EVANS SCHOOL OF PUBLIC POLICY AND GOVERNANCE
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Evans School Policy Analysis and Research (EPAR)

Review of Interoperability and Regulations of Mobile Money
EPAR Request No. 313

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Prepared for the DFS Interoperability Working Group of the ITU Focus Group on Digital Financial Services
September 8, 2015

Abstract

We review the literature on the status of interoperable payment schemes and regulations for financial services (particularly mobile money) in 46 developing countries, and identify examples of countries with interoperable mobile money schemes and/or regulations pertaining to mobile money and/or interoperability. Following a brief introduction to mobile money and interoperability, we present an overview of the status of mobile money in the 46 selected countries. We then review country regulations regarding both mobile money and payment systems as well as the form of these regulations (National Payment Law or Strategy, regulations, guidelines, etc.) for each country. We further discuss mobile money regulations, specifically regulations that pertain to bank-based versus non-bank based mobile money schemes, regulatory safeguards, and agent banking. In the final section we review regulations pertaining to interoperable mobile money services and outline where such regulations have been documented, highlighting countries with interoperable mobile money markets.

Key Findings:
- Thirty-three of the 46 developing countries reviewed have some form of regulation that covers mobile money.
- Twenty-four of 33 countries' regulations currently permit "non-bank" models of operation for mobile money.
- Twenty-one countries have mobile money schemes that are interoperable in some form, and 18 have specific regulations regarding interoperability and mobile money.
- Six of the 18 countries that address interoperability in their mobile money regulations do not have interoperable mobile money markets.

1. Introduction

For many of the world's poor, a number of obstacles limit access to finance and financial networks. Physical barriers, like large distances to banks or ATMs, make participation costly, especially for rural populations. Lack of documentation and high associated costs are other commonly cited barriers that may contribute to high unbanked populations in low-income countries (World Bank, 2008a). Digital banking and mobile phone financial applications are increasingly being proposed by regulators as a potential approach to overcome such barriers and increase financial inclusion. Nearly 45 percent of the developing world's population now has access to mobile phone accounts, presenting an opportunity to reach the unbanked (Scharwatt, Katakam, Frydrych, et al., 2015). Radcliffe & Voorhies (2012) argue that connectivity is the first step on the pathway to financial inclusion. They contend that connectivity is a prerequisite to services that leverage mobile phone platforms to offer digital remote payments, and eventually a full range of financial services like savings, credit, and

insurance. In many regions the process of moving from basic connectivity to digital payments is already underway: at the end of 2014, mobile money services were operational in 89 markets around the world. Sixty percent of these markets are in developing countries (Scharwatt et al., 2015).

Still, while *access* to mobile money services is proliferating, *uptake* within countries is far more varied. In countries like Kenya, Tanzania, and Uganda, there are now as many, or nearly as many, registered mobile money users as there are members of the adult population. But in other countries like Bangladesh, Pakistan, and the Philippines—all of which launched mobile money services six or more years ago—registered mobile money users as a percentage of the adult population remain below 15 percent (Evans & Pirchio, 2015). Low or slow uptake represents a roadblock on the theorized pathway to digital financial inclusion. This challenge has led researchers to seek to understand underlying conditions that can propel or stymie mobile money schemes.

One commonly cited factor influencing the emergence and uptake of digital financial services is regulation. Flexible, open financial regulatory frameworks can enable innovation and allow multiple business models to operate in the provision of mobile financial services (Financial Access Initiative, 2012). Conversations around "flexible" regulations for mobile money schemes typically center on whether a country's regulations allow non-banks to provide mobile financial services, meaning that entities such as mobile network operators (MNO) can "lead" schemes. A non-bank-based model is defined as "a mobile financial services business model (bank-based or nonbank-based) in which (i) the customer has a contractual relationship with a non-bank financial service provider and (ii) the non-bank is licensed or otherwise permitted by the regulator to provide the financial service" (Alliance for Financial Inclusion, 2012, p. 4). One study found higher growth rates for mobile money schemes to be correlated with regulatory operational models that allow *both* non-banks and banks to lead services (Evans & Pirchio, 2015). In addition, regulations concerning the use of third parties to provide digital financial services may also enable mobile money schemes' growth. Mobile money schemes facilitate the electronic transfer and storage of money, but many cash-oriented markets require physical currency. Large third party agent networks serve as "cash-in" and "cash-out" points for mobile money schemes. Thus, the extent to which countries regulate who can be a third party agent and what services they can provide can affect costs for operators and their ability to scale agent deployment (Breloff & Tarazi, 2011).

