanked population in informal sector, MM turns into a digital channel through which banks absorb financial resources and savings used to be outside the sphere of formal financial system with lowered operating costs, and can potentially transform the deposits into credit. With the increasing inflow of loanable funds, banks are now afforded the ability to intermediate more loans and investible resources for productive investment in private businesses and entrepreneurs (Gencer, 2011; Suri, 2017). That is, in essence, the story of increased financial connectedness enabled by MM facilitates efficient capital accumulation and allocation, which in turn leads to productivity growth (Jack et al., 2010).
Quite recently, several studies focus on the impact of MM on financial deepening. Ndirangu and Nyamongo (2014) observed that in the six years after the launch of M-Pesa in 2007, the ratio of private bank deposits to GDP has risen roughly from 30% to 45% in Kenya. Similarly, Bank of Ghana (2017) documented explosive growth of volume and value of MM transactions that signals the progress toward cash-lite economy. This indicates the reduced real money demand and increased accumulation of loanable deposits for banks to make productive investment. More rigorous empirical examination was carried out in Uganda. As MM has enabled households to substitute liquid and other lumpy assets for financial assets, access to MM reduces the demand for money in the long run and accordingly the positive relation between MM balances and private sector credit is established (Maweije and Lakuma, 2017). Adding to this, Nampewo et al. (2016) found that MM balances Granger cause private sector credit growth in the long run, suggesting that MM has expanded the breadth and depth of financial intermediation.

**MM and Macro-level Benefits: Country Well-being**

Building upon the benefits of MM observed at the household, business, and community level along with its contribution to financial development, it is arguable that MM, when widely used in an economy, is likely to become an important enabler of socioeconomic development. Based on conceptual modeling across East African Community (EAC) countries, Adam and Walker (2015) proposed that the mobile financial services innovation would reduce the incompleteness of financial markets
and increase macroeconomic stability of the countries. More importantly, the study suggested that the EAC countries may benefit from further spread of MM, with benefits mainly going to the bottom of the pyramid, the low-income population segments. As it takes several years for MM to take off and for the aggregate benefits to precipitate, the macro-level research is still in its infancy. Nonetheless, the current comprehensive scan of the literature identifies emergence of scholarly efforts tackling the macro-socioeconomic implications of MM in Sub-Saharan Africa.

Three macro-level outcomes are identified in the literature: economic growth, poverty reduction, and human capital improvement. First, Mawejje and Lakuma (2017) showed that increase in MM balances exhibits significant effects on GDP since MM was available in 2009 in Uganda. In the similar vein, Beck and his colleagues documented that introduction of M-Pesa in 2007 in Kenya can explain 10% of the per capita income growth between 2007 and 2013 (Beck et al., 2018); and 14% of the total factor productivity growth between 2006 and 2013 (Beck et al., 2016).

Second, given the tight link between economic growth and poverty reduction in developing countries, we expect to see MM-enabled poverty reduction. In his study on the impact of financial development on poverty reduction, Rewilak (2017) argued for the potential of MM to reduce poverty level through financial development. More rigorous evidence was provided by Suri and Jack (2016). The study found that over the period of 2008 and 2014, the growing access to M-Pesa in Kenya increases per capita consumption level and lifts 194,000 households out of
poverty. This figure is roughly equivalent to 4.2% of Kenyan households who lived below the poverty line in 2008.¹⁹

Finally, a few studies point to the role of MM in improving human capital. By reducing transaction costs and facilitating internal money transfer, MM could afford households the opportunity to achieve more efficient allocation of labor over space and time (e.g., acquisition of labor skills, migration to higher-return labor markets), and of human capital investment (e.g., schoolgoing children) (Jack and Suri, 2011). Although Suri and Jack (2016) did not find the direct, significant effect of MM on migration or number of migrants, the study provided suggestive evidence that household size significantly decreases with the increased access to MM. Whereas the link between MM and migration remains puzzled, the contribution of MM to child development is documented in a cross-country (African and Asian countries) study by Rotondi and Billari (2017). The authors found that households using MM are less likely to have children in school age that are not enrolled at school. Interestingly, the notable role of MM in increasing the chance of children attending school is shown to be most evident in the Sub-Saharan African countries including Kenya, Nigeria, Tanzania, and Uganda.

Discussion

This section first summarizes what we know about the socioeconomic transformation enabled by MM in Sub-Saharan Africa. We then turn to discuss untapped territories in the current literature.

What We Know

On the demand side, access to quality financial services, i.e., money transfer and savings, plays a pivotal role for households to end poverty and hunger, and to live healthier and more productive lives, stabilize their livelihoods, and plan for their future (e.g., Ashraf et al., 2006). This also holds true for businesses, especially MSEs, who require frictionless financial services to maintain sustainability and grow their businesses. However, such basic financial needs are far from being satisfied in Sub-Saharan Africa mainly due to the poor provision of either traditional banking services or information financial services options on the supply side. Whereas formal financial infrastructure, i.e., traditional banking services, has been criticized for a series of financial barriers including accessibility, affordability, and eligibility (e.g., Beck et al., 2008), use of informal financial options, i.e., hiding cash at home and ROSCAs, often comes with costs and risks, such as money loss, theft, and limited liquidity (e.g., Mas, 2010). The past decade witnesses that this financial services gap has been narrowed since the advent of MM, the end-to-end digital financial services that are made possible by rearranging telecommunication infrastructure, a network
of transactional agents, mobile phones, and the prospective users who were unbanked or under-banked.

The fundamental novelty of MM lies on the digitization of cash into e-money and the use of mobile phone as the medium for financial transactions. These features make it possible for MM to play a transformative role in driving socioeconomic development in Sub-Saharan Africa. The root problem of insufficient formal or informal financial services is partly attributable to excessive immersion in cash (Radcliffe and Voorhies, 2012) that needs to be kept and circulated in physical way, which inevitably engenders considerable frictions. Nonetheless, operating with e-money, MM minimizes the physicality of cash and enables users to circumvent traditional spatial and temporal financial barriers and frictions. Most importantly, MM speeds up and ensures smooth financial transactions among users, which essentially endows mobility of financial resources and capabilities, i.e., purchasing power, in a society as a whole. The literature agrees that MM, as a convenient, secure, and affordable financial tool, has contributed to narrowing the previous financial services gap (e.g., Fanta et al., 2016; Aron, 2018). Accordingly, MM has been observed to ignite and grow explosively in several Sub-Saharan African counties such as Kenya, Tanzania, and Uganda.

MM has been dominantly used in two ways: money transfer and savings. It has been concurred among scholars that the availability of MM has been disrupting the way people transfer money, replacing the traditional means such as via travelling friends
and bus drivers (e.g., Mbiti and Weil, 2016). In addition, as MM provides monetary storage function that allows users to deposit small amount of money for short-term necessities and future use, the tool turns into a substitute for a number of informal savings options such as hiding cash at home (e.g., Waweru and Kamou, 2017).

Although MM can hardly be considered the traditional savings accounts (i.e., no interest rate), the use of savings function of MM is found to increase the chance of saving and be associated with greater amount of money saved (e.g., Ouma et al., 2017). Despite the seemingly trivial role of MM in disrupting financial behaviors at the micro level, as MM continues to spread into a greater population in a society, we start to see socioeconomic benefits afforded by MM at multiple levels.

Households, in particular those who were marginalized from traditional banking services, are the major beneficiaries. Leveraging the instant, frictionless e-money transfer and storage function of MM, households are afforded the ability to smooth a range of negative shocks, improve disposable income and consumption level, especially food expenditure, and grow their family businesses, i.e., improved productivity of small farm businesses. Not only households, MSEs, suffering lack of access to quality financial services, also benefit from using the disruptive financial services tool. The availability of MM enables MSEs to reduce transaction costs, secure financial transactions, and improve liquidity and working capital capability. The increased operational efficiency has been suggested to have positive impacts on SMEs performance such as sales revenue.
Although the community-level evidence is limited to Kenya, it is shown that MM, once widely used in a community, generates aggregate socioeconomic benefits such as capital accumulation and favorable business environment, which stimulates local economic expansion and community development. More rigorous evidence has been documented at the macro level. In particular, widespread use of MM in a society contributes to financial sector development by promoting financial inclusion and financial deepening. In line with the theory of finance and growth, the literature shows that financial innovation even achieved outside the boundary of traditional financial institutions can generate positive macro-socioeconomic implications including economic growth, poverty reduction, and human capital improvement.

It is worth noting that although the socioeconomic benefits are reviewed, organized, and discussed separately based on the level of analysis, they are by no means mutually exclusive. Instead, they interrelate, build upon, and reinforce each other. Arguably, the use of MM by households not only yields immediate benefits for household welfare, but creates a number of enabling conditions that trigger long-term socioeconomic development. For example, the beneficiaries are able to invest in education, resulting in improved human capital and supply of quality labor. The universal use of MM then gives rise to the enabling business environment that makes it possible for MSEs to incorporate MM into financial transactions and grow their businesses, which has positive repercussions for production and consumption, job creation, and income generation among others. Additionally, financial system
becomes more efficient in capital accumulation and allocation that are believed to spur entrepreneur activities and improve the overall productivity, which stimulates socioeconomic development with major benefits ultimately going back to households.

Building upon the systematic review, we could safely reach the conclusion that MM, when widely used in a country in Sub-Saharan Africa, can serve as a transformative digital engine for socioeconomic development. This conclusion, however, should be taken with caution because the transformative evidence is limited to the countries where MM has ignited and grown explosively, such as Kenya, Tanzania, and Uganda. Despite the encouraging words, it appears that we are still far from being fully aware of the emerging phenomenon, the issues to which we turn below.

**What We Don’t Know**

Upon systematically mapping the literature, we are now in a good position to discuss the undertapped territory of MM phenomenon. The current review reveals multifaceted research gaps in the literature: thematic, theoretical, methodological, and geographic gaps. Accordingly, these gaps inform future research directions.
Thematic gaps

Before proceeding to the underexplored themes at each level of analysis, we would like to shed light on two important themes that deserve scholarly attention: unintended consequences and socioeconomic implications for actors involved.

Unintended Consequences

The current literature is dominantly focused on studying positive socioeconomic benefits. However, as the theory of technology affordance and constraint (e.g., Majchrzak and Markus, 2012) suggests, the emergence of MM is likely to have dark side such as money laundering and fraud (e.g., Merritt, 2011). Since the regulatory issue is beyond the scope of the present review, we focus on two other concerns that are suggested by the selected studies, namely, household conflicts and digital divide.

First, the introduction of MM might create a number of household conflicts. As one of the few qualitative studies in the literature, Morawczynski (2009) found that due to the convenient money transfer service of MM, urban migrants are making fewer visits back to their family in rural villages. Accordingly, the left-behind, often women, have to take greater responsibility, i.e., taking care of the farm by themselves, and they are concerned that since their husbands don’t have to visit home often they might feel lonely and find secret wives. Adding voice to this, Kusimba et al. (2015) also pointed out that the fact that e-money is easily hidden and protected might create potential family disputes and exclusion, i.e., allocation of received funds
among family members, marriage breakage, and emotional exclusion of fathers working in urban areas. Obviously, more research is needed to examine to what extent the use of MM disrupts social relations within and among family and relatives in a negative way, and whether such an unintended consequence is generalizable to countries where MM is popular.

Second, whereas MM has been highly applauded for filling the financial services gap, it might be the source of another digital divide. It is arguable that because of the inherent differences of material, cognitive, and social resources between the rich and the poor (e.g., De Haan and Rijken, 2002), there might be the digital inequality in adoption, use, and even outcomes of MM. This may apply not only at the household level, but at the higher level. For example, Yokossi (2017) found that the economic impact of access to M-Pesa is stronger in sub-locations that are initially richer, urban, and have better road and traditional banking infrastructure. This finding alerts us to the potential Matthew Effect of MM: the richer community gets richer socioeconomic benefits of MM. The question of the potential emergence of digital divide and of whether MM is able to lift the poorer community out of poverty and stagnant local economy is yet to be explored.

*Socioeconomic Implications for Actors Involved*

In addition to the potential unintended consequences, the present review also reveals that a multitude of key actors involved in the MM ecosystem have so far
received little attention. They include MM transactional agents, service providers and their competitors, government, and entrepreneurs. First, the transactional agents are often the established MSEs who incorporate MM cash-in and cash-out services into their existing businesses. It is likely that introduction of MM services may invite more customer footprints, which would improve saves turnover and providers the opportunity to expand their businesses. However, Peša (2018) is the only study treating MM agents as the major research subject; yet the focus was given to the labor relations between business owners and tellers. Second, the scarcity of research is also noted as for the service providers and their competitors. The typical question would be: what are the implications of introducing MM for the service providers and other players in the industry? Again, Mbiti and Weil (2016) is one of the few studies in this regard. The authors found that the introduction of M-Pesa has forced other money transfer companies to lower prices and to improve their products and services. Unfortunately, the extent to which MM has been disrupting the remittances industry in what aspects remains unknown.

Third, government and entrepreneurs in public and private sector may represent the next wave of important user groups; but, they have been weakly examined in the literature. Fundamentally, MM can be considered a disruptive digital payment infrastructure that avoids cash-based barriers and frictions. Therefore, the authorities may incorporate MM to facilitate administrative operations such as easy collection of payment, efficient dissemination of resources, instant settlement, and
better visibility and traceability of transactions. For example, in Kenya National Health Insurance Fund accepts insurance premium payment via MM (Kirika, 2018) and Nuru International, an NGO looking to ending extreme poverty, uses MM payments in its program (Gencer, 2011).

By the same token, MM also affords entrepreneurs the opportunity to start up new businesses with MM-enabled digital business model. For instance, M-Kopa in Kenya is a representative case of this kind. This startup develops “pay-as-you-go-and-own” digital business model that enables off-the-grid households to access to electricity by taking a solar system home, pay a daily amount through M-Pesa, and finally have the ownership of the equipment. M-Kopa is one of the emerging initiatives where MM service providers and entrepreneurs are in partnership with each other to extend and enhance the provision of energy and water services to those who were previously excluded from mainstream development (GSMA, 2014). It is worth noting that such an innovative incorporation of MM in public and private sector may also generate significant benefits for the society as a whole, suggesting another important pathway through which MM enables socioeconomic development. However, little research has been conducted in this domain.

**Underexplored Themes at Each Level of Analysis**

Upon the comprehensive scan of the literature, we also note a number of underexplored themes at each level of analysis. At the household level, in addition
the potential unintended consequence of household conflicts, future research is
invited to examine the following issues such as household multi-location due to
instant transfer of financial resources and capabilities; startup of microenterprises
in rural areas with accumulated capital; the potential change in consumption
pattern due to increased disposable income; the potentially reduced motivation for
job-hunting because the unemployed are likely to live on the financial support from
family members; and the anticipated increase in household happiness as MM
enables them to efficiently hedge against negative shocks.

At the business level, future studies should be geared toward the following three
directions. First, the existing outcomes are limited to MSEs growth and sales
revenue; and what’s worse, it is not entirely clear how they are operationalized or
measured. Future research should implement more rigorous approaches, like Islam
et al. (2017), to study outcomes regarding growth, and explore other key
performance indicators such as financial, customer, and process dimension. Second,
the dominant research focus has been placed on business benefits for the existing
MSEs. What would be of great interest are the cases in which MM enables the
prospective entrepreneurs to create new MSEs. That is, the affordances of MM in
creating new businesses should deserve equal attention as in the case of growing
and expanding incumbent businesses. Finally, although MM is not popular among
medium and large enterprises, Mas and Ng’weno (2012) observed that some of
them start to accept customer payment via MM. Therefore, use and consequences of MM for those businesses may become another important research stream.