As conversations around regulation mature, questions around the interoperability of mobile money schemes have also become increasingly important. Interoperability "enables users to make electronic payment transactions with any other user in a convenient, affordable, fast, seamless and secure way via a single transaction account" (ITU Focus Group on Digital Financial Services, 2015). In practice, interoperability has meant different things in different countries. Mobile Network Operators (MNOs) in Indonesia, Pakistan, Sri Lanka, and Tanzania, for instance, have entered into contracts that allow users of their respective mobile money schemes to transfer funds across mobile wallets, mobile money accounts, and bank accounts, but this type of agreement has not been brokered elsewhere (Scharwatt et al., 2015). Other countries, like Malawi, have established national switches through which payments can be routed to any financial institution or MNO (Bankable Frontier Associates, 2015). Finally, many countries achieve a semblance of interoperability by making agent networks interoperable. In this case, users of different mobile money schemes cannot directly send money to each other electronically. Instead, an electronic voucher is generated when one user sends money to another across different networks. The recipient must then take this voucher to "be cashed out at an agent in the sender's network" (Camner, 2013).

Whether interoperability exists and how it is regulated matter because of the costs and benefits to customers and businesses. Customers are expected to benefit from interoperability through lower prices and expanding network access. A 2012 CGAP report argues that "interoperability can reduce costs through greater efficiency of infrastructure deployment and may also increase competition between providers in ways which results in cost saving being passed on to customers" (p. 2). In theory, interoperability can also increase consumer demand for and adoption of mobile money services (Buckley and Malady, 2015). This increase in demand occurs through the "network effect," whereby services become more useful to individuals as the size of a network grows because users can "send and receive money to and from a larger range of counterparties" (Financial Access Initiative, 2012, p. 2). As the perceived benefits of using the service grow, more

individuals join.

Still, in some cases private sector interests can be opposed to interoperability. Large MNOs with extensive infrastructure and upfront investment in mobile money networks have little incentive to interoperate with smaller MNOs if they have cornered the market. Established, dominant MNOs are particularly wary of regulation that may obviate their competitive advantage (Kumar & Tarazi, 2012b). In addition, there are related issues with timing. While "businesses typically expect to interoperate their systems eventually [they] don't want to do it without recouping the substantial investments they have made into developing services and related infrastructure" (*ibid.*, p. 1). Interoperability can also go against operating business models. Many MNOs add mobile money schemes to their catalog of offered services as a way to encourage customer "stickiness." Interoperating systems removes an incentive for a customer to remain with a particular provider. Mandating interoperability through regulation has thus been argued to destabilize existing markets and even reduce incentives for companies to launch new mobile money operations (Financial Access Initiative, 2012).

Given the impact that regulation and interoperability can have on developing mobile money markets and consequently on financial inclusion, we undertake a literature review that focuses on these topics in 46 countries across Latin America, Sub-Saharan Africa, and South and Southeast Asia. The objectives of this report are to review the status of mobile money schemes and existing regulations in developing countries, and to ascertain what level of interoperability is in place for existing schemes.

The literature review addresses two core questions:

1. *Regulations on mobile money and interoperability*: What are examples of countries with regulations for mobile money and/or financial interoperability, and where and how are those regulations formalized?
2. *Interoperability for mobile money*: What are examples of countries in which different mobile money schemes in the same country have established or are in the process of establishing interoperability?

Section 2 of this report outlines our search methodology. In Section 3, we examine the current status of mobile money schemes across 46 countries. Section 4 provides an overview of the basic characteristics of mobile money regulation in each country, including observations of whether non-bank based models of operation are allowed. Section 5 examines interoperability regulations and types of interoperability found across the 46 reviewed countries. It further examines whether regulations for interoperability coincide with the actual implementation of interoperable mobile money systems.

2. Methodology

Our literature search aimed to identify regulations governing relevant digital financial service schemes in developing countries, and to find information on the interoperability of these schemes. We used the following search strings to identify relevant articles and websites:

- Interoperability: interoperability AND (payment OR "mobile money" OR "digital finance")
- National Payment Systems: ("national payment" OR "national payments") AND (system OR law)
- Regulations: regulation AND ("mobile money" OR interoperability) AND (payment OR transaction)

Using these search strings, we conducted searches of the academic literature using Scopus and Google Scholar. In addition, we applied these search strings to multiple websites that focus on financial inclusion and regulations, including the Consultative Group to Assist the Poor (CGAP), World Bank, Finmark, Better than Cash, Alliance for Financial Inclusion, and Bank for International Settlement. Lastly, we entered our search strings into Google for a broad search of relevant websites and documents. We screened the first 100 results for each of our searches. Results selected for review were limited to full-text English documents that described payment schemes or digital financial services in developing countries in Sub-Saharan Africa, Latin America, or South or Southeast Asia, and were published after 2005.

Our initial search yielded 229 unique articles and webpages that appeared to be relevant from the title and abstract. Of these 229 articles, 178 were country- or region- specific, 14 were global in scope, and 37 were non-country specific with useful background information on interoperability and digital financial services or on national payment schemes. The documents included specific information on payment schemes and regulations in 46 developing countries. We conducted a supplemental search on each of these countries' central bank websites for primary documents on payment system laws and

strategies as well as regulations on digital financial services. This search yielded 40 additional relevant documents. We also conducted supplementary searches using Google to answer any questions from the review framework that were not addressed for particular countries. In particular we conducted supplementary searches for recent evidence regarding mobile penetration rates and number of registered users for mobile money services. Terms we used for supplementary searches included: the specific name of a country, mobile money, regulation, law, interoperability, penetration, registered, and users. *Appendix 1* includes a summary of the body of evidence reviewed by country, including key sources of information.

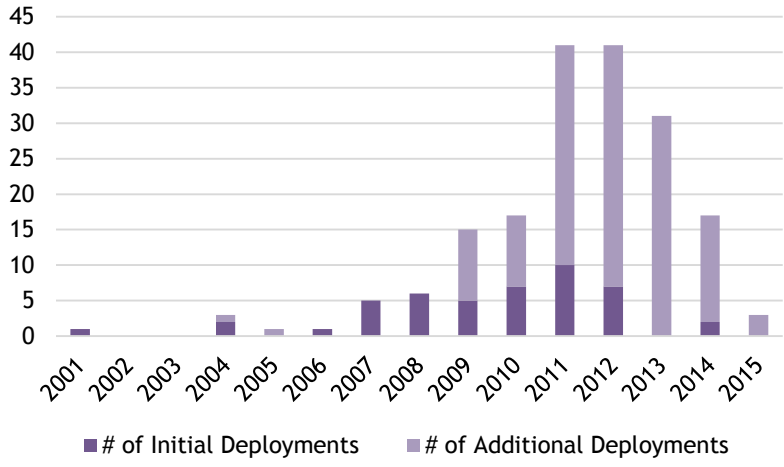
After identifying and retrieving relevant documents for review, we developed a review framework to organize the information from the documents and to code the evidence into a spreadsheet for analysis. The framework (included in *Appendix 2*), captures information on mobile money services, regulations for different payment schemes, and interoperability. For each question in the review framework, we developed categorical responses in order to facilitate comparative analysis. The resulting spreadsheet includes one line for each country identified in our initial search, summarizing evidence from all documents with information on that country. In order to capture the most recent information, we prioritized articles for review by date beginning with the most recent documents.

Following the review and coding, we compare – subject to data availability - mobile money systems and policies in these countries. This review summarizes the information included in our results coding spreadsheet, which is included as an attachment along with the report.

3. Mobile Money in Developing Countries

Mobile money was first introduced in the Philippines in 2001, though it took around five years before other developing countries began to deploy similar schemes and nearly a decade before widespread adoption occurred. Mobile money schemes were introduced to at least 10 new markets from 2011 to 2013, with six more launched in 2014 (Scharwatt et al., 2015). *Figure 1* displays the mobile money deployments[1] by year for the countries we review. The introduction of mobile money into new markets (dark purple) occurred at a fairly consistent rate from 2007 to 2013 (5-10 each year). However, an increasing number of additional deployments in already existing markets (light purple) began in 2009, with peak growth from 2011-2013. The relatively low uptake of mobile money systems in 2015 is likely attributable to a lack of up-to-date data. That said, a general slowdown in growth of mobile money services has been observed for the subset of countries that we review, with deployments peaking in 2011-2012.[2]

Figure 1. Mobile Money Deployments by Year



Source: Information from GSMA MMU Deployment Tracker, n.d.

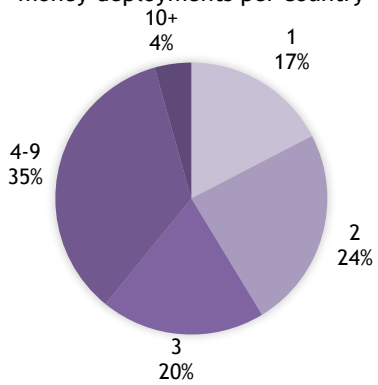
The most recent data indicate that there are 265 live deployments of mobile money schemes and 102 planned deployments worldwide (GSMA, n.d.). The types of services available and number of providers in developing countries has been rapidly increasing as mobile money becomes an established method for banking, transfers, and payments, as well as a tool for

[1] "Deployment" indicates a launched and operational system.
[2] All data collected from GSMA MMU Deployment Tracker. Equitel in Kenya (Hanford, 2015) and the ASBANC ecosystem in Peru (Bourreau & Valletti, 2015) are noted included in this chart.

financial inclusion (Scharwatt et al., 2015). As illustrated in *Figure 2,* the number of mobile money deployments per country varies greatly.[3] A majority of countries we review (59%) have at least three providers offering mobile financial services. A 2015 GSM Association (GSMA) report looks specifically at the number of mobile money services for the unbanked and maps the data by country (*Figure 3).* India and Nigeria have the largest number of deployed mobile money schemes, at 15 and 19 respectively (Evans & Pirchio, 2014).