The community-level evidence is encouraging, but it is too limited as the existing studies are only conducted in Kenya. We therefore advocate that more research examine whether the findings of Plyler et al. (2010) are generalizable in other communities of different countries where MM is widely used. As for financial development, the current literature sheds light on the impact of MM on financial inclusion and financial deepening. However, according to Cihak et al. (2013), two additional dimensions, efficiency and stability, are equally important in evaluating the progress toward financial development. More studies are needed to examine the comprehensive contribution of MM to financial system. Finally, we call for replicate research examining the issues of economic growth, poverty reduction, and human capital improvement in other countries. Moreover, future research at the marco level should give equal attention to the social side (i.e., human development index, social inclusion, happiness) and economic side (i.e., income equality, employment) of socioeconomic development.

**Theoretical Gaps**

The dominant quantitative research in the literature consistently reveals the correlation between MM and positive socioeconomic outcomes across multiple levels. Whereas the documented empirical evidence provides plausible building
blocks for theoretical inquires, the research addressing how and why questions remains scant. In particular, the causal mechanisms through which MM leads to socioeconomic development are under-theorized. Studies, i.e., Jack and Suri (2014), Munyegera and Matsumoto (2016), and Sekabira and Qaim (2017), proposed that use of MM improves household welfare through money transfer. Although the studies empirically showed the positive impact of MM on the frequency and amount of money transfer, they remain silent about the subsequent link that connects money transfer to household welfare. The common limitation of existing theoretical exploration is twofold. First, the proposed mechanisms, i.e., money transfer, are often treated as gray-boxes or intervening factors, which simply sit between MM and outcomes. Second, due to data availability, those studies may be blind to other mechanisms at work. For example, Sekabira and Qaim (2017) admitted that the study failed to empirically exclude other mechanisms such as precautionary savings enabled by MM. It should be noted that these limitations are due to the inherent constraint of quantitative research.

In examining causal mechanisms, we urge future research to consider the following aspects. First, instead of treating mechanisms as intervening factors, future studies need to take qualitative research approaches to pursue systems understanding of causal mechanisms (Beach and Pedersen, 2016); that is, to unpack the causal processes by identifying how causal forces are transmitted through a series of interlocking activities, in which a multitude of actors may be engaged, to produce
outcomes. Second, mechanisms heterogeneity should be acknowledged. In other words, different mechanisms may be at work at different levels. This review study provides some insights into this, i.e., facilitating financial resources and capabilities at the micro level; improving operational efficiency at the meso level; stimulating local economy expansion at the meso level; and promoting financial inclusion and financial deepening at the macro level. As other key players, such as government and entrepreneurs, have not been studied in depth, we believe that more mechanisms wait to be discovered in future research.

Third and related to the above point, mechanisms at multiple levels may interact with each other and may or may not transform into others across the levels. As suggested above, MM leads to complicated socioeconomic phenomenon and multilevel mechanisms may come to play. However, we do not know yet whether macro-level mechanisms can always be reducible to micro-level mechanisms and whether micro-level mechanisms always transform into higher level ones. Finally, in examining causal mechanisms, future scholars should take contextual factors into account. Given the differences in spatiality, temporality, and other environmental factors, some mechanisms may be triggered; some may be converted into others; and some others may be deactivated. For example, Plyler et al. (2010) found the ripple and spillover effects of MM that benefit not only users and non-users in Kenyan communities. However, in her study of MM use and rainfall risk smoothing in Tanzanian villages, Riley (2018) did not find such a spillover effect that MM
household users do not benefit from having others using MM in the village when a rainfall shock occurs. The stark contrast in terms of mechanisms may be attributable to differences in spatiality (e.g., Kenyan communities vs. Tanzanian communities), temporality (e.g., long-term vs. short-term), or contextual factors (e.g., absence vs. presence of shocks).

Identifying causal mechanisms of MM is of extreme important in both theory and practice. On the one hand, this knowledge helps us develop our understanding of how and why MM enables socioeconomic development and informs practitioners to better leverage this innovative financial services tool. On the other hand, it may also explain why we do not see transformative role of MM in some contexts, even though MM becomes popular. More importantly, as the smartphone era is around the corner in Sub-Saharan Africa, we expect more advanced mobile financial services and more possibilities unleashed by mobile-based digital innovations. The knowledge of causal mechanisms associated with MM is believed to provide necessary lessons for those developing economies to get prepared for the next wave of digital transformation.

**Methodological Gaps**

As for methodology, the current literature is characterized by the dominance of quantitative research (see Table 2.2). However, this does not necessarily mean that the approaches used are all robust. Compared with the research at the household
and the country level, the studies on business benefits for MSEs in general lack validity of what have been measured, and employ basic descriptive analyses without robustness checks such that the extent to which we can rely on the results is arguably in question. Against the methodological bias, we advocate the use of qualitative approaches in investigating the MM-enabled socioeconomic benefits in future research. In particular, as the literature shifts the focus toward issues such as unintended consequences and under-examined potential actors, we believe that the methodological gaps might be wiped out by the emergence of qualitative research or mixed methods. It should be noted that we are not arguing for a particular research method; rather, the point is that the diversified yet balanced research methods will be instrumental in fully understanding the multilevel and multifaceted phenomenon.

**Geographic Gaps**

The closer review of the literature also reveals three geographic gaps: the bias toward select countries, namely, Kenya, Uganda, and Tanzania; toward rural households; and toward urban MSEs (see Figure 2.5 and Figure 2.6). Corresponding to each gap, we propose three future research directions. First, as shown in Figure 1, other countries in Sub-Saharan Africa, i.e., Ghana, Zambia, Zimbabwe, Mozambique, and Namibia, also see dramatic growth of MM. Given that, future research needs to examine whether these countries can benefit from MM to the same extent as Kenya, Uganda, and Tanzania (and if any differences). Second, theoretically, the research of urban households is equally important as rural households. Whereas rural
households reap benefits such as increased disposal income and risk sharing, it would be of great interest to examine how urban households are afforded or constrained by MM. For example, does MM help increase their income level? How does the use of MM help or hinder their ability to handle with negative shocks? Finally, although most MSEs are concentrated in urban areas, small businesses located in rural areas deserve equal attention given their role for local socioeconomic development. Future research should go beyond small farm family businesses and look into the possibilities of frugal innovations unleashed by MM for rural MSEs. For instance, how does MM help rural small business expand? How do rural entrepreneurs leverage MM to start up new businesses?

**Contribution and Limitation**

This review essay mainly contributes to the digital innovation and MM literature. First, the central tenet of the digital innovation literature is that digital innovation enables sociotechnical transformation (e.g., Tilson et al., 2010; Yoo et al., 2012); yet, most of the studies address the conceptualizing issues of digital innovation (e.g., Faulkner and Runde, 2013), and the organizational impacts (e.g., Boland et al., 2007), with little focus given to the societal impacts. Adding voice to this, in his comprehensive literature review, Nielsen (2017) identified a significant lack of empirical and theoretical research on digital innovation in developing countries. Hence, this systematic review essay adds knowledge to the digital innovation literature by documenting the transformative role of MM and the resulting
socioeconomic benefits, which warrant future exploration of the theoretical link between digital innovation and sociotechnical transformation in a society, especially in developing countries. Second, as an emerging phenomenon, the research on MM remains sporadic and our understanding is rather limited (Kim et al., 2018; Aron, 2018). In particular, we do not have a solid knowledge of the socioeconomic benefits enabled by MM. The present essay, therefore, contributes to the emerging MM literature by synthesizing empirical evidence of the socioeconomic benefits at multiple levels, identifying research gaps, and proposing future research directions.

This study is mainly limited by the scope of studies reviewed. For the theoretical consideration, we only analyzed studies conducted in Sub-Saharan Africa. Also, for the present purpose, we intentionally left out studies focusing on issues such as adoption, regulation, and business model and research mainly discussing potential or feasibility of MM. Future review research could look into the omitted issues in depth. For example, a comparison review study examining the differences in determinants of MM adoption in developing countries and mobile payment adoption in developed countries will be of great interest.

**Conclusion**

In Sub-Saharan Africa, due to deficiencies of formal and informal financial infrastructure, the basic financial needs are not well met and the associated social
issues, i.e., financial exclusion are invariably experienced. However, this situation has been alleviated since the introduction of MM. As a digital innovation resulted from sociotechnical rearrangement of telecommunication and microfinance, MM provides basic financial services such as money transfer, savings, and bill payment in a convenient, secure, and affordable way. The availability to MM not only provides value-added services to the banked, but most importantly transforms the way the unbanked enjoy financial services. A growing body of studies suggests that MM provides a promising digital pathway for developing countries in Sub-Saharan Africa to achieve social ends and fuel economic development. As one of the pioneering efforts, we conducted a systematic review of the literature in this area. In particular, this review study examined the role of MM in transforming the way people transfer money and save, and documented socioeconomic benefits at the micro, meso, and macro level. Despite the encouraging findings, more rigorous research is needed to investigate the under-explored socioeconomic implications and theorize the causal mechanisms. The present literature review is by no means exhaustive. We just hope this study serves as a useful springboard for future scholars from a variety of disciplines to carry out research tackling the fundamental questions pertaining to broader societal and economic benefits unleashed by MM.
CHAPTER III. MACROECONOMIC IMPACTS OF MOBILE MONEY

This essay is sole-authored.

This essay, titled as “Mobile Money and Socioeconomic Development: A Cross-Country Investigation in Sub-Saharan Africa,” is accepted with minor revision in the Journal of International Technology and Information Management (JITIM) 2019 Special Issue on Information Technology for Developing Economies.
Abstract

Over the past decade, mobile money, as a disruptive financial services innovation, has been widely adopted in Sub-Saharan Africa where the majority of population was financially excluded. Despite the transformative role of mobile money, the macro-level socioeconomic implications have been weakly examined so far. To fill the research gap, this essay explores the theoretical and empirical links between mobile money and socioeconomic development. Drawing on the theory of technology affordances and the emerging mobile money literature, this essay argues that mobile money, when adopted on a massive scale, has the potential to lead to socioeconomic development at the societal level. Results of Difference-in-Differences analysis show that mobile money, when widely adopted, has a positive effect on a country’s economic growth. Additional analysis reveals that the positive effect is found to increase as mobile money spreads into a society over time. This essay contributes to the emerging mobile money literature by documenting the positive relationship between mobile money and socioeconomic development at the societal level.

Keywords: Mobile Money, Affordances, Socioeconomic Development, Economic Growth, Financial Inclusion, Developing Economies
Introduction

In recent years, two industries that have seen phenomenal growth in developing economies are telecommunications and microfinance. Both industries have fuelled socioeconomic development by opening up new possibilities for communication and financial services to populations in both rural and urban areas (e.g., Aker and Mbiti, 2010; Majchrzak et al., 2016; Khandker, 2005; Andrianaivo and Kpodar, 2012). The uniquely flexible digital technologies make it possible to reconfigure and recombine sociotechnical elements of telecommunications and microfinance, giving birth to a widely applauded financial technology innovation: mobile money. Since its inception in the mid-2000s, mobile money has been believed to hold the potential to transform the landscape of financial inclusion and generate significant socioeconomic benefits in developing economies (e.g., Plyler et al., 2010; Jack et al., 2013; GSMA, 2015; Aron, 2017).

Two billion people in the world remain unbanked, without access to safe, secure, and affordable financial services (GSMA, 2015). Financial exclusion leads to a variety of serious social problems such as social exclusion, poverty, and income inequality, which, in turn, further marginalizes the unbanked low-income population from formal economy and social activities (Radcliffe and Voorhies, 2012). Over the last decade, this situation has been alleviated since the introduction of mobile money (e.g., M-Pesa in Kenya), with which individuals, households, and
businesses access basic financial services (e.g., person-to-person money transfer and payments) over mobile phones. With cash digitized into electronic money (e-money), mobile money overcomes a range of financial barriers, provides advantages over traditional banking services, and has been particularly attractive for low-income population who are excluded from traditional banking services (Mas, 2010; Jack and Suri, 2014; Aron, 2017).

As widely deployed in developing economies over time, mobile money has been increasingly argued to be a promising digital pathway to satisfy the unmet financial demands, facilitate financial inclusion, and drive socioeconomic development.

However, research on this phenomenon is still in its infancy, and understanding of the socioeconomic benefits of mobile money has so far been limited (Aron, 2017). In particular, the emerging literature dominantly focuses on socioeconomic impacts at the household level (e.g., Mago and Chitokwindo, 2014; Jack and Suri, 2014) and the small business level (e.g., Bångens and Söderberg, 2011; Chale and Mbamba, 2015), with few studies at higher levels of analysis (e.g., Plyler et al., 2010). Although the documented evidence suggests the potential aggregate effects, research at the societal level remains scant. Moreover, very few, if any, studies have provided cross-country empirical evidence. To fill the research gap, this essay asks and addresses the following research question:

**Research Question:** Does mobile money, when widely adopted, improve a country’s socioeconomic development?
In providing a theoretical account of the link between mobile money and socioeconomic development, this essay draws on the theory of technology affordances (e.g., Markus and Silver, 2008). The unique perspective of the theory is that what mobile money brings about is essentially a set of new affordances to be exploited and actualized by users. This essay maintains that the affordances of mobile money, once actualized on a massive scale, generate not only immediate socioeconomic benefits, but the conditions for subsequent affordances that are likely to be triggered and actualized to produce far-reaching socioeconomic impacts at a higher level. As the affordances and the impacts realized at different levels build on and reinforce each other, socioeconomic development is precipitated at the societal level over time.

Using a number of empirical specifications based on Difference-in-Differences approach, this essay notably finds that successful take-off of mobile money deployment in a developing economy leads to economic growth. In addition, the results show that the positive effect grows over time as a greater population adopts mobile money. Robustness checks not only corroborate the main results but also reveal that the positive increasing effect of mobile money still holds even when controlling for mobile phone usage. The findings contribute to the emerging literature by establishing the positive relationship between successful mobile money deployment and socioeconomic development, which is, to the best of the author’s knowledge, the first cross-country evidence.
The remainder of this essay is structured as follows. Section 2 reviews the literature of mobile money in developing economies and discusses technology affordances of mobile money. In Section 3, research methodology is described. Main results are reported in Section 4 and a series of robustness checks are discussed in Section 5. Section 6 closes this essay with theoretical and practical implications.

**Literature Review**

This section first discusses mobile money and its deployment and adoption in developing economies, especially in Sub-Saharan Africa. Then, the theory of technology affordances is applied to provide the theoretical account of the link between mobile money and socioeconomic development, followed by the review of the socioeconomic benefits of mobile money at micro-, meso-, and macro-level. Finally, based on the theoretical discussion and reviewed evidence, a testable hypothesis is developed.

**Mobile Money in Developing Economies**

Mobile money, also called mobile financial services, refers to the use of information and communication technologies (ICT) and non-bank retail channels to extend the delivery of basic financial services to users who would not be reached profitably with traditional branch-based financial services (GSMA, 2015). By definition, mobile money is primarily deployed in developing economies to facilitate financial
inclusion and socioeconomic development. Therefore, it is important to conceptually demarcate mobile money from other mobile technology-based financial services, i.e., mobile banking in developed economies. The distinguishing characteristics are that 1) users can sign up for the service without an existing bank account; 2) users can convert cash and e-money into each other by visiting an authorized transactional agent outside of bank branches; and 3) users initiate transactions using an interface that is available on basic mobile handsets. The fundamental differences are summarized in Table 3.1.