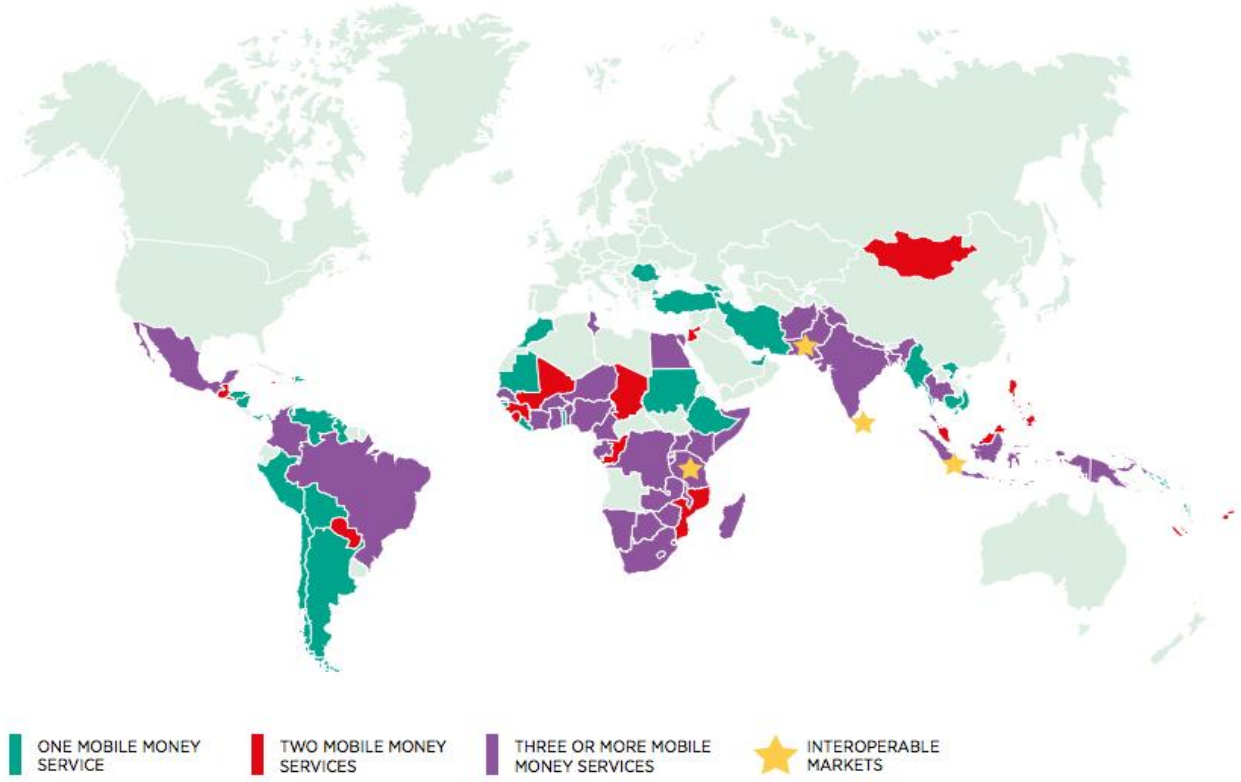
Mobile money services are most often offered by a bank or competing mobile network operator (MNO) as an independent provider. A limited number of "full integration" mobile money initiatives have provided possible alternative models to the dominant individual provider or partnership schemes (Bourreau & Valletti, 2015). We find examples of such initiatives in Peru, Kenya, and Japan. In Peru, the Association of Banks of Peru (ASBANC) launched a national mobile money "ecosystem" open to all banks and telecom operators in 2014 (*ibid.*). The platform, to be developed with the assistance of Ericsson, creates a shared, interoperable platform in which customers can access a range of mobile financial services through the cooperation of both banks and MNOs (Ericsson, 2014). Other "full integration" models include Japan and Kenya where a single operator oversees mobile money services for a large agent network for "vertical integration over the value chain" (Bourreau & Valletti, 2015). However, these models remain relatively uncommon.

Figure 2. Number of mobile money deployments per country



[3] Our method of screening only identified countries with mobile money schemes, reflected in *Figure* 2. Countries with no mobile money deployments are not included in this review.

***Figure 3**. Number of Mobile Money Services for the Unbanked (December 2014)*



Source: Scharwatt et al, 2015.

Evans & Pirchio (2015) study the market shares of MNOs with mobile money deployments to assess the risk of monopolistic tendencies in 22 developing countries.[4] They conclude that it is common for the market share of mobile money captured by an MNO to reflect, to some degree, the market share held for mobile phones. For example, four MNOs operate in Kenya – Safaricom, Airtel, Orange, and Essar – and each deploys a mobile money service. The mobile phone market share distribution is 68% for Safaricom, 16% for Airtel, 7% for Orange, and 8% for Essar, while the related mobile money market shares by the same providers are 71% (M-Pesa), 20% (Airtel Money), 1% (Orange Money), and 8% (Yucash), respectively. The market share is the same for mobile phone and mobile money services within a margin of six percent for each MNO, indicating no monopolistic tendencies. Similar patterns were seen across the other 21 countries studied (Evans & Pirchio, 2015). This conclusion does not consider formal banking institutions and other non-bank actors that deploy mobile money schemes.