Table 3.1: Comparison of Mobile Money and Mobile Banking

<table>
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<th>Mobile Money</th>
<th>Mobile Banking</th>
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<tr>
<td><strong>Primary focus</strong></td>
<td>To provide basic financial services via mobile phone to achieve financial inclusion</td>
<td>To deliver existing banking services via mobile phone to make them easily accessible</td>
</tr>
<tr>
<td><strong>Deployed mainly in</strong></td>
<td>Developing economies</td>
<td>Developed economies</td>
</tr>
<tr>
<td><strong>Target customer base</strong></td>
<td>Low-income population with limited access to financial services</td>
<td>Existing customers</td>
</tr>
<tr>
<td><strong>Banking business</strong></td>
<td>Little credit provision</td>
<td>Deposit-taking and credit services</td>
</tr>
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Mobile money is made possible by digitally reconfiguring existing sociotechnical elements that were previously disconnected (Yoo et al., 2012). In particular, taking advantage of powerful affordances of digital technologies (Kallinikos et al., 2013), mobile money providers are able to orchestrate telecommunications infrastructure,
a network of transactional agents, and mobile phones to establish an end-to-end digital financial services system. Whereas telecommunications infrastructure provides the technical foundation, agents play a key role by offering front-line customer service, including, but not limited to, service registration, cash-in, and cash-out. By visiting an authorized “brick-and-mortar” agent, users create mobile money accounts under instruction. Then, a user can start the cash-in process— converting cash into e-money stored in mobile money account. With value stored, the user may initiate a range of financial transactions such as person-to-person money transfer, bill payment, airtime top-up. In the case of receiving e-money from individuals, merchants, or institutions, the recipient can exchange e-money for cash at an agent—the cash-out process.

Leveraging on high penetration of mobile phones and widely scattered transactional agents (Mas and Morawczynski, 2009; Kendall et al., 2012; GSMA 2015), mobile money is able to serve as an alternative to and/or substitute for traditional banking services. Mobile phone—“a bank branch in the pocket”—is empowered to carry a sizable function of banking services. Likewise, transactional agent—“a bank branch in the neighbourhood”—that would have otherwise little to do with banking services are empowered to function as bank branches. As penetration rate grows, mobile money is believed to broaden the reach and coverage of basic financial services at affordable costs into populations who would otherwise be excluded from traditional
banking services (e.g., GSMA, 2015; Evans and Pirchio, 2015; Beck et al., 2016; Aron, 2017).

Since its inception, mobile money has been widely deployed and adopted in developing economies, especially in Sub-Saharan Africa. As of 2015, mobile money was available in 93 countries via 271 deployments. In 2015, 37 economies had ten times more registered agents than bank branches, and registered customer accounts grew 31% to reach a total of 411 million globally. In terms of transaction volume, mobile money processed over a billion transactions in December 2015, which was more than double what PayPal processed globally (GSMA, 2015). The number of mobile money transactions (per 1,000 adults) and value of the transactions (% of GDP) in several Sub-Saharan African countries with successful mobile money deployments are depicted in Figure 3.1 and Figure 3.2, respectively.20 These figures suggest the potential substantive socioeconomic effects of mobile money; that is, the disruptive financial innovation facilitates active participation of users in economic activities, and has gradually become a crucial financial tool in driving socioeconomic development.

20 The data were collected from International Monetary Fund Financial Access Survey: http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C/
Technology Affordances of Mobile Money

Technology affordance refers to “an action potential, that is, to what an individual or organization with a particular purpose can do with a technology or information system” (Majchrzak and Markus, 2012, pp. 832). By digitally orchestrating a new set of sociotechnical elements and relationships, an ICT innovation provides multiple
functionalities (Yoo et al., 2012), which generates multiple affordances for users. Users with different capabilities and purposes are able to achieve a variety of goals by exploiting and exploring multiple affordances of an innovation (Markus & Silver, 2008). For example, a smart phone can be used as a navigator, a music player, a digital camera, and a social media tool, which will lead to outcomes of different degrees and types. Furthermore, as products and services are accessed, delivered, and consumed in a digital way, users are afforded the ability to circumvent traditional socioeconomic frictions (e.g., time-space constraints), and leverage data, knowledge and resources that were previously hardly accessed. For instance, crowdfunding affords entrepreneurs not only the ability to collect funds from the crowd, but the possibility to take advantage of non-financial value (e.g., knowledge of product development, marketing, human capital) provided by the crowd (e.g., Lehner et al., 2015).

Given its explanatory power, the technology affordances perspective has been increasingly applied to examine uses and consequences of an innovation (e.g., Leonardi, 2013), and received further theoretical development. Extending the previous theory that was focused on individual-level affordances as action potentials, Strong et al. (2014) shifted the focus from action potentials toward actualization of the potentials and theorized the process of actualizing affordances of an innovation in an organizational context, which explains organizational-level change. It is argued that when the primary affordances of an innovation (concerned
with key functions and capabilities) are perceived as advantageous over existing practices and processes, the affordances are being simultaneously actualized by many individual actors. Such dynamic actualization not only generates immediate concrete outcomes, but may create enabling, stimulating, and releasing conditions under which a group of actors enact secondary and tertiary affordances (Strong et al., 2014). The newly enacted affordances are likely to be interrelated and interactive, and their actualization may contribute to achieving goals at group and/or organizational level. In the context of ICT innovations for development, it is therefore arguable that when affordances of an innovation are actualized by individual users on a large scale, we may expect societal-level socioeconomic development to precipitate over time.

To understand the affordances of mobile money, it is necessary to briefly survey the landscape of financial services in developing economies. Prior to the advent of mobile money, low-income population had limited access to traditional banking services, due to poor formal financial infrastructure (e.g. low penetration of bank branches and ATMs) (Triki and Faye, 2013), and a series of financial barriers including accessibility, affordability and eligibility (Beck et al., 2008). Thus, it is not surprising that the financially excluded group had to rely on informal financial services, i.e., hiding cash under the mattress, participating in saving groups with, sending money via bus driver, etc. However, none of them could sufficiently satisfy their financial needs because of costs and risks associated with cash, i.e., theft, loss,
limited liquidity, etc. (Mas, 2010; Mbiti and Weil, 2011). The fundamental problem of insufficient formal and informal financial services is attributable to excessive immersion in cash (Radcliffe and Voorhies, 2012). Cash needs to be kept, transported, and circulated in physical ways, and hence creates considerable frictions in developing economies where financial as well as basic public infrastructures remain underdeveloped. Consequently, in such economies, the access and use level of quality financial services that meet basic financial needs is rather limited.

Against this backdrop, mobile money is developed to cater to the basic financial needs of individuals, households, and businesses, especially those who are marginalized from traditional banking services (Radcliffe and Voorhies, 2012; Evans and Pirchio, 2015; Aron, 2017). Operating with e-money and involving cash to a minimum level, mobile money can relax time-space constraints and helps users stay out of costs and risks associated with cash (Mas, 2010; Mbiti and Weil, 2011). As such, mobile money reduces a variety of transactions costs including costs of sending and receiving money over distances, transport costs of travel to a bank or government office, coordination costs between consumers and goods/services providers, and opportunity costs such as loss of money (Ramada-Sarasola, 2012; Aron, 2017). Therefore, the primary affordances of mobile money are that unbanked users are afforded the ability to access a number of basic financial services, and conduct effective financial transactions with reduced costs than ever before. As the
 affordances of mobile money are actualized by users, especially the unbanked, on a massive scale, we expect to see socioeconomic benefits created at multiple levels, which I turn to next.

**Mobile Money and Socioeconomic Development**

Based on the theoretical discussion of technology affordances of mobile money, this sub-section reviews empirical evidence on socioeconomic benefits at micro-, meso-, and macro-level.

**Mobile Money and Household Welfare**

A growing body of studies shows that actualization of the primary affordances of mobile money produces socioeconomic benefits concerning household welfare improvement. First, household income and consumption are enhanced due to frictionless e-money transfer among friends and family members via mobile money. For example, low-income households in rural areas in Kenya reported that income increased by up to 30% through transfers from their social networks (Morawczynski and Pickens, 2009). With disposable income, household consumption is improved. Jack and Suri (2011) observed that annual individual expenditure of M-Pesa users was, on average, 67% higher than that of non-users. Second, through instant e-money transfer, households are afforded the ability to smooth negative shocks arising from events such as drought, disease, school dropout, to which households would otherwise have been susceptible (e.g., Jack and
Suri, 2014; Aker et al., 2016). Third, mobile money also affords household users the ability to grow family businesses. Sekabira and Qaim (2017) found that mobile money enables smallholder coffee farm households in Uganda to accumulate capital and assets by improving agricultural marketing (e.g., transactions with buyers from distant regions) and facilitating off-farm economic activities (e.g., small businesses in trade, handcrafts).

**Mobile Money and Small Businesses Growth**

Small businesses in developing economies often suffer several financial constraints such as lack of access to funds, debt collection, liquidity, cash-flow management and low sales (Bångens and Söderberg, 2011). Since use of e-money can substantively reduce transactions costs and facilitate financial trade (Simiyu and Oloko, 2015; Nyaga and Okonga, 2014), mobile money affords small businesses the ability to circumvent those financial bottlenecks and improve business operation and growth. Chale and Mbamba (2015) agreed with Bångens and Söderberg (2011) that small businesses in Tanzania benefit from mobile money in various aspects including sales transactions, purchase of stock, receiving payment, and payment of goods and services, which is translated into improved financial performance. More evidence has been documented in Kenya. Small businesses have been found to experience growth in sales revenue by saving and receiving money, and making payments through mobile money (Kirui and Onyuma, 2015; Ngaruiya et al., 2014; Wanyonyi
and Bwisa, 2013), which speeds up the cycle from capital to inventory to receivables and back to capital for future investment (Higgins et al., 2012).

**Mobile Money and Community Development**

Given socioeconomic benefits at the household and business levels, the aggregate effects seem plausible in a community where mobile money is widely adopted. A few studies suggest that mobile money can serve as an engine for community development and local economy. Ramada-Sarasola (2012) maintained that affordances of mobile money, once widely actualized in a community, produces impacts on increasing efficiency of the local financial market, boosting local infrastructure, increasing labor demand, and increasing the need for local innovations. Likewise, Plyler et al. (2010) empirically examined the spillover and ripple effects of M-Pesa in Kibera (an urban slum) and Muranga and Kitui (two rural districts) in Kenya. The study showed that both users and non-users benefit from the actualized affordances of M-Pesa through the four overarching socioeconomic effects, along with 11 sub-effects, at the community level: local economic expansion (money circulation, expansion of businesses, and employment opportunities), security (money, food, and physical), capital accumulation (human, social, and financial capital) and business environment (ease of transactions and quality control). In the similar vein, Yokossi (2017) recently found that ubiquitous access to mobile money services in communities of Kenya contributes to local economic activity and performance.
Mobile Money and Financial Inclusion

Once adopted on a massive scale, mobile money affords the improved financial inclusion. Due to the lack of access to quality financial services in developing economies, the rural poor households are willing to adopt and use mobile money because it provides an accessible, convenient, cheap, and secure way of transferring money, saving money, and making payments (e.g., Mbiti and Weil, 2011; Mago and Chitokwindo, 2014). In addition, Mas and Ng’weno (2012) showed that mobile money is regarded as an efficient alternative and complement to cash in business transactions for informal small businesses. At the macro level, Evans and Pirchio (2015) concluded that mobile money is more likely to take off and expand financial inclusion in poorer countries that lack formal financial infrastructure (e.g., low penetration of bank branches and ATMs). The financial inclusion impact of mobile money in Sub-Saharan Africa has been widely documented not only in industry reports, i.e., GSMA (2015), but also in academic research, i.e., Fanta et al. (2016). It is worth noting that deepened financial inclusion has been found to drive socioeconomic development in developing economies (e.g., Ashraf et al., 2006; Sahay et al., 2015).

Recap: A Testable Hypothesis

Mobile money, as a package of efficient and effective digital financial services, is found to promote household welfare (e.g., Sekabira and Qaim, 2017). As a greater
number of users integrate mobile money in their daily lives, mobile money turns into a fundamental payments infrastructure, which creates favorable conditions under which small businesses are afforded to adopt mobile money to grow and expand their businesses. Since small businesses constitute a vast majority of business community in developing economies (e.g., Mead and Liedholm, 1998), the improved businesses arguably contribute to socioeconomic development by producing more jobs and promoting household income, which, in turn, can be consumed, saved, and invested into human/financial capital. In addition, the widespread use of mobile money deepens financial inclusion (e.g., Fanta et al., 2016), which eliminates financial frictions and costs for both businesses and public sectors to push the frontier of socioeconomic development that will ultimately benefit households (Sarma and Pais, 2011). In short, the documented evidence reveals that affordances of mobile money, once actualized on a massive scale, engenders not only immediate socioeconomic benefits, but the conditions for subsequent affordances that are likely to be triggered and actualized to precipitate socioeconomic impacts at the societal level.

Despite these findings at the micro and meso level, research at the societal level remains scant. In the context of Kenya, Beck et al. (2016) found that the introduction of M-Pesa in 2007 explained 14% of total factor productivity growth between 2006 and 2013. Yet, the generalizability of this finding may be limited as the study only investigated a single country. In their cross-country study, Andrianaivo and Kpodar
(2012) showed that the positive relationship between financial inclusion (measured by number of deposits/loans accounts per head) and economic growth was stronger in countries where mobile money has been deployed. This finding, however, deserves further investigation because only three countries (Zambia, South Africa, and Kenya) were considered. Despite the limited evidence, the two studies point to the potential socioeconomic impacts of mobile money at the societal level.

To summarize the literature, it is arguable that mobile money, when adopted on a massive scale, can be considered a driving force of socioeconomic development. To make it testable, this essay focuses on a particular aspect—economic growth—of socioeconomic development, and formulates the following hypothesis:

*Hypothesis:* Mobile money, when widely adopted, has a positive effect on a country’s economic growth.

**Methodology**

Since mobile money has not been around for long, macro-level research is mainly constrained by limited data availability (Triki and Faye, 2013). One potential way to overcome this limitation and examine the link is to use the Difference-in-Differences (DD) approach. The underlying logic of DD is to determine the effect of a treatment (e.g., policy, medication, training program, etc.) by measuring the differences of the mean changes in outcomes of a treatment and a control group in pre- versus post-
period (Card and Krueger, 1993; Autor, 2003; Angrist and Pischke, 2008). For example, in their seminal study, Card and Krueger (1993) used the minimum wage law as a treatment, and investigated the impact of the law on employment growth by comparing fast food stores in New Jersey and Pennsylvania, one of which was affected by the law, while the other was not.

In this spirit, this essay considered the widespread adoption of mobile money (or successful mobile money deployment) as a treatment, and attempted to examine the impact on economic growth by comparing countries in which mobile money has been widely adopted with countries where mobile money was not available (as of 2015) or identified as a failed deployment. In an attempt to infer the potential causal link, this study followed the spirit of Granger causality and augmented the base DD specification with Lead (anticipatory effects) and Lag (post-treatment effects) variables (e.g., Autor, 2003). In what follows, the basic elements—treatment and control group, and time period—are constructed. Then, data and variables are described, and finally the base and augmented models are specified.

**Treatment, Control Group, and Time Period**

In using DD approach, the impact of a treatment would be more convincing if members in the treatment and control groups shared similar characteristics, i.e., patients with the same disease. Following this logic, this essay considered countries from the same region—Sub-Saharan Africa, instead of sampling from the population.
The motive of choosing this area is threefold. First, the countries are closer to each other in socioeconomic sense relative to the case in which a Sub-Saharan African country is compared with a Latin American country; second, the majority of those countries are developing economies, and 75% of the population in this area do not have access to traditional banking services (Alexandre et al., 2011); and third, mobile money has been intensively deployed and rapidly adopted in this area (GSMA, 2015; Evans and Pirchio, 2015).