3.1 Status of Mobile Money Schemes

A number of factors may influence the speed at which a mobile money scheme grows within a given financial market. However, given that mobile money is a recently adopted method of financial transactions, many markets remain at early stages of development. Evans & Pirchio (2015) estimate the points at which mobile money systems "ignite" by analyzing the evolution of certain indicators such as the active number of users or the number of transactions in developing countries. Ignition is identified in the study by locating the inflection point at which the given indicator suggests a system has reached

[4] Bangladesh, Burkina Faso, Cote d'Ivoire, Democratic Republic of Congo, Ghana, Haiti, India, Indonesia, Kenya, Madagascar, Mexico, Nigeria, Pakistan, Paraguay, Philippines, Rwanda, Somaliland, South Africa, Sri Lanka, Tanzania, Uganda, and Zimbabwe.

critical mass. The study found that while countries can ignite as early as two months after the initial mobile money deployment in a market, most of the countries studied took at least one year and others took upwards of four years to experience accelerated growth. After critical mass is reached in a mobile money system, sustained growth can occur for many years (Evans & Pirchio, 2015).

Six primary indicators useful for comparing the current status of mobile money schemes include: [5]

- Registered Mobile Money Users as a Percent of Mobile Phone Users
- Active Mobile Money Users as a Percent of Mobile Phone Users
- Registered Mobile Money Users as a Percent of Adult Population
- Active Mobile Money Users as a Percent of Adult Population
- Registered Mobile Money Accounts Compared to Bank Accounts
- Total Transactions as a Percent of GDP

Evidence for each of these indicators could not be found for every country we review. For countries with limited information, we incorporate secondary indicators that indicate evidence of a set period of growth or decline in a market, or anecdotal narratives about a country's mobile money system. *Table 1* provides an overview of the information for all primary indicators, except for active mobile money users as a percent of adult population due to limited data availability. The table also includes the date the first mobile money scheme in the country was launched, and the current number of mobile money operators (MMOs). Twenty countries that did not have information for any of the primary indicators were removed from the table. A complete table of both primary and secondary indicators for each country is available in *Appendix 3*.

[5] This list is adapted from Evans & Pirchio's *An Empirical Examination of Why Mobile Money Schemes Ignite in Some Developing Countries but Flounder in Most* (2015).

Table 1. Indicators of Mobile Money Development by Country

Country	Launch of First Mobile Money Scheme[6]	# of MMOs[7]	Registered Mobile Money Users as % of Mobile Phone Users[8]	Active Mobile Money Users as % of Mobile Phone Users[9]	Registered Users as % of the Adult Population[10,11]	Registered Mobile Money Accounts Compared to Bank Accounts[12]	Transactions as % of GDP[13]
Bangladesh	Nov. 2006	9	22.2% (2014)	10.5% (2014)	22.8% (2014)		1.0% (2013)
Cambodia	Dec. 2008	1					5.9%[14] (2013)
Colombia	Feb. 2009	5			7.1%[15 16] (2015)		
DRC	Jan. 2012	4	9.5% (2013)	1.3% (2013)	7.5% (2013)	More mobile money (2013)	0.8% (2013)
Ghana	Apr. 2009	5	19.3% (2014)		35.9% (2014)		
Guinea	Aug. 2012	2				More mobile money (2014)	
Haiti	Oct. 2010	2	9.8% (2013)	0.8% (2015)	10.4% (2013)		
India	Jan. 2007	15		1.0% (2013)			
Indonesia	Nov. 2007	6	7.9% (2013)	1.2% (2011)	14.5% (2013)		
Kenya	Feb. 2007	7	83.7% (2014)	39.9% (2014)	102.2% (2014)	More mobile money (2013)	49.3% (2013)
Lesotho	Feb. 2011	3				More mobile money (2014)	
Madagascar	May 2010	3	20.6% (2013)	1.7% (2013)	12.9% (2013)	More mobile money (2013)	
Mexico	Mar. 2012	3	2.6% (2013)		3.4% (2013)		
Nigeria	Jan. 2011	19	5.4% (2013)	0.3% (2013)	7.5% (2013)		
Pakistan	Sept. 2009	7	3.3% (2014)	1.5% (2014)	3.7% (2014)		5.1% (2013)
Paraguay	Jan. 2008	2		0.9% (2012)		More mobile money (2014)	
Philippines	Sept. 2004	2	7.8% (2013)	5.2% (2013)	13.2% (2013)		2.0% (2009)
Rwanda	Jan. 2010	6	53.0% (2014)	25.4% (2013)	59.4% (2014)	More mobile money (2014)	2.6% (2013)
South Africa	Oct. 2004	6	3.5% (2012)	0.3% (2012)	7.3% (2012)		
Sri Lanka	May 2012	2	4.9% (2013)	1.0% (2013)	7.4% (2013)		0.1% (2013)