The criterion distinguishing the treatment from the control group is whether mobile money has been widely adopted. As an emerging phenomenon, there is no hard and universal rule, and the decision has to be made in an exploratory fashion. However, in investigating the adoption pattern of successful versus failed mobile money deployments in developing economies, Evans and Pirchio (2015) concluded that mobile money either ignites and takes off quickly or does not do so at all. Based on that conclusion, this study identified the countries in treatment group. Using the number of mobile money accounts per 1,000 adults collected from International Monetary Fund Financial Access Survey21, this essay examined adoption patterns in Sub-Saharan African countries. Among those, the upper panel of Figure 3 includes six countries that Evans and Pirchio (2015) identified as those with successful mobile money deployments. In a similar vein, this essay determined four additional

21 International Monetary Fund Financial Access Survey. URL: http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C/
countries that show successful mobile money adoption patterns (See the lower panel of Figure 3.3). To some extent, this exploratory approach is reasonable, because penetration approaches 800 out of 1,000 adults in a few years since mobile money was introduced in those countries. Taken together, treatment group consists of 10 countries (see Table 3.2).

Figure 3.3: Mobile Money Adoption in Treatment Group
As for the control group, there are two sub-sets. The first set includes six countries where mobile money had not been carried out as of 2015, according to GSMA Mobile Money Development Tracker. This Tracker documents deployments of mobile money initiatives in developing economies around the world. The second set encompasses five countries with failed mobile money deployment as per Evans and Pirchio (2015). In short, the treatment and control groups, respectively, comprise 10 and 11 countries (see Table 3.2).

Table 3.2: Countries in Treatment and Control Group

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana (BWA)</td>
<td>Angola (AGO)</td>
</tr>
<tr>
<td>Côte d’Ivoire (CIV)</td>
<td>Burkina Faso (BFA)</td>
</tr>
<tr>
<td>Ghana (GHA)</td>
<td>Cape Verde (CPV)</td>
</tr>
<tr>
<td>Kenya (KEN)</td>
<td>Central African Republic (CAF)</td>
</tr>
<tr>
<td>Namibia (NAM)</td>
<td>Chad (TCD)</td>
</tr>
<tr>
<td>Rwanda (RWA)</td>
<td>Comoros (COM)</td>
</tr>
<tr>
<td>Tanzania (TZA)</td>
<td>Equatorial Guinea (GNQ)</td>
</tr>
<tr>
<td>Uganda (UGA)</td>
<td>Madagascar (MDG)</td>
</tr>
<tr>
<td>Zambia (ZMB)</td>
<td>Nigeria (NGA)</td>
</tr>
<tr>
<td>Zimbabwe (ZWE)</td>
<td>South Africa (ZAF)</td>
</tr>
<tr>
<td></td>
<td>Sudan (SDN)</td>
</tr>
<tr>
<td><strong>Total: 10</strong></td>
<td><strong>Total: 11</strong></td>
</tr>
</tbody>
</table>

---

22 GSMA Mobile Money Development Tracker. URL: https://www.gsma.com/mobilefordevelopment/m4d-tracker/mobile-money-deployment-tracker/
In addition to the treatment and control groups, the other key element of the DD approach is time period. According to GSMA Mobile Money Development Tracker, mobile money had been intensively launched in Sub-Saharan Africa between 2008 and 2010. Given this observation, this study considered 5 years prior to and post this intensive launch period. It should be noted that there is no universal pre- and post-period in the dataset because the timing of mobile money deployment varies across countries. At the end, a balanced panel dataset was created, consisting of 273 country-year observations, with 21 countries ranging from 2003 to 2015.

**Variables**

Following prior research (e.g., Datta and Agarwal, 2004), this essay uses GDP per capita growth rate \((GDPPCGR)\) as the dependent variable, measuring economic growth. This data was extracted from World Development Indicators, World Bank. The key explanatory variable is Mobile Money \((MM)\), a dummy variable. It is assigned the value of 1 for treatment country in the year when mobile money is available; otherwise 0. In doing so, this variable captures the effects of successful mobile money deployments on the treatment countries in post periods. This data was derived from GSMA Mobile Money Development Tracker. Following previous studies (e.g., Sassi and Goaied, 2013), this essay considers three control variables: government consumption (% of GDP) \((Lgc)\); inflation rate (annual %) \((Linf)\); and trade openness (% of GDP) \((Ltrade)\). All control variables were transformed into logarithmic form and the data was collected from World Development Indicators.
Due to the limited data availability (and missing values), some frequently used
control variables such as interest rate and education level were dropped.

**Model Specifications**

When examining the antecedents of economic growth, a typical concern is that one
can hardly consider all factors that relate to economic growth. To overcome this
concern, this essay adopted a three-pronged approach. First, country-fixed effects
were used to control for country-specific, time-invariant characteristics. Second,
year-fixed effects were deployed to control for year-specific variables that might
vary over time but not across countries. Third, multiple control variables were
introduced as aforementioned. Consistent with the economic growth literature (e.g.,
Sassi and Goaied, 2013; Andrianaivo and Kpodar, 2012), I estimated a standard
growth model as below.

\[ y_{it} = \beta_0 + \beta_1 MM_{it} + \beta_2 X_{it} + \gamma_i + \lambda_t + \epsilon_{it} \]

In this model, \( y_{it} \) represents economic growth, measured by GDP per capita growth
rate (\( GDPPCGR \)) of a country \( i \) in year \( t \). \( MM_{it} \), as a dummy variable, captures the
treatment effect of successful mobile money deployment in a country \( i \) in year \( t \). \( X_{it} \)
represents control variables of a country \( i \) in year \( t \). \( \gamma_i \) and \( \lambda_t \) represent country- and
year-fixed effects, respectively. \( \epsilon_{it} \) is error term.
In order to infer the potential causal link, *Lead* (anticipatory effects) and *Lag* (post-treatment effects) variables were created in the spirit of Granger (1969). The Granger idea is to see whether causes happen before consequences, and not *vice versa*. If mobile money causes economic growth, *Lead* variables should be *insignificant* with the coefficients close to *zero*, whereas *Lag* variables are *significant* (Autor, 2003; Angrist and Pischke, 2008). In addition to causality detection, using *Lead* and *Lag* variables offers two additional advantages. First, it enables the test of parallel trend assumption of the DD approach (Angrist and Pischke, 2008). Second, as *Lag* variables essentially *decompose* the dummy variable, $MM_{it}$, into a series of dummy variables, one can observe the pattern of mobile money impact over time (e.g., either increasing or decreasing or flattening), which is of substantive interest. Accordingly, the augmented model was formulated as follows.

$$y_{it} = \beta_0 + \beta_1 Lead_i + \beta_2 Lag_i + \beta_3 X_{it} + \gamma_i + \lambda_t + \varepsilon_{it}$$

Due to the small sample size, the number of variables that could be considered in the above model is limited. As such, 2 *Lead* variables and 3 *Lag* variables were constructed for each country. *Lead 2* and *Lead 1* are indicator variables for 3 years and 2 years prior, respectively. Since it was observed that a pilot study was often
conducted prior to the commercial launch of mobile money\textsuperscript{23}, this study intentionally omitted 1 year prior as an effort to mimic deployment of mobile money in a country as an intervention (or treatment) as per the DD design. As for \textit{Lag} variables, I created three indicators that reflect three phases rather than individual post-treatment years. \textit{Lag 1}, \textit{Lag 2} and \textit{Lag 3} represent three phases, corresponding to 1) launch year (of the first mobile money deployment) and one year after; 2) two years and three years after; and 3) four or more years after, respectively.

The STATA package was used to estimate the country-/year-fixed effects models. Also, this study implemented the \textit{vce (cluster)} option to cluster standard errors on country, which returns more robust standard errors of point estimates (Bertrand et al., 2004). Summary statistics of variables are reported in Table 3.3.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|l|l|l|}
\hline
\textbf{Variable} & \textbf{Obs} & \textbf{Mean} & \textbf{SD} & \textbf{Min} & \textbf{Max} \\
\hline
GDPPCGR & 273 & 2.806 & 5.918 & -36.830 & 32.248 \\
\hline
MM & 273 & 0.249 & 0.433 & 0 & 1 \\
\hline
Lead 2 & 273 & 0.037 & 0.188 & 0 & 1 \\
\hline
Lead 1 & 273 & 0.037 & 0.188 & 0 & 1 \\
\hline
Lag 1 & 273 & 0.073 & 0.261 & 0 & 1 \\
\hline
Lag 2 & 273 & 0.073 & 0.261 & 0 & 1 \\
\hline
\end{tabular}
\caption{Summary Statistics}
\end{table}

Results

The results are reported in Table 3.4. Consistent with previous research (e.g., Sassi and Goaied, 2013; Andrianaivo and Kpodar, 2012), government consumption ($Lgc$) and inflation rate ($Linf$) are negatively associated with economic growth, whereas trade openness ($Ltrade$) is positively related to economic growth. These results verify the validity of the models specified in the current setting.

Table 3.4: Impact of Mobile Money on Economic Growth

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$MM$</td>
<td>----</td>
<td>3.120***</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1.103]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead 2</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-1.154</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[1.781]</td>
</tr>
<tr>
<td>Lead 1</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>0.328</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[2.662]</td>
</tr>
<tr>
<td>Lag 1</td>
<td>----</td>
<td>----</td>
<td>2.792***</td>
<td>2.683**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[0.932]</td>
<td>[1.071]</td>
</tr>
<tr>
<td>Lag 2</td>
<td>----</td>
<td>----</td>
<td>2.887*</td>
<td>2.763**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[1.410]</td>
<td>[1.316]</td>
</tr>
<tr>
<td>Lag 3</td>
<td>----</td>
<td>----</td>
<td>3.748**</td>
<td>3.612**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[1.691]</td>
<td>[1.683]</td>
</tr>
<tr>
<td>$Lgc$</td>
<td>-4.871*</td>
<td>-4.538*</td>
<td>-4.585*</td>
<td>-4.644*</td>
</tr>
</tbody>
</table>
Column (2) shows that mobile money, when widely adopted, is positively associated with a country’s economic growth. The coefficient means that when comparing the treatment and control groups, the countries with successful mobile money deployments experience, on average, 3.12% points higher economic growth than those in control group, other things being equal. The explanatory power of mobile money is also illustrated by the increase in overall $R^2$ from 0.109 to 0.148. When we decompose the dummy variable, $MM$, into three phases, $Lag 1$ through $Lag 3$, the results (Column (3)) reveal that the effect of mobile money remains significantly positive throughout the three phases. Moreover, the coefficient increases over time, showing greater impact on economic growth as the mobile money service penetrates deeper into the population.
As expected, even when *Lead* variables are introduced to the base model (Column (4)), the positive increasing effect of mobile money holds with negligible change in size. The inclusion of *Lead* variables does not result in any change in overall $R^2$. Furthermore, the coefficients of *Lead* variables are found close to zero and insignificant, whereas the impacts of *Lag* variables remain positive. It is also worth noting that a sharply increasing effect on economic growth in the first few years after successful deployment of mobile money is observed (see Figure 3.4). These observations, together, reveal that in Granger’s spirit mobile money leads to economic growth, and not the reverse causality. Put differently, successful mobile money deployments serves as an engine for economic growth, rather than being a consequence of it. In addition, the coefficients of *Lead* and *Lag* variables show that current specification of the DD models does not violate the parallel trend assumption (Angrist and Pischke, 2008), which lends further support to these results.

![Figure 3.4: Point Estimates of Coefficients of Lead and Lag Variables](image)

Figure 3.4: Point Estimates of Coefficients of Lead and Lag Variables
Robustness Checks

To test robustness of the results, two extra analyses were performed. First, an alternative dependent variable, GDP growth rate, was considered. Second, another control variable, mobile phone per head, was included in the model. The rationale for introducing mobile phone penetration is to disentangle the effect of mobile money from that of mobile phone usage. The results are reported in Table 3.5.

Column (6) and (7) show that due to the inclusion of mobile phone usage, there is a slight decrease in the effect of MM as well as Lag variables, compared with the previous results. Although Lag 2 becomes insignificant, the effect of successful mobile money development turns out to be significantly positive in the later phase, Lag 3, which in general concurs with the prior results. Even if we use GDP growth rate as the dependent variable (Column (9) and (10)), the results hold consistent. In short, the robustness checks corroborate the major results that successful mobile money deployment contributes to economic growth and that the effect grows over time. In addition, the results further reveal that the pattern of positive, increasing impact persists even when controlling for the effect of mobile phone usage.

Table 3.5: Robustness Checks

<table>
<thead>
<tr>
<th></th>
<th>DV: GDP per capita growth (annual %)</th>
<th>DV: GDP growth (annual %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>MM</td>
<td>----</td>
<td>2.636**</td>
</tr>
</tbody>
</table>
What is of great interest here is the change in coefficient of mobile phone per head. In line with previous studies (e.g., Lee et al., 2012), mobile phone per head, as a proxy for mobile phone usage, is positively correlated with economic growth. However, when we introduce mobile money in the model, the effect becomes statistically
insignificant. Given the small sample size, the number of additional variables that can be considered is limited. Further research could examine in depth the dynamics between mobile money and mobile phone usage by expanding the sample size as additional data on mobile money becomes available.

Discussion and Conclusion

This essay investigates whether successful mobile money deployment, or the widespread adoption of mobile money, leads to socioeconomic development at the societal level. In exploring the theoretical link, this essay builds on the technology affordances perspective. Essentially, what mobile money brings to users are a set of new affordances, or action potentials, which, once actualized, could help circumvent or overcome traditional socioeconomic frictions. By digitizing cash into e-money, mobile money affords the unbanked users the ability to access and use a number of basic financial services in a more efficient and effective way than ever before.

As a greater number of users actualize these affordances, socioeconomic benefits have been observed at various levels. In particular, mobile money affords households the ability to improve household welfare and small business owners the possibility to expand their businesses. These outcomes are shown to contribute to higher-order socioeconomic development including community development, local economy and financial inclusion. Along these lines, it is hypothesized that mobile
money, when widely adopted, can have a positive effect on economic growth, the 
economic aspect of socioeconomic development. Based on the Difference-in-
Differences approach, this essay notably finds that mobile money, when adopted on 
a massive scale, has an increasingly positive effect on economic growth over time, 
and that this pattern persists even when controlling for mobile phone usage.

The findings of this essay contribute to the literature in two ways. First, although the 
majority of mobile money studies have shown socioeconomic impacts of mobile 
money for households and small businesses, the literature still owes us the broader 
societal and economic implications. The current findings add knowledge to the 
emerging literature by documenting the societal-level socioeconomic impacts of 
mobile money. This essay, to the author’s best knowledge, is the first cross-country 
study that explores the potential causal link and shows the positive relationship 
between successful mobile money deployment and economic growth. Second, the 
cross-country evidence established in this study sets the foundations for future 
theoretical and empirical research. To advance our understanding of the role of 
mobile money, it is of extreme importance to develop an integrative theoretical 
framework addressing the following aspects: 1) whether the relationship exists; 2) 
how the relationship operates; and 3) why the relationship occurs. As the findings 
provide empirical support regarding the whether inquiry, this essay constructs the 
fundamental building block for future inquiries. Yet, it should be noted that since 
this essay focuses on the economic dimension of socioeconomic development, future
research is needed to examine the link between mobile money and social benefits such as well-being and poverty reduction in a country.