[6] GMSA, n.d.
[7] *Ibid.*
[8] Evans & Pirchio, 2015, unless stated otherwise.
[9] *Ibid.*
[10] *Ibid.*
[11] Sources from World Bank consider "adult" population to be 15+.
[12] Scharwatt et al., 2015.
[13] Evans & Pirchio, 2015, unless stated otherwise.
[14] Mondato, 2014.
[15] BBVA Innovation Center, 2015; World Bank, 2015.
[16] Approximate: refers to the number of individuals who "manage their money digitally"

Swaziland[17]	Feb. 2011	2	62.3%[18] (2015)	21.9%[19] (2015)	53.6%[20] (2015)	More mobile money (2014)	3.02%[21] [22] (2015)
Tanzania	Mar. 2008	5	115.9% (2013)	40.1% (2013)	117.1% (2013)	More mobile money (2013)	53.3% (2013)
Thailand	Nov. 2004	3			10.8%[23] (2012)		0.02%[24] [25](2012)
Uganda	Feb. 2009	7	106.2% (2014)	9.0% (2012)	90.8% (2014)	More mobile money (2013)	39.7% (2014)
Zambia	Oct. 2008	5			4.9% (2010)	More mobile money (2013)	
Zimbabwe	Jan. 2011	4	30.1% (2013)	19.5% (2013)	47.9% (2013)	More mobile money (2013)	22.0% (2012)

Twenty-six countries have evidence for at least one of the indicators featured in *Table 1*. The most widely available indicator is registered mobile money users as a percent of adult population (21 countries). The penetration of mobile money for the adult population ranges from 3.4 percent in Mozambique to 117.1 percent in Tanzania (infoDev, 2014a; Evans & Pirchio, 2015). Given both the variable quality and inconsistency of available data (we find evidence on mobile money's growth or penetration for only 26 of 46 reviewed countries), and reluctance to categorize the "success" of mobile money schemes that are at varying stages of development, no analysis was done to associate particular regulatory schemes or interoperability schemes with mobile money growth. For general comparison purposes, however, we do include the category "registered mobile money users as a percent of the adult population" in tables throughout this paper.

4. Regulations for Mobile Money

Mobile money refers to any "mobile-based transactional service that can be transferred electronically using mobile networks" (Alliance for Financial Inclusion, 2012, p. 3). Thus, it is a subset of larger concepts like "electronic money," which refers to any kind of stored value on an electronic device (e.g. a chip, prepaid card, mobile phone, or computer stystem)" (ibid., p. 4). Electronic money in turn falls under even larger governing parameters for "payment systems" generally. As such, while some regulations are specific to mobile money, many other regulations are targeted toward broader payment systems, with mobile money being just one topic covered under their provision.

Table 2 provides a summary of which countries have a National Payment Law, National Payment Strategy, and regulations that cover mobile money. They are defined as follows:

- **National Payment Law** - An Act, Bill, or Law that specifically governs the payment system for a given country.
- **National Payment Strategy -** A modernization strategy, vision, development strategy, framework strategy, roadmap, or other strategy document specifically related to the national payment system for a particular country.
- **Mobile Money Regulations (formal and informal) -** A regulation, law, guideline, directive, resolution, circular, practice note, or royal decree pertaining to electronic money, or specifically, mobile money. A detailed discussion of the differences between formal and informal regulation is found in Section 4.1.

[17] All percentages represent MTN-provided services only, approximate.
[18] Mdluli, 2015.
[19] *Ibid.*
[20] *Ibid.*
[21] Mdluli, 2015; World Bank, n.d.
[22] US $41.12 million per month (converted to USD on 9/4/15).
[23] Leishman, n.d.; World Bank, 2015: Approximate.
[24] *Ibid.*
[25] Approximate: US $900 million per year.

Table 2. National Payment Laws, Strategies, and Mobile Money Regulations by Country

Country	National Payment Law	National Payment Strategy	Mobile Money regulations (formal and informal)	Registered MM Users as % of the Adult Population
Afghanistan	X	--	X	
Argentina	--	--	--	
Bangladesh	X	--	X	22.8%
Brazil	X	--	X	
Cambodia	X	--	X	
Colombia	--	--	X	7.1%
Costa Rica	--	--	--	
Dominican Republic	X	--	--	
Democratic Republic of Congo	--	--	X	7.5%
El Salvador	--	--	Drafted[26]	
Ghana	X	X	X	35.9%
Guatemala	--	X	X	
Guinea	--	--	Drafted[27]	
Haiti	--	--	X	10.4%
Honduras	--	--	--	
India	X	X	X	
Indonesia	--	--	X	14.5%
Kenya	X	--	X[28]	102.2%
Lesotho	Drafted[29]	X	X	
Liberia	X	--	X	
Madagascar	--	--	Drafted[30]	12.9%
Malawi	Drafted[31]	X	X	
Malaysia	X	--	--	
Mexico	X	--	X	3.4%
Mozambique	X	--	--	
Myanmar	--	--	X	
Namibia	X	X	X	
Nepal	--	X	X	
Nicaragua	--	--	X	
Nigeria	X	--	X	7.5%