So far, the questions as to how and why remain underexplored at the macro level. In particular, the mechanisms through which mobile money generates far-reaching socioeconomic benefits are under-theorized. Although the major focus here is not to examine the mechanisms, this essay provides at least two important theoretical implications based on the technology affordances perspective. On the one hand, while existing studies implicitly agree with the mechanism of deepening financial inclusion (e.g., Aron, 2017), this essay suggests other potential mechanisms, i.e., enabling small businesses to grow and expand their businesses. On the other hand, this essay also highlights the necessity and importance of acknowledging the co-existence and potential interaction of multiple mechanisms across different levels. As discussed above, it is arguable that mechanisms at the household (e.g., improving income and consumption), business (e.g., growing small businesses) and the community level (e.g., expanding local economy) may reinforce each other. Still, in-depth research is needed to further our understanding of the causal mechanisms.

In practice, the findings provide several lessons for a number of stakeholders. First, the findings underline the importance of mobile money rollout in developing economies where a majority of the population has limited access to basic financial services. Mobile money has been shown to be able to drive socioeconomic development, rather than being a consequence of it. Second, because the findings
suggest the increasingly positive effect of mobile money, stakeholders may expect wider societal and economic outcomes as mobile money spreads into society over time. To that end, policymakers and authorities should devise policies that facilitate integration of mobile money into business and public sectors. For example, digital entrepreneurs as well as the governments may benefit from incorporating mobile money into the management, organization, and distribution of social resources in the society, i.e., healthcare, insurance, and government subsidy. Finally and most fundamentally, stakeholders should work in concert to create the enabling environment (e.g., deregulation) and to develop programs (e.g., financial literacy, training program) to boost adoption and use of mobile money, especially among financially excluded groups.

Like others, this study has limitations. The major one is concerned with limited data availability and the resulting small sample size. This issue, however, is unavoidable partly because mobile money has not been around for long and partly because data collection efforts remain sporadic and insufficient (e.g., the IMF Financial Access Survey is one of very few sources that provide panel data). As a result, only a few control variables were considered in the current setting. Similarly, because of small sample size, this essay did not consider additional variables (e.g., interaction term of mobile money and mobile phone penetration) that would otherwise provide more insights into the phenomenon. The other limitation concerns the approach used to
distinguish the treatment and control groups, which was exploratory and judgmental and therefore open to debate.

In conclusion, a growing number of ICT innovations have been transforming the way people live, work, and do business in developing economies. This essay examined digitally-enabled socioeconomic development in the context of mobile money. In developing economies, mobile money, as disruptive digital financial services, helps the unbanked users circumvent traditional financial barriers and frictions and provides a set of basic financial services in a convenient, cheap, and secure way. Mobile money, therefore, has been argued to hold the potential to drive socioeconomic development. As a pioneering effort, this essay concluded that widespread adoption of mobile money leads to economic growth. Moreover, the results showed that the positive effect increases over time as a growing number of people integrates the services into their daily lives and businesses. The findings not only demonstrate socioeconomic benefits of mobile money at the societal level, but also establish empirical and theoretical foundations for future efforts at theorizing the associated mechanisms, which will help organize and manage mobile money to become a blessing to developing economies.
CHAPTER IV. MOBILE MONEY USAGE

This essay is co-authored with M. Lynne Markus.

The earlier version of this essay, titled as “Mind the Gap: The Digital Divide in Usage of Mobile Money in Kenya,” was accepted and presented in the 4th Post-ICIS Research Workshop on SIG Social Inclusion (SIGSI), San Francisco, CA.

This essay should be cited as follows:

Abstract

Mobile money in Kenya has been applauded as a success story, as evidenced by its remarkable adoption rate. The widespread adoption of mobile money might appear to suggest the closure of the digital divide among the “haves” and “not-haves” in Kenya. This essay argues, however, that having access to mobile money is not the same thing as using it in ways that decrease financial exclusion. That is, even if there is the closed gap in adoption, the digital divide might still exist in mobile money usage. This essay examines digital inequality in mobile money usage and investigates the socioeconomic differences that discriminate among usage levels and types. The findings show that whereas the digital divide in usage frequency and extent has decreased over time, the gap in the usage scope (breadth of services used) persists. Moreover, this essay finds that structural socioeconomic differences consistently separate active users from non-active users, regardless of whether the divide is analyzed in terms of frequency, scope, or extent. Finally, the findings reveal dynamics in socioeconomic factors as some are more influential in explaining the divide in the earlier diffusion phase and others emerge as more influential factors in the later phase. This essay contributes to the literature by showing the dynamics of the digital divide and the sticky socioeconomic differences standing in the way of financial and social inclusion even when mobile money has diffused widely through society.
Keywords: digital divide, mobile money, financial inclusion, system usage, socioeconomic differences.

Introduction

Mobile money (MM) refers to the use of information and communication technologies and non-bank retail channels to extend the delivery of basic financial services to people, especially the low-income population, who are marginalized and excluded from formal financial services (GSMA, 2015). Over the last decade, MM has been intensively launched in Sub-Saharan Africa to fill the financial services gap, mainly created by limited formal financial infrastructure and deficient informal financial services approaches (Mas, 2010; Evans and Pirchio, 2015; Aron, 2017). With cash digitized into e-money, MM frees users from traditional financial barriers and frictions (i.e., time/space constraints, loss), and enables them to use basic financial services (i.e., money transfer, bill payment, receive payments, etc.) in a convenient, secure, and affordable way via mobile phones (e.g., Jack et al., 2010; Mbiti and Weil, 2011; Jack and Suri, 2014). One of the first and most successful cases of MM to date is M-Pesa in Kenya. In the six years after the first commercial launch in 2007, the M-Pesa adoption rate was approaching the saturation level as the number of registered MM accounts outnumbered the Kenyan adult population.24

24 Data source: http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C
This essay starts with the intuition that even though the high MM adoption rate may indicate the closure of the digital divide in adoption, a gap in MM usage may persist. In this spirit, we ask whether there is the digital divide in MM usage in Kenya. Review of the MM literature, however, shows that previous studies predominantly look into the users, usage, and socioeconomic benefits of MM (e.g., Mbiti and Weil, 2011; Wanyonyi and Bwisa, 2013; Kirui et al., 2013), while the potential digital divide in MM usage has received little attention. The issue of digital divide is worthy of great attention as the digital divide literature suggests that an emerging technological innovation inevitably engenders the digital divide in both adoption and usage (e.g., DiMaggio and Hargittai, 2001; van Dijk and Hacker, 2003; van Dijk, 2013). This is mainly because individuals and/or households with greater socioeconomic resources tend to take the lead in adopting, using, and therefore benefiting from the emerging technologies, while others follow. The socioeconomic differences among segments of population in a society point to the plausibility of the digital divide even in the context of a high adoption rate.

There are at least three reasons to believe that studying the digital divide in MM usage and the associated socioeconomic differences is of extreme importance. First, given the ever-increasing MM adoption rate in emerging economies, it is time for us to redirect the research focus from the gap in adoption toward the gap in usage (Dewan and Riggins, 2005). Second, the knowledge of the digital inequality in usage may help explain the discrepancies, or even the paradox, in the socioeconomic
outcomes of MM among different usage groups (Lamb and Sawyer, 2005; Witte and Mannon, 2010). Finally, as socioeconomic differences lie at the center of the theoretical arguments in the digital divide literature (van Dijk and Hacker, 2003; van Dijk, 2013), it is important to update our knowledge of the role of socioeconomic differences in this emerging phenomenon so that the stakeholders can establish policy interventions and combat the divide.

Motivated by the research gap and significance of the topic, this essay aims 1) to investigate whether there is the digital divide in MM usage; and 2) if so, to examine socioeconomic differences that explain the digital divide. To avoid any potential confusion, it should be noted that this essay mainly focuses on the digital divide in MM usage, and therefore, the gap between those who use and those who do not use MM is beyond the scope of the study.

Drawing on the system usage literature (e.g., Burton-Jones and Straub, 2006), this essay considers three dimensions of MM usage: frequency, scope, and extent. Using data collected from the Kenya FinAccess Household Survey, this essay employed descriptive analysis, discriminant analysis, and logit regression analysis. Descriptive analysis shows that there is digital inequality in MM usage, even though MM has spread extensively in Kenya. In particular, whereas the digital inequality in frequency and extent of usage decreases over time, the gap in usage scope remains

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25 http://fsdkenya.org/finaccess/
persistent as only a minority of users explores and exploits advanced financial services, i.e., bill payment, money transfer to/from a bank account. In addition, discriminant analysis reveals that the divide is attributable to structural socioeconomic differences: A common set of socioeconomic factors—formal financial inclusion, income, education, financial literacy, residence, and age—consistently discriminates among different usage groups. Finally, results of logit regression point to the complex dynamics in socioeconomic factors that explaining the digital inequality. Factors, such as bank account ownership and mobile phone ownership, are more influential in explaining the digital inequality in the earlier diffusion phase; yet, other factors, such as financial literacy and age, become more influential in the later phase.

The findings contribute to the intersection of the MM and digital divide literature. First, to the authors’ knowledge, this essay is one of the initial efforts to study the digital divide issue in the MM literature. We looked into the digital divide in usage (not adoption) and shows the presence and dynamics of the divide: some gaps decrease, but some persist over time. What is worth noting is that the digital inequality in usage exists even when the adoption gap has almost been closed. Second, this essay contributes to the digital divide literature by advancing our understanding of the pivotal role of socioeconomic differences: The differences are structural as they are deeply solidified and sticky in society. Regardless of whether the digital divide is analyzed in terms of frequency, scope, or extent, the same set of
socioeconomic factors are found to separate active users from non-active users even though the adoption rate approaches the saturation level.

The remainder of this essay is structured as follows. Section 2 reviews several relevant literatures. Data and research method are described in Section 3, and results are reported and discussed in Section 4. Section 5 closes this essay with the discussion of theoretical and practical implications.

**Literature**

In this section, we first discuss MM in Kenya by reviewing the MM literature and then propose a MM digital divide framework. Finally, we draw on the system usage literature to identify three dimensions of MM usage to be analyzed.

**Mobile Money in Kenya**

In Kenya, the first MM service, M-Pesa, was launched in 2007 by Safaricom, the biggest mobile network operator in the country. As M-Pesa demonstrated the viability of MM in the following years with astonishing user base growth (Mas and Morawczynski, 2009), a number of players entered the market in 2010 and 2011, i.e., MobiKash, Orange Money, and Airtel Money. Despite the different service providers, users in general have access to a similar set of financial services such as person-to-person money transfer, bill payment, airtime purchase, merchant payment, and
money transfer from/to bank account, etc.\textsuperscript{26} The diffusion of MM and its importance in the Kenyan economy since 2007 have been remarkable (see Figure 4.1\textsuperscript{27}). It is observed that in 2013, the number of MM accounts outnumbered the Kenyan adult population, and the total value of transactions reached as much as 40\% of the Kenya GDP.

![Figure 4.1: Growth of MM in Kenya](image)

The successful MM story in Kenya is attributable to three factors. First, MM meets unfilled financial needs. Kenya has a long tradition of rural to urban migration, with family members who work in cities regularly send money back to their families in rural areas (Morawczynski and Pickens, 2009; Orlikowski and Barrett, 2014). Compared with the traditional costly and risky means of money transfer (e.g., via bus driver), MM has been preferred for its convenience, timeliness, and security, and

\textsuperscript{26}https://www.gsma.com/mobilefordevelopment/m4d-tracker/mobile-money-deployment-tracker/

\textsuperscript{27}Data source: IMF Financial Access Survey 2017
widely used to fill this void. Second, the success story is partly due to the growth of a MM agent network, which helps users register for the service and provides cash-in/cash-out services (Jack and Suri, 2014). In a country with 1,500 bank branches in total, about 165,000 MM agents (as of 2016) were distributed across the country.\textsuperscript{28} Finally, regulatory bodies create a facilitating environment (Mas and Morawczynski, 2009). For example, a year after its launch, M-Pesa was able to partner with PesaPoint, one of the largest ATM services providers in Kenya, to provide ATM withdrawals services. In 2012, Safaricom launched M-Shwari, the savings and loans services, in collaboration with Commercial Bank of Africa.

As MM has extensively diffused, this phenomenon is of great interest to scholars. A growing body of studies has examined the users, usage, and socioeconomic benefits of MM in Kenya at multiple levels of analysis. In terms of users and usage, Mbiti and Weil (2011) found that M-Pesa users tend to be young, educated, banked, affluent, and living in urban areas, and that the overwhelming usage is for person-to-person money transfer. Small businesses are also found to use MM to receive customer payment, purchase from suppliers, and collect debt (e.g., Wanyonyi and Bwisa, 2013). Socioeconomic benefits of MM have been widely studied. M-Pesa helps households promote income and consumption level (Kirui et al., 2013) and affords households the ability to smooth negative shocks (e.g., drought, disease) through instant money transfer among their social networks (Jack and Suri, 2014). The

\textsuperscript{28} http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C

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socioeconomic benefits at the business level (e.g., Kirui and Onyuma, 2015) and the community level (e.g., Plyler et al., 2010) have also been well documented. Although those studies advance our understanding of the phenomenon, little research looks into the digital divide in MM usage. This is somewhat understandable because the potential digital divide in usage might have been concealed by the impressive adoption rate and the related socioeconomic benefits. However, as will be discussed shortly, the divide in usage differs conceptually from the divide in adoption and is worth further investigation.

A Mobile Money Digital Divide Framework

The digital divide can be defined as gaps among individuals, households, businesses, and geographic areas in accessing and using information communication technologies (ICTs) such as mobile phone and the Internet (Dewan and Riggins, 2005). There is a general consensus among scholars that digital divide is multidimensional concept (e.g., DiMaggio and Hargittai, 2001), and it is a complex and dynamic social phenomenon (e.g., van Dijk and Hacker, 2003). The digital divide is multifaceted, because the divide can be described in terms of access, adoption, and usage at the individual, organizational, and global level (Wei et al., 2011). In addition, the digital divide is complex and dynamic, because some divides may decrease over time (e.g., basic access), some differences may expand (e.g., social capital differences between users and non-users), and some may be reproduced in face of new ICTs (e.g., from dial-up to broadband) (van Dijk, 2005). Whereas
previous research has mainly focused on the divide in access and its determinants (Kauffman and Techatassanasoontorn, 2005), as ICTs continue to diffuse into society, the research focus has been redirected toward the digital inequality in usage (Dewan and Riggins, 2005).

In examining the digital divide of MM, this essay proposes a MM digital divide framework, building on Dewan and Riggins (2005) and Wei et al. (2011). Figure 4.2 depicts three levels of digital divides. The first level, digital divide in MM adoption, refers to the inequality of access to MM. One is considered as an adopter if he or she registered for a MM account; otherwise, the person is a non-adopter. This level corresponds to the traditional definition of digital divide—gap between “haves” and “not-haves”—or the binary treatment of digital divide. The second level, digital divide in MM usage, refers to the discrepancies in using MM. It arises due to the first-level digital divide and to other contextual factors, such as digital skills and literacy. It is worth noting that digital divide in usage sheds light on multiple dimensions of usage, i.e., frequency and variety (e.g., van Dijk, 2005). The third level, digital divide in MM outcome, results from the first two levels of digital divide, plus other contextual factors (Wei et al., 2011). A difference in socioeconomic outcomes is expected between adopters and non-adopters, as well as between active users and dormant users (e.g., Jack and Suri, 2014; Kirui and Onyuma, 2015).
This framework has several implications. First, the divide in usage is conceptually distinct from the divide in adoption (e.g., Goldfarb and Prince, 2008). Although the saturated MM adoption rate may suggest that the adoption gap has been bridged, the rate says little about usage patterns, not to mention the divide in usage. Second, this framework sheds light on the significance of the digital inequality in usage, which fills the conceptual void between adoption and outcomes (Witte and Mannon, 2010; Wei et al., 2011). In the context of a high adoption rate, studying the gap in usage may provide insights into variable outcomes or puzzling issues like the IT productivity paradox (e.g., Brynjolfsson, 1993). Third, following the tradition of the digital divide literature, this framework considers the antecedents of digital divide (e.g., Dewan and Riggins, 2005; Agarwal et al., 2009). When the framework is applied across multiple research settings, mobile phone ownership and environmental factors are worth noting. However, in the particular context of
In the literature, several theoretical lenses explaining the digital divide focus on socioeconomic differences. The most general argument is the Matthew effect, whereby the rich get richer and the poor get poorer (e.g., van Dijk, 2005; Helsper, 2012). van Dijk (2005) argued that “those who already have a head start in possessing particular resources benefit more from a new resource than those who are behind and already have some disadvantage.” (pp. 125). Similar to the Matthew effect is the usage gap hypothesis (van Dijk and Hacker, 2003, van Dijk, 2004), building on the classic knowledge gap hypothesis (Tichenor et al., 1970). The usage gap hypothesis states that socioeconomic inequalities and cultural and demographic differentiation among segments of population increase the probability of usage gaps in emerging ICTs. In the similar vein, de Haan and Rijken (2002), drawing on the work of Bourdieu (1984), theorized the influence of material, social, and cognitive resources in explaining differences in ICT possession, usage, and skills. Despite the different intellectual origins and research foci (e.g., the gap in possession, access, or usage), the central tenet of those perspectives is that individuals and/or households with greater socioeconomic resources (or higher socioeconomic status) tend to

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29 According to World Bank, in 2009, mobile penetration approached 100% among the Kenyan adult population.
adopt new technologies faster, have and gain more skills, and therefore engage in a broader range of activities more frequently and effectively.