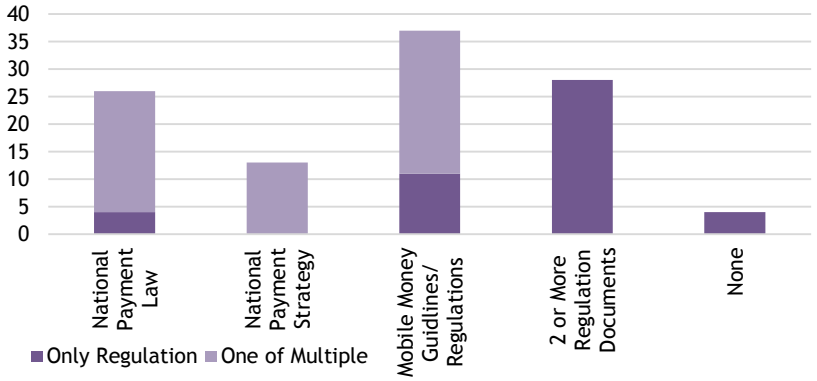
[26] The Central Reserve Bank (BCR) in El Salvador in finalizing the new regulatory framework and requires the approval of Legislature (TeleGeography, 2014).
[27] Regulations were expected to enter before the end of 2014; however, we do not find evidence that it has been enacted.
[28] Mobile money is governed under the country's National Payment Law. Separate regulations do not exist.
[29] Lesotho has drafted a payment systems act; however, we do not find evidence that it has been enacted.
[30] Madagascar is adapting regulations concerning mobile money and branchless banking (Riquet, 2013).
[31] Malawi has had a draft NPS bill since 2002, but it has never been enacted (Better than Cash Alliance, 2015a).

Pakistan	X	--	X	3.7%
Papua New Guinea	X	X	--	
Paraguay	X	--	X	
Peru	X	--	X	
Philippines	--	--	X	13.2%
Rwanda	--	X	X	59.4%
Senegal	--	--	--	
Sierra Leone	X	--	X	
South Africa	X	X	--	7.3%
Sri Lanka	X	--	X	7.4%
Swaziland	--	X	X	53.6%
Tanzania	Drafted[32]	--	X	117.1%
Thailand	--	X	X	10.8%
Uganda	--	--	X	90.8%
Zambia	X	X	Drafted[33]	4.9%
Zimbabwe	X	--	X[34]	47.9%

Of the 46 countries we review, 42 have either a national payment law, national payment strategy, or regulations that cover mobile money. Thirty-seven countries have some form of regulation on mobile money, making it the most common type of financial regulation in our review. Of these 37 countries, four are still drafting regulations or waiting for the regulations to come into effect (El Salvador, Guinea, Madagascar, and Zambia). Mobile money is regulated under the national payment law in Kenya; separate regulations were not found. National payment laws exist for 26 of the countries (three are drafted but not yet enacted), and national payment strategies are in place for 13. National payment strategies are approached differently in each country, with five countries having multi-year "roadmaps" or "visions" (India, Malawi, Swaziland, Thailand, and Zambia), and seven countries having general modernization and development strategies (Ghana, Guatemala, Lesotho, Namibia, Nepal, Rwanda, and South Africa). We did not find information allowing us to categorize Papua New Guinea's strategy document. Additional detail on these various types of regulatory documents is captured in the results coding spreadsheet.

As seen in the breakdown of regulations displayed in *Figure 4,* countries where we find national payment strategies always also had either an NPS law or mobile money regulation. Ghana, India, and Namibia are the only countries where evidence of all three policy documents is found. In Ghana, the Payment Systems Act was passed in 2003, followed by the first release of the Guidelines for E-money Issuers in Ghana in 2008 (Bank of Ghana, 2003; Zetterli, 2015). The second draft of mobile money guidelines were released in 2015, one year after the Strategic Payments Roadmap (Zetterli, 2015;

Figure 4. Overview of Laws, Strategies and Regulations



[32] Tanzania's NPS has been drafted and was expected to be passed in 2014. However, we find no evidence that it has been enacted. (Di Castri & Gidvani, 2014)
[33] Establishing regulations for e-money
[34] Zimbabwe has internal, unpublished guidelines on mobile money.