Based on the framework, this essay mainly focuses on the digital divide in MM usage and is particularly interested in examining the associated socioeconomic differences. It should be noted that the present study differs from the prior digital divide research in terms of research setting, which allows for the examination of the influence of socioeconomic differences, regardless of difference in adoption among segments of population. That is, whereas the previous studies have implicitly attributed the divide in usage to the entangled factors of both the adoption (or access) gap and socioeconomic differences (e.g., Dewan and Riggins, 2005), the current research setting—nearly saturated adoption level—enables us study whether socioeconomic differences are still vital in explaining the usage gap by controlling for the adoption gap. Before proceeding to the examination, we need to conceptualize MM usage.

**The Concept and Dimensions of Mobile Money Usage**

The conceptualization of MM usage is based on the system usage literature in IS research. System usage refers to an activity that involves three elements: 1) a user, i.e., the person using the IS; 2) a system, i.e., the object being used; and 3) a task, i.e., the function being performed (Burton-Jones and Straub, 2006, pp. 231). Like digital divide, system usage is perceived as a multilevel and multifaceted concept (Burton-
Jones and Straub, 2006; Burton-Jones and Gallivan, 2007). The concept is multilevel as it can be considered as individual and collective usage across the individual, group, and organizational level, which may or may not have strong interdependencies depending on the context (Burton-Jones and Gallivan, 2007). Usage is multifaceted, because its dimensions and functions vary across different research settings, giving rise to a variety of measures of usage, including, but not limited to, duration, extent, frequency, variety, voluntariness of usage (Burton-Jones and Straub, 2006).

Focusing on the individual/household level, MM usage is defined as a goal-oriented activity that a user performs with MM in order to meet his or her financial needs. For the present purpose and given data availability, this essay considers three dimensions of MM usage, namely, frequency, scope, and extent. First, frequency of MM usage, capturing the time dimension, measures how frequently a user uses MM. Second, scope of MM usage, representing the breadth of activities, measures the diversity of financial services (e.g., money transfer, airtime purchase, savings, pay bills, etc.) accessed via MM. Finally, extent of MM usage, as the aggregate measure of the previous two, shows the overall extent to which MM is used. The three measures are arguably sufficient to study the digital divide in usage, not only because they reflect all elements of usage—user (MM user), system (MM), and task (MM used to meet financial needs), but because they capture the noteworthy multifunctionality of MM (scope of MM usage).
To summarize, the brief review of the MM literature shows that little attention so far has been given to the digital divide in MM usage (as opposed to adoption), while the digital divide literature points to the importance of studying the divide in usage and socioeconomic differences. Drawing on the system usage literature, we conceptualize MM usage and identify three dimensions of usage. Taken together, this essay is dedicated to 1) examining whether, in the context of high adoption rate, there still remains a digital divide in MM usage with respect to frequency, scope, and extent; and 2) if so, investigating the socioeconomic differences that explain the digital inequality among different usage groups.

**Method**

This study employs descriptive analysis, discriminant analysis, and logit regression analysis. First, we conducted descriptive analysis to see whether the digital inequality in MM usage exists and/or changes over time. Descriptive analysis in IS research is particularly useful for studies of emerging IS phenomenon (Gregor, 2006). Second, this essay used discriminant analysis to examine socioeconomic differences that explain the digital divide. Discriminant analysis can be used to not only determine the set of factors that allows for the best discrimination among different groups, but also to measure the relative importance of each individual factor (McLachlan, 2004). Hence, with this technique we are able to identify the socioeconomic factors that best separate two or more MM usage groups, and more
importantly, we can show which socioeconomic factors are more influential in explaining the digital divide. This analysis is well accepted in the digital divide literature. For example, Hilbert (2010) finds the set of socioeconomic factors that separate the Internet adopters and non-adopters, among which income level is the most influential factor. Finally, logit regression analysis was used to examine changes in the explanatory power of socioeconomic factors over the diffusion phases. It should be noted that whereas results of discriminant analysis reveal relative importance of each factor within the model, results of logit regression inform change in impact of a particular factor across the models. Taken together, we are able to determine relative importance as well as changes in the explanatory power of socioeconomic factors over MM diffusion phases.

Data

Data was extracted from the series of Kenya FinAccess Household Survey that measures the access, usage, quality, and impact of both traditional (e.g., bank accounts) and emerging (e.g., MM) financial services in Kenya. In addition to the data on financial services usage, these surveys also capture social, cognitive, economic, and demographic dimensions of respondents/households. Among the four surveys so far (2006, 2009, 2013, and 2016), this essay used the latter three surveys because the first MM was available in 2007. Since the digital divide in usage is the major focus, we only collected data of MM users; in particular, the data on usage of a variety of financial services, and a set of socioeconomic and demographic
factors. As those surveys are nationally representative, the associated results can be
generalized to the population. From the *Survey 2009, 2013, and 2016*, we collected
2548, 4221, and 6197 observations (who are all MM users), respectively.

**Dependent Variables**

This study constructs three dependent variables to capture frequency, scope, and
extent of MM usage. *Fre_MM (Frequency of usage)* measures how frequently MM is
used. Three levels are constructed: 1) *daily/weekly usage*—MM is used daily or at
least once in a week; 2) *monthly usage*—MM is used at least once in a month; and 3)
*irregular usage*—MM is used once in three months or less. *Scp_MM (Scope of usage)*
measures the scope of financial services that users access via MM. Two levels are
created: *general usage* and *extensive usage*. General usage refers to the use of two
basic features: money transfer and airtime purchase. This is a reasonable measure
because those two features are found to dominate in both transaction volume and
value, according to GSMA (2013; 2014). However, it should be noted that
measurement of general usage is adjusted for the *Survey 2016* by adding another
two features: deposit when traveling and save money. The rationale of the
adjustment is to reflect the fact that those two features become more popular over
time. Extensive usage then refers to the use of other advanced financial services (e.g.,
pay bills, pay for goods, receive payments, transfer money to/from bank account,
etc.) *in addition to* the set of basic features. *Ext_MM (Extent of usage)* is the aggregate
of the previous two measures. Two levels are constructed: *heavy usage* and *light*
usage (see Table 4.1). The usage of MM is identified as heavy when the user uses MM at least once a week, regardless of scope or when the user employs an extensive scope of services at least once a month. The similar yet opposite logic applies to the measurement of light usage.

Table 4.1: Measurement of Heavy Usage and Light Usage

<table>
<thead>
<tr>
<th>Scope of Usage</th>
<th>Frequency of Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily/Weekly</td>
</tr>
<tr>
<td>General</td>
<td>Heavy</td>
</tr>
<tr>
<td>Extensive</td>
<td>Heavy</td>
</tr>
<tr>
<td></td>
<td>Monthly</td>
</tr>
<tr>
<td>General</td>
<td>Light</td>
</tr>
<tr>
<td>Extensive</td>
<td>Heavy</td>
</tr>
<tr>
<td></td>
<td>Irregular</td>
</tr>
<tr>
<td>General</td>
<td>Light</td>
</tr>
<tr>
<td>Extensive</td>
<td>Light</td>
</tr>
</tbody>
</table>

Explanatory Variables

This study considers a wide range of socioeconomic factors. First, we consider the material precondition of MM usage: mobile phone ownership. Second, a set of demographic factors are included, i.e., residence, age, and gender of household head. Third, the important economic and cognitive factors—income, education, and financial literacy—are analyzed. Finally, the extent to which a user is financially included (or excluded) is also considered. The descriptions of explanatory variables and summary statistics are reported in Table 4.2 and Table 4.3.

Table 4.2: Descriptions of Explanatory Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>1 if the respondent owns a mobile phone; otherwise, 0</td>
</tr>
<tr>
<td>Residence</td>
<td>1 if the household is located in urban area; otherwise, 0</td>
</tr>
<tr>
<td>Age_cat</td>
<td>1: below 25; 2: 25-34; 3: 35-44; 4: 45-54; 5: above 55</td>
</tr>
<tr>
<td>Gender</td>
<td>1 if the household head is male; otherwise, 0</td>
</tr>
<tr>
<td>Variable</td>
<td>2009</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>SD</strong></td>
</tr>
<tr>
<td>MP</td>
<td>0.80</td>
</tr>
<tr>
<td>Residence</td>
<td>0.47</td>
</tr>
<tr>
<td>Age_cat</td>
<td>3.20</td>
</tr>
<tr>
<td>Gender</td>
<td>0.79</td>
</tr>
<tr>
<td>MS</td>
<td>0.72</td>
</tr>
<tr>
<td>Hh_size_cat</td>
<td>2.45</td>
</tr>
<tr>
<td>Earner_cat</td>
<td>2.71</td>
</tr>
<tr>
<td>Income_dc</td>
<td>6.20</td>
</tr>
</tbody>
</table>
In this section, we first identify whether there is the digital divide in MM usage based on descriptive analysis of the Kenya FinAccess Household Survey 2009, 2013, and 2016. Then, we move on to discriminant analysis and logit regression to show the set of socioeconomic factors that explain the digital divide and changes in their explanatory power over the diffusion phases.

The Digital Divide in Mobile Money Usage

As MM has rapidly spread throughout Kenya since 2007, the usage level has also experienced a remarkable growth. According to the Surveys, 39% of respondents were MM users by 2008, and in four years the usage rate jumped up to 65% (see Figure 4.3). By the end of 2015, 72% of respondents reported that they currently used MM. Although this impressive usage level shows that MM has penetrated deeply in the Kenyan population, the rate per se informs little about the actual usage patterns among different segments of population, not to mention the digital divide in MM usage. We need to dissect the actual usage.
Figure 4.3: Growth of Mobile Money Usage Rate

In zooming into the actual usage of MM, this essay focuses on the three dimensions of MM usage. Figure 4.4 depicts the distribution of different usage groups with respect to frequency (upper), scope (middle), and extent (lower). The upper panel of Figure 4.4 reveals that MM has been used more frequently by a greater Kenyan population. The proportion of daily/weekly usage increased from 16% in 2009 to 45% in 2016, and accordingly, the opposite side—irregular usage—decreased dramatically. Although the gap concerning usage frequency has narrowed over time, we observe that digital inequality persisted in 2016 as 40% of respondents used MM only once in a month, and 15% barely used the services.
Figure 4.4: The Digital Divide in Mobile Money Usage

Different from the decreasing gap in usage frequency, the middle panel of Figure 4.4 shows the persistent digital divide in the scope of usage over time. It is observed that only one fourth of respondents reported that they used other value-added services (e.g., pay bills, receive payments, transfer money to/from bank account, etc.) in addition to the basic features such as money transfer and airtime purchase. This pattern holds for about 10 years after MM was available in the country, showing that only a limited number of users took advantage of the advanced financial services, with the majority being marginalized in this regard. At the aggregate level,
when we consider the digital divide in the extent of usage, the lower panel of Figure 4.4 reveals the decreasing trend. However, it is arguable that the narrowing digital gap in usage extent exists mainly because a greater number of users use MM more frequently, but not because a greater population makes use of the advanced financial services.

Ideally, most Kenyan adults, if not all of them, use MM frequently and benefit from both basic and advanced financial services. However, the descriptive analysis shows the existence and changing nature of the digital divide. Whereas the inequality of usage frequency has narrowed, the digital gap in usage scope persists over time. Although we see a decreasing trend in the digital divide regarding the extent of usage, this is mainly due to the more frequent usage of basic MM services. It is not attributable to the extensive usage of advanced financial services like bill payments.

**Socioeconomic Differences in the Digital Divide in Mobile Money**

**Usage**

The results of discriminant analysis are shown in Table 4.3. The models across the Kenya FinAccess Household Survey 2009, 2013, and 2016 are all significant, but not very strong. For example, the model of extensive versus general usage (DV: Scp.MM) in 2009 (Column 4, Table 4.3) is significant (F test=34.196, Wilks’ λ=0.851,
canonical correlation\(^{30}=0.386, p<0.01\), but the identified discriminant function accounts for only 14.90% of the variance in the scope of MM usage. Based on the identified function, 77.43% of respondents are correctly reclassified into the original categories. Although the models are not strong, the significant results suffice for our research purpose—to identify the influential socioeconomic factors that explain the digital divide in usage. More importantly, the analysis, as will be shown below, generates stable results.

<table>
<thead>
<tr>
<th>DV: Fre-MM</th>
<th>DV: Scp-MM</th>
<th>DV: Ext-MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acc_formal</td>
<td>0.662</td>
<td>0.251</td>
</tr>
<tr>
<td>Income_dc</td>
<td>0.109</td>
<td>0.393</td>
</tr>
<tr>
<td>Edu_cat</td>
<td>0.200</td>
<td>0.244</td>
</tr>
<tr>
<td>Fin_literacy</td>
<td>0.143</td>
<td>0.164</td>
</tr>
<tr>
<td>Residence</td>
<td>0.243</td>
<td>0.282</td>
</tr>
<tr>
<td>Age_cat</td>
<td>-0.087</td>
<td>-0.192</td>
</tr>
<tr>
<td>MP</td>
<td>0.134</td>
<td>0.282</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.097</td>
<td>-0.014</td>
</tr>
<tr>
<td>Ms</td>
<td>0.142</td>
<td>0.067</td>
</tr>
<tr>
<td>Hh_size_cat</td>
<td>-0.020</td>
<td>-0.070</td>
</tr>
<tr>
<td>Earner_cat</td>
<td>0.024</td>
<td>n.a.</td>
</tr>
<tr>
<td>Acc_informal</td>
<td>0.066</td>
<td>0.101</td>
</tr>
<tr>
<td>Excluded</td>
<td>0.015</td>
<td>0.028</td>
</tr>
<tr>
<td>No.of obs</td>
<td>2548</td>
<td>4,221</td>
</tr>
<tr>
<td>F test (F)</td>
<td>12.861</td>
<td>27.502</td>
</tr>
<tr>
<td>Prob. &gt;F</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Wilks’ λ</td>
<td>0.880</td>
<td>0.860</td>
</tr>
<tr>
<td>Canonical</td>
<td>0.336</td>
<td>0.365</td>
</tr>
</tbody>
</table>

\(^{30}\)The canonical correlation is the correlation between the new canonical variables generated by applying the weights from the discriminant function, and the grouping variable (in this case: extensive vs. general usage).
The coefficients of standardized discriminant function tell how the explanatory variables considered in the model combine to create a new variable that maximally discriminates between different usage groups. Hence, the coefficients in Table 4.4 can be interpreted as a measure of the relative importance of each socioeconomic dimension (Hilbert, 2010). The coefficients are presented in descending order of importance. From Table 4.4, we can observe a number of consistent results across the dimensions of MM usage. First, the fact that a user is formally included (e.g., traditional banking services) is the most important factor (Acc_formal) distinguishing active users from non-active users. Second, a set of economic and cognitive dimensions—income (Income_dc), education (Edu_cat), and financial literacy (Fin_literacy)—serves as the second most important factors that discriminate different usage groups. Third, the following important factors concern the demographic dimensions: residence (Residence) and age (Age_cat). Finally, compared with the combined effect of socioeconomic factors, mobile phone ownership (MP), as the precondition of adopting and using MM, is found less influential in explaining the digital inequality. Although not owning a mobile phone was the major barrier to MM adoption (Jack and Suri, 2011), as the device gap has been closed dramatically, socioeconomic differences of residence, age, income, education, and financial literacy have come to play a major role in influencing and explaining the divide in MM usage.
The observation above, however, is valid within the model. One might wonder if the results vary across diffusion phases and change over time. To this end, we employed logit regression analysis and the results are shown in Table 4.5 and Table 4.6.