Standard Chartered, 2014). In India, The Payment and Settlement Systems Act was passed in 2007, followed shortly by regulations on mobile money in 2008 (modified in 2009) (Reserve Bank of India, 2008; Ashta, 2012). In 2012, the Reserve Bank of India released the Payment Systems in India Vision 2012-2015 document to guide the national payment strategy (Reserve Bank of India, 2012). In Namibia, the "Namibia National Payment System Vision" 2015 aims to modernize the old national payments law to reflect new goals. Current regulatory frameworks address the delivery of mobile payment options in Namibia (Brouwers, 2014).

While the Democratic Republic of Congo (DRC), Honduras, and Myanmar do not have a single national payment law, we find evidence of multiple documents in each country that contribute to regulating national payment systems. In Myanmar, the Financial Institutions of Myanmar Law and the Control of Money Laundering Law provide a legal foundation for operating a national payment system (Thida Maw, 2012). In both the DRC and Honduras, central bank laws and other regulatory documents mention payment systems (World Bank, 2008b).

4.1 Mobile Money-Specific Guidelines and Regulations

We now review in greater detail the mobile money-specific guidelines and regulations of the 46 countries, with attention to provisions that impact operational models, protection of funds, and agent networks. Regarding operational models, we specifically review whether non-bank based[35] models are allowed to operate mobile money schemes. Non-bank based models usually allow *both* bank and non-bank based models to proliferate, whereas countries with a "bank-based" model *do not* permit customers to contract directly with banks. *Table 3* provides an overview of the primary "regulatory" documents by country and short descriptions of the rules contained within.

Table 3. Mobile Money Regulations across 46 Developing Countries

	Mobile Money Guidelines/Regulation	Year Released/ Updated	Regulations at a Glance
Afghanistan	Money Service Providers Regulation	2008	*Non-bank-based*. Banks *and* mobile service providers can operate as e-money institutions (EMI). At minimum, EMIs must offer ability for customers transfer virtual money in five ways: 1) through person-to-person transfers; 2) bill payment; 3) airtime top-up; 4) Money transfer or remittance; 5) and domestically and internationally (Biallas, Stefanski, & Sayed, 2013).
Argentina	Not specified		
Bangladesh	Mobile Financial Service Guidelines, 2011	2011/2015	*Bank-based*. While banks field and train agents who facilitate sign-up and operation of mobile money (MM), onus is on banks ensure adherence to "know your customer" (KYC) protocols other monitoring. Regulations allow MM payments between sectors: people-business-government (IFC, 2013a).
Brazil	Medida Provisoria 615/13 (for Mobile Payments), 2013	2013	*Non-bank based*. Regulations create a new entity—known as a "payments institution"—that can issue e-money. To back e-money, payment institutions must set up an account that is equal in value to money issued within the system (Almanza, 2013).
Cambodia	Prakas (Rules and Implementing Regulations) on Third Party Processors	2010	*Bank-based*. "A bank…shall require a Third-party processor to open an account in its own bank in order to hold cash that has received from customers for transferring purpose such as through mobile phones" (National Bank of Cambodia, 2010, p. 7).
Colombia	Ley de Inclusión Financiera (Financial Inclusion Bill)	2014	*Non-bank based (restricted)*. Non-bank and mobile network operators (MNO) can only offer "remote cash-in and cash-out

[35] A mobile financial services business model…in which (i) the customer has a contractual relationship with a nonbank financial service provider and (ii) the nonbank is licensed or otherwise permitted by the regulator to provide the financial services(s)" (Alliance for Financial Inclusion, 2012, p. 3).

			operations, the allocation of customers' funds in electronic deposit accounts and… transactional services such as remittances, transfers, and payments" (Sanin, 2014, p. 1).
Costa Rica	Not specified	--	
Dominican Republic	None		*Operational model not specified*. E-money is regulated through the 2002 National Payment System law, but it does not contain provisions for MNOs to provide e-money services (IFC, 2012a).
DRC	Directive #24 – Relating to the Issuance of Electronic Money and Electronic Money Institutions	2011	*Non-bank based*. "E-money issuers are required to report to the central bank on a monthly basis for monitoring purposes…service providers can share agents, but this is not mandatory." Circulating e-money must be matched in separate account (Di Castri, 2014, p. 10).
El Salvador	Drafted		*Operational model not specified*. "The Central Reserve Bank (BCR) of El Salvador is in the final stages of preparing a new regulatory framework for mobile financial services…The new legislation will allow wireless operators to establish a sister company dedicated to the provision of mobile financial services, which will enable customers to make top-ups, withdraw and deposit funds, and pay bills" (TeleGeography, 2014, p. 1).
Ghana	Guidelines for E-money Issuers in Ghana	2008/2015	*Non-bank based*. New regulations move Ghana from a strict bank-based, "many-to-many" model in which at least three banks had to participate in every service to a non-bank model. In addition, there is a "mandatory pass-through of any interest earned on e-money float account to the customers whose funds are being intermediated" (Zetterli, 