Table 4.5: Changes in Explanatory Power of Socioeconomic Factors (1)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Scope</th>
<th>Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acc_formal</td>
<td>Decreasing</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Income_dc</td>
<td>Increasing</td>
<td>Increasing</td>
</tr>
<tr>
<td>Edu_cat</td>
<td>Decreasing</td>
<td>Neutral</td>
</tr>
<tr>
<td>Fin_literacy</td>
<td>Increasing</td>
<td>Increasing</td>
</tr>
<tr>
<td>Residence</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Age_cat</td>
<td>Neutral</td>
<td>Increasing</td>
</tr>
<tr>
<td>MP</td>
<td>Decreasing</td>
<td>Decreasing</td>
</tr>
</tbody>
</table>

Table 4.6: Changes in Explanatory Power of Socioeconomic Factors (2)

Table 4.5 reports standardized coefficients of socioeconomic factors. The results, in general, remain consistent with those of discriminant analysis: The presence of
structural socioeconomic differences. As discussed above, logit regression analysis, 
with standardized coefficients, enables us to examine the changes in explanatory 
power of those socioeconomic factors. Table 4.6 summarizes the changing trend 
regarding each dimension usage over the diffusion phases.

Taken together, the results of logit regression analysis shows that some gaps remain 
constant, some increase/decrease, and some fluctuate. Factors such as gender, 
household size, and financial exclusion remain constant, and are found not 
influential. The effect of education fluctuates over time, and that of age varies to 
some extent across the dimensions of usage. Yet, regardless of usage dimensions, 
while the impacts of bank account ownership and mobile phone ownership 
somewhat decrease, the influence of income and financial literacy is increasingly 
important in explaining the digital divide in frequency and scope. In particular, 
financial literacy, which does not emerge as an important factor in the early stage, 
becomes the most important one separating heavy and light usage in the later phase. 
Despite the changing nature of the factors, the results consistently point to the 
importance of the same set of socioeconomic factors in explaining the digital divide, 
namely, formal financial inclusion, income, education, financial literacy, residence, 
and age.
Discussion and Conclusion

Over the last decade, mobile money (MM) in Kenya has been applauded as a success story for promoting financial inclusion by providing convenient, secure financial services at an affordable cost via mobile phones. The number of registered MM accounts has outnumbered the Kenyan adult population and the network of transaction agents has been extensively scattered across the country to support the operation and provision of mobile financial services. Despite the remarkable rollout of MM, the usage pattern of MM has received little attention in either the MM or digital divide literatures. To fill the gap, we ask whether a digital divide in MM usage persists. The descriptive analysis shows the presence of digital divide in usage: whereas digital inequality in usage frequency narrows, the digital gap in usage scope persists over time. Then, discriminant analysis revealed that a common set of key socioeconomic factors is influential in explaining the digital divide in frequency, scope, and extent of MM usage. Finally, logit regression analysis showed the complex dynamics in explanatory power of socioeconomic factors over the MM diffusion phases. These findings provide important theoretical and practical implications.

The first noteworthy finding is that the digital divide in MM usage, especially regarding usage scope, persists even when the adoption rate reaches the saturated level. This observation points to the necessity of distinguishing adoption gap from
the gap when studying the digital divide (e.g., Dewan and Riggins, 2005; Pearce and Rice, 2013). An extremely high adoption rate may indicate that the adoption gap has been bridged, but this by no means suggests that the usage gap has narrowed or closed. Although an increasing number of users integrate the services more often into their lives, the majority still stick to basic services, with only a minor portion of users exploring and exploiting advanced financial services. The digital divide in usage scope reflects the recently observed struggle in diffusion of M-Shwari, which provides the advanced savings and loans services based on M-Pesa platform. Despite the success of M-Pesa, diffusion of M-Shwari is rather limited (Cook and McKay, 2015; Mirzoyants-McKnight and Attfield, 2015). The digital divide, especially the sticky gap in scope of usage, signals persistent differences in awareness, knowledge, and capabilities among users.

Along these lines, another notable finding concerns the structural socioeconomic differences among usage groups. As mentioned above, a number of theoretical perspectives shed light on how socioeconomic differences help explain the digital divide (e.g., the Matthew effect, the usage gap hypothesis). In line with the literature, this essay finds that a set of socioeconomic factors—formal financial inclusion, income, education, financial literacy, residence, and age—consistently separates active users from non-active users. Yet, the current finding provides two additional insights into our understanding of the structural socioeconomic differences in a particular context (e.g., van Dijk and Hacker, 2003; van Dijk, 2005). On the one hand,
socioeconomic disparities appear to be deeply "solidified" in society, because they remain influential in explaining the digital divide in MM usage even when adoption is nearly universal. On the other hand, the socioeconomic disparities tend to be "sticky," because the same set of socioeconomic dimensions invariably discriminate active users from the rest, regardless of whether the digital divide is analyzed in terms of frequency, scope, or extent, and regardless of diffusion phases.

Given these structural socioeconomic differences, it is very unlikely that the users on the “better side” of the gap will stop increasing their lead and lean backward, or that those on the “worse side” will catch up to narrow the gap. As MM advances with the provision of more complicated financial services requiring a higher level of digital skills and financial literacy, the digital divide is likely to persist and even expand over time (van Dijk, 2013). If the digital divide in usage is left unattended, a series of unintended consequences may occur. The ever-evolving mobile financial services might polarize the usage landscape. Whereas the active users may get more active by leveraging advanced financial services more frequently, the dormant users are likely to remain inactive, lag behind, or even become further marginalized.

What’s worse, one may anticipate a digital divide in outcomes (Witte and Mannon, 2010; Wei et al., 2011), i.e., the stark differences in household income and welfare that are partly attributable to the polarized patterns of financial services usage. At the aggregate level, the likely unintended consequence is the “MM Paradox”: although the MM adoption and usage level is remarkable, the progress in financial
inclusion, social inclusion, and inclusive socioeconomic development remains stagnant.

In combating the digital divide and the potential MM paradox, the present findings call for theorizing about how and why the digital divide in usage persists. Earlier theoretical lenses provide insights by highlighting the structural socioeconomic differences as the fundamental causes. However, it appears that we know little about the mechanisms by which socioeconomic differences lead to the resistant divide. In particular, one common limitation of those perspectives is concerned with the tendency to gloss over the relations between users and ICTs. One of the promising theoretical remedies in this regard is the theory of technology affordances (e.g., Markus and Silver, 2008), which considers emergent action potentials arising in the relations between users’ purposes and capabilities and the properties of ICTs. Such theorization could help us understand better how and why the digital divide is reproduced over time and provide knowledge for policy interventions.

In practice, the current findings have two important implications. First, the authorities and stakeholders of financial inclusion need to be aware of multidimensionality of the digital divide, and accordingly, draw clear conceptual demarcations between adoption and the usage divide. It would be rash to take for granted that a high MM penetration rate necessarily means the reduced digital inequality in usage. Given the widespread adoption of MM, it may be time for policy
makers to shift the focus from promoting adoption toward narrowing the usage gap. Second, the fundamental task of the government will be to prevent the structural inequality in usage from becoming more intense. Among the common set of solidified and sticky socioeconomic factors, most of them can hardly be changed in the short run. But, we still stand a chance to turn the table around. For example, authorities along with service providers can establish a series of facilitating programs (e.g., financial literacy, training) specifically targeting non-active users, with the aim of narrowing the usage gap and ultimately the gap in the socioeconomic outcomes.

In conclusion, this essay makes the case that even when the mobile money adoption rate approaches the saturation level, the digital divide in mobile money usage persists and plays out as a dynamic and complex social phenomenon. Furthermore, the socioeconomic differences that explain the divide are found to be deeply solidified and sticky, regardless of adoption rates, diffusion phases, or usage dimensions analyzed. Although these findings may appear to be discouraging, they suggest promising interventions for closing the digital divide and deepening (not just widening) financial and social inclusion. Mobile money may be a necessary condition for those desirable outcomes, but it cannot succeed on its own: it has to be effectively used!
CHAPTER V. DISCUSSION AND CONCLUSION

Digital innovation has been increasingly argued to hold the potential to transform existing sociotechnical practices, processes, and structures (e.g., Tilson et al., 2010; Yoo et al., 2012; Lucas et al., 2013). However, the emerging digital innovation literature is limited due to its predominant focus on the usage and consequences of digital innovation in organizational settings (e.g., Lucas et al., 2013). Moreover, the transformative potential of digital innovation in developing countries context has been weakly examined (e.g., Nielsen, 2017). To fill this research gap and facilitate our understanding of societal-level digital transformation, this dissertation investigates the research question: \textit{How and why does digital innovation lead to socioeconomic transformation, when it does?}

To tackle the research question, this dissertation proposed a multilevel theoretical framework, building on the digital innovation and technological transition literatures. The proposed theory attempted to illustrate how and why digital innovation enables socioeconomic transformation at the micro, meso, and macro level. The validity of the proposed theory was examined in the empirical domain of Mobile Money (MM) in Sub-Saharan Africa, the context in which the transformative impacts of digital innovation are theoretically plausible and empirically observable because of the sociotechnical features of MM. Three empirical studies were
conducted to investigate socioeconomic transformation enabled by MM at multiple levels.

This dissertation makes significant contribution to the literature in two ways. In theory, the overall findings not only point to the transformative role of digital innovations beyond organizational settings, but also demonstrate the plausibility of using the proposed theory to examine digital innovation and the resulting socioeconomic transformation at the societal level. As for the subject matter, the findings of three essays systematically documented socioeconomic benefits and challenges of MM at multiple levels and therefore advanced our understanding of the emerging digital transformation phenomenon. In the following sections, I discuss major findings, theoretical implications, and contributions of each essay. At the end, this chapter closes with discussion of future research.

**Major Findings and Theoretical Implications**

Guided by the proposed theoretical framework (see Figure 5.1), three essays were designed and conducted with mixed research methods across multiple levels of analysis. In particular, *Essay 1* aimed to document socioeconomic benefits of MM at the micro, meso, and macro level; *Essay 2* hypothesized and tested whether MM, when adopted on a massive scale, contributes to socioeconomic development; and *Essay 3* zoomed into the MM phenomenon and attempted to unpack MM usage by
focusing on the digital divide issue. As shown in Figure 5.1, the overall findings provide empirical evidence that fits into the proposed theoretical framework, which justifies the validity and plausibility of the theory.

Figure 5.1: MM and Socioeconomic Transformation in Sub-Saharan Africa

**Essay 1: Socioeconomic Impacts of Mobile Money**

The first essay was dedicated to systematically synthesizing socioeconomic benefits enabled by MM in Sub-Saharan Africa. The analysis of 63 academic empirical studies showed that countries, in which MM has been widely used, witnessed the transformation of household financial behaviors (i.e., money transfer and storage) and a variety of socioeconomic benefits at multiple levels. First, households,
especially those who were financially excluded, are now afforded the ability to smooth a range of negative shocks, improve disposable income and consumption level, especially food expenditure, and grow their family businesses. Second, the availability of MM enables MSEs (Micro and Small-sized Enterprises) to reduce transaction costs, secure financial transactions, and improve liquidity and working capital capability. Increased operational efficiency was found to contribute to MSEs performance.

In addition, the findings showed that MM, once widely used in a community, generates aggregate socioeconomic benefits such as capital accumulation and favorable business environment, which stimulates local economic expansion and community development. At the macro level, widespread use of MM in a society contributes to financial sector development by promoting financial inclusion and financial deepening. Finally, this essay documented the macro-socioeconomic implications of MM such as economic growth, poverty reduction, and human capital improvement. Taken together, Essay 1 concluded that MM, when widely used in a country of Sub-Saharan Africa, can serve as a transformative digital engine for socioeconomic development.

These findings provide several theoretical implications. First, according to the proposed theory, we expect to observe socioeconomic impacts at multiple levels when digital innovation is widely used in a society. This belief is confirmed by the socioeconomic benefits of MM documented at the micro, meso, and macro level.
Second, the findings suggest that socioeconomic benefits achieved at multiple levels interrelate, build upon, and reinforce each other, which together precipitate socioeconomic development over time. For example, the universal use of MM by households not only improves household welfare, but results in a number of enabling conditions that ignite long-term socioeconomic development. The household beneficiaries are able to invest in education, leading to improved human capital and supply of quality labor. Also, the widespread use of MM establishes the enabling business environment that makes it possible for MSEs to incorporate MM into financial transactions and grow their businesses, which has positive repercussions for production and consumption, job creation, and income generation among others.

Finally and related to the above point, the findings point to the dual natures of causal mechanisms associated with digital innovation: multidimensionality and multilevel. On the one hand, under certain circumstances different causal mechanisms could be triggered at a particular level, i.e., sharing risk and improving family businesses at the household level. On the other hand, mechanisms across multiple levels are not independent of each other; rather, they seem to be intertwined with each other as discussed above, i.e., transformation of micro-level mechanisms into the macro-level one. Regretfully, this essay did not explicitly theorize those mechanisms and their dynamic relationships. However, the findings provide suggestive evidence that warrants future research in this regard.
Essay 2: Macroeconomic Impacts of Mobile Money

The second essay zoomed out from the MM-enabled digital transformation and examines the cross-country macroeconomic implications of MM in Sub-Saharan Africa. Drawing on the theory of affordances, I argued that the affordances of MM, once realized on a massive scale, generate not only immediate socioeconomic benefits, but the conditions for subsequent affordances that are likely to be triggered and actualized, which produces far-reaching socioeconomic impacts at a higher level. Results of Difference-in-Differences analysis showed that MM, when widely adopted, has a positive effect on a country’s economic growth, rather than being a consequence of it. Additional analysis revealed that the positive effect increases as MM spreads into a society over time. This implies that the universal use of MM serves as an engine for socioeconomic development in Sub-Saharan Africa.

These findings not only justify the proposed theory in the order of micro to macro level, but offer theoretical implications for future research in the reversed order of macro to micro level. First, the proposed theory posits that widespread use of a digital innovation generates socioeconomic impacts at lower levels, which contribute to the aggregate impact at the macro level over time. As a result, the massive use of a digital innovation is conjectured to be positively associated with macro-level socioeconomic indicators. The current findings lend strong support to this micro-to-macro level conjecture, justifying the validity of the proposed theory.
Moreover, the macro-level findings of this essay inform future research on MM in Sub-Saharan Africa at the micro level. As discussed in Essay 1, the emerging MM literature mainly documented socioeconomic benefits at the macro level in few countries such as Kenya and Uganda. The important question left unanswered is whether the macro-socioeconomic implications of MM are generalizable to other countries such as Rwanda, Zambia, and Zimbabwe, where MM is widely used. The cross-country evidence established here points to the macro-level impacts of MM even though the socioeconomic benefits at lower levels have been weakly documented. Therefore, the current findings construct the fundamental building block for future inquiries into the socioeconomic benefits of MM and the associated causal mechanisms at lower levels in countries that received little scholar attention so far.

**Essay 3: Mobile Money Usage**

The third essay zoomed into the MM-enabled digital transformation by investigating the digital divide in MM usage in Kenya. This essay started with the intuition that whereas the widespread MM adoption might suggest the closure of the digital divide among the “haves” and “not-haves”, universal access does not necessarily mean that the gap in usage is narrowed among different population segments. In other words, even if the gap in adoption is closed, the digital divide might still exist in usage (e.g., breadth of services used). In support of the conjecture, the findings showed that whereas the digital divide in usage frequency has decreased over time, the gap in
the usage scope persists. Moreover, this essay found that structural socioeconomic differences invariably separate active users from non-active users, regardless of the divide being analyzed in terms of frequency or scope, and regardless of diffusion phases. Moreover, this essay suggested the dynamics in the structural socioeconomic differences over diffusion phases; that is, whereas in the earlier diffusion phase bank account and mobile phone ownership are the most influential factors, in the later phase other factors—income, education, financial literacy, and age—emerge to separate different usage groups.

The findings of the third essay imply that potential unintended consequences might be an important dimension of socioeconomic transformation. In developing countries context, digital innovations hold the potential to serve marginalized groups by affording them the ability to leapfrog traditional constraints and obtain previously inaccessible socioeconomic resources. However, achievement of this inclusive impact requires not only adoption but effective usage of a digital innovation by the target users. Given the structural differences in socioeconomic resources and capabilities between the rich and the poor, it is likely that an emerging digital innovation might become another source of social inequality, i.e., unequal distribution of social resources and life chances, which may further discriminate the bottom of the pyramid from the mainstream development.

As shown in the third essay, the MM adoption gap decreases over time, yet the digital inequality in MM usage persists mainly due to socioeconomic differences that
are deeply solidified among population segments. This might further result in a divide in the socioeconomic benefits reaped by the rich and the poor. Hence, the current findings raise an important theoretical query: *Do digital innovations provide for, or divide, the populations of developing countries?* Although digital innovations tend to be overwhelmingly perceived and framed as having positive socioeconomic repercussions, the findings redirect our attention toward the potential dark side of digital innovations that can occur even when we are enjoying the bright side.

**Contributions**

Despite being rooted in the digital innovation literature, this dissertation is an interdisciplinary project investigating multiple dimensions of digital innovation and the resulting socioeconomic transformation in the context of MM in Sub-Saharan Africa. As summarized in Table 5.1, the overall findings contribute to the following literatures: digital innovation, mobile money, digital divide, and finance and growth. Next I turn to each.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Contributions</th>
<th>Essays</th>
</tr>
</thead>
</table>
| **Digital Innovation**   | • Proposes a multilevel theoretical framework of digital innovation and socioeconomic transformation
• Provides empirical evidence justifying validity of the framework in the context of MM in Sub-Saharan Africa
• Demonstrates transformative role of digital innovation at the | Essay 1, Essay 2 |
Mobile Money
- Systematically documents socioeconomic benefits of MM at multiple levels
- Identifies multiple research gaps and proposes future research directions
- Establishes a positive association between widespread use of MM and socioeconomic development in the cross-country context, suggesting a casual relationship from MM to socioeconomic development
- Investigates MM as possibly contributing to the digital divide that has been under-scrutinized

Digital Divide
- Extends the traditional view of the digital divide that is limited to adoption, and examines digital inequality in usage in a context where adoption approaches saturation level
- Identifies structural socioeconomic differences that are sticky and deeply solidified in society

Finance and Growth
- Demonstrates that financial innovation achieved outside the sphere of traditional financial institutions, i.e., MM, can equally enable socioeconomic development

Digital Innovation

The central tenet of the digital innovation literature is that digital innovation has the potential to lead to socioeconomic transformation. However, the transformative role of digital innovation is mainly studied in the organizational field and therefore socioeconomic transformation at the societal level, especially in developing countries context, has received little scholarly attention. This dissertation therefore makes signification contribution to the literature by proposing a multilevel
framework illustrating how and why digital innovation leads to societal-level transformation. In particular, Essay 1 (Socioeconomic Impacts of Mobile Money) systematically documents socioeconomic benefits of MM at multiple levels, which supports the proposition that socioeconomic transformation is precipitated over time through a multilevel, cumulative, and spiral process in which socioeconomic benefits afforded by a digital innovation at the micro, meso, and macro level interact, build on, and reinforce each other.

In addition, the cross-country empirical evidence established in Essay 2 (Macroeconomic Impact of Mobile Money) suggests that the proposed framework has generalizable explanatory power without being specific to a particular country. Findings of Essay 2 confirm the generalizability of the framework by showing that digital innovation, when widely used in a society, is associated with macro-level socioeconomic indicators even though socioeconomic benefits at the micro and meso level have been weakly documented. Taken together, findings of Essay 1 and Essay 2 contribute to the digital innovation literature by justifying validity and plausibility of the proposed framework, which can be applied in future research guiding theoretical and empirical exploration of other digital transformation phenomena.
Mobile Money

As an emerging phenomenon, research on MM is still in its infancy and our understanding of the phenomenon is far from being organized or comprehensive. Against this backdrop, findings of this dissertation contribute to the MM literature in several ways. First, Essay 1 (*Socioeconomic Impacts of Mobile Money*), to the best of my knowledge, is the first systematic literature review documenting and synthesizing socioeconomic benefits enabled by MM at the micro, meso, and macro level. Also, the systematic scan of the literature reveals multiple research gaps and proposes future research directions. Second, Essay 2 (*Macroeconomic Impact of Mobile Money*) establishes the positive association between widespread use of MM and socioeconomic development in the cross-country context, providing suggestive evidence for the causal effects of MM in Sub-Saharan Africa. Finally, Essay 3 (*Mobile Money Usage*) is the first scholarly effort investigating the digital divide issue regarding MM. In particular, the findings about structural socioeconomic differences call attention to the potential unintended consequences of MM.

Digital Divide

Extending the traditional digital divide perspective focused on adoption, the findings of Essay 3 (*Mobile Money Usage*) update our understanding of the dynamics of digital divide in usage and the associated socioeconomic differences. The major contribution of Essay 3 lies in the research setting—the universal MM adoption in
Kenya—which distinguishes this essay from prior digital divide studies. This peculiar research setting allows for examination of the influence of socioeconomic differences, regardless of the influence in adoption among segments of population. That is, whereas previous studies have implicitly attributed the divide in usage to the entangled factors of both the adoption gap and socioeconomic differences, the current research setting—nearly saturated adoption level—enables us study whether socioeconomic differences are still vital in explaining the usage gap by controlling for the adoption gap. Therefore, the findings of Essay 3 contributes to the digital divide literature by showing the persistence of digital inequality in MM usage and the sticky socioeconomic differences that persist even when MM adoption approaches the saturation level.

**Finance and Growth**

In the finance and growth literature, the major focus has been given to the growth impact of formal financial development, i.e., expansion of bank branches and ATMs, growth of deposit and loan accounts, etc. However, the findings of Essay 2 (*Macroeconomic Impact of Mobile Money*) offer strong empirical evidence that financial innovation achieved outside the sphere of traditional financial institutions, i.e., MM, can equally contribute to socioeconomic development in Sub-Saharan African countries where formal financial infrastructure remains underdeveloped.
Future Research

As the starting point to achieve my career goal of developing a theoretical framework addressing the link between digital innovation and socioeconomic transformation, this dissertation proposes a primitive multilevel framework and uses three essays to test its validity. However, more research is needed to refine the framework and extend its generalizability. To that end, my short-run research plan is to dig deeper into the proposed theory in the context of MM.

First, the major limitation of this dissertation is concerned with the failure to explicitly theorize the causal mechanisms and processes by which MM leads to socioeconomic transformation in Sub-Saharan Africa. In this spirit, I plan to develop a conceptual paper, based on Essay 1 (*Socioeconomic Impacts of Mobile Money*), to identify the associated causal mechanisms and transformation of those mechanisms across multiple levels, as Markus and Rowe (2018) suggested. Second, although context is proposed as an indispensible dimension of the theoretical framework, this dissertation does not shed light on that issue. Studying context is of extreme importance in both theory and practice because (de)activation mechanisms, how they play out, and the way different mechanisms interact might be contingent on contextual factors. In this regard, I would like to conduct a comparative study of MM in different countries to develop a contextual explanation of the MM phenomenon.
Third, the current MM literature overlooks an important user group—government and entrepreneurs in public and private sector—who can apply MM to ignite the next wave of driving force. MM affords authorities and entrepreneurs the opportunity to create digital business models that circumvent traditional time-space constraints and deliver digitalized services to the marginalized group in a convenient and affordable way. In exploring such entrepreneurship opportunities unleashed by MM, I plan to include a case study research in my future research pipeline. Last but not least, I am also interested in examining the policy implications of disruptive MM services in society.

In the long run, I would like to extend my research toward other digital innovations in the financial services industry, especially the financial technology innovations driven by business analytics. For instance, application of the disruptive blockchain technology in microfinance mortgage industry and face recognition technology in auto-finance industry are of great interest to me. It is expected that research on various types of digital innovations across different research settings at multiple levels would put me in a position to develop a rigorous theoretical framework explaining how and why digital innovation enables socioeconomic transformation, when it does, which will help us better prepare for the increasingly digitalized society.
Concluding Remarks

This dissertation focuses on digital innovation and socioeconomic transformation by examining MM and its transformative role in Sub-Saharan Africa. Whereas some dimensions of the digital transformation are answered (e.g., socioeconomic benefits at multiple levels, the digital divide, macroeconomic implications), new questions are raised and remain to be addressed (e.g., social mechanisms, digital entrepreneurship). Like the convergence and generative nature of digital innovation, the research on digital transformation requires bringing together perspectives from multiple disciplines and exploring the multidimensionality of the resulting transformation in a divergent manner. As such, this dissertation covering a wide range of disciplines (e.g., information systems, finance, and digital divide) provides a good foundation for future research that tackle the theoretical and empirical links between digital innovation and socioeconomic transformation.
# APPENDIX

Table A.1: Select Studies on Digital Innovation in Organizational Settings

<table>
<thead>
<tr>
<th>Studies</th>
<th>Digital Innovation in Context</th>
<th>Research Method</th>
<th>Theory/Literature</th>
<th>Major Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra-organizational impact</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kranasios &amp; Allen (2014)</td>
<td>Mobile technology in police force</td>
<td>Case study</td>
<td>Activity theory</td>
<td>Showed several ways in which mobile technology has changed the nature (e.g., norms, patterns) of mobile work activity. The change was through dialectic interaction between mobile technology and policing activities</td>
</tr>
<tr>
<td>Dery et al. (2014)</td>
<td>Smart phone use in a global financial services firm</td>
<td>Case study</td>
<td>Structuration theory</td>
<td>Mobile communication technology practices have changed the way users manage connectivity across work and non-work</td>
</tr>
<tr>
<td>Barrett et al. (2012)</td>
<td>Robotic innovations in two pharmacy units</td>
<td>Field study</td>
<td>Mangle of practice</td>
<td>Engagement with the robot’s hybrid and dynamic materiality over time reconfigured boundary relations among the three occupational groups</td>
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<td>Beane &amp; Orlikowski (2015)</td>
<td>Robotic telepresence in a hospital</td>
<td>Field study</td>
<td>Sociomateriality, coordination of distributed work</td>
<td>The use of robotic telepresence intensified outcomes of coordination work both positively and negatively, resulting in contrary implications for subsequent coordination of work</td>
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<td>Dougherty &amp; Dunne (2012)</td>
<td>Digital technologies in drug discovery</td>
<td>Interview</td>
<td>Epistemic cultures, knowing in practice</td>
<td>Digitalization created new knowledge boundaries concerning fault line between two occupational groups in complex drug innovation</td>
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<td>Kallinikos (2013b)</td>
<td>Computing technologies in cultural memory organizations (e.g., libraries, museums)</td>
<td>Conceptual</td>
<td>Institutional analysis of technology, constructions of social reality</td>
<td>The operations of cultural memory organizations increasingly mingle with computing technologies, reframing longstanding professional practices</td>
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<td><strong>Inter-organizational impact</strong></td>
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<td>Leonardi &amp; Bailey (2008)</td>
<td>A suite of technologies for engineering artifacts in an automobile manufacture and contractors</td>
<td>Mixed methods (survey and case study)</td>
<td>IT outsourcing, knowledge transfer A set of new work practices was developed to address knowledge transfer challenges posed by digital technologies across home sites and offshore sites</td>
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<td>Lee &amp; Berente (2012)</td>
<td>Digital emission control systems in automobile industry</td>
<td>Regression analysis</td>
<td>Dominant design, modularity As opposed to the arguments of received innovation literature, they found in the context of digital control systems OEMs focused on component innovations while suppliers increased architectural innovation activities</td>
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<td>Boland et al. (2007)</td>
<td>3-D technology in architecture, engineering and construction</td>
<td>Case study/field study</td>
<td>Path creation, trading zones, intercalation of innovations Adoption of digital innovation by focal firm engendered multiple innovations in technologies, work practices, and knowledge across multiple communities</td>
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<td>Selander et al. (2010)</td>
<td>Digital innovations in mobile device industry</td>
<td>Case study/field study</td>
<td>Open innovation, innovation ecosystems, competing values theory The process of ecosystem relationships transformation was featured by ongoing tensions among competing values by varied group of players</td>
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<td>Lyytinen et al. (2015)</td>
<td>N/A</td>
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<td>Digital innovation, networks of innovation Four types of emerging innovation networks supported by digitalization were distinguished: 1) project innovation networks; 2) clan innovation networks; 3) federated innovation networks; and 4) anarchic innovation networks. They also proposed five novel properties of digital infrastructures in supporting each type of innovation network</td>
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<td>Scott &amp; Orlikowski (2012)</td>
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<td>Akesson (2009)</td>
<td>Digital innovation in newspaper industry</td>
<td>Mixed methods</td>
<td>Ubiquitous information environment, value networks Digital innovation triggers changes in value, value networks and business models in newspaper industry</td>
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<td>Journal of Development</td>
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Note: MSEs = Micro and Small Enterprises; Quant = Quantitative; Primary = Primary Study; Secondary = Secondary Study; Cross-country = Cross-country Study; Country = Country Study; Qual = Qualitative; Community = Community Study; Household = Household Study; Household/ = Household/Study; Kenya, Uganda, Malawi, Zambia = Kenya, Uganda, Malawi, Zambia Study; Tanzania = Tanzania Study.
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REFERENCES

CHAPTER I


CHAPTER II


CHAPTER III


CHAPTER IV


CHAPTER V


VITA

Wenxiu (Vince) Nan attended Longjing High School in Jilin Province, China. He graduated from Beijing Normal University in Beijing, China with a Bachelor Degree in Management in 2009. Vince earned his Master Degree in Management from Beijing Normal University in 2012. In August 2013, he entered the PhD Program at Bentley University.

Permanent Address: 175 Forest Street, Waltham, MA 02452

This manuscript was typed by the author, Wenxiu (Vince) Nan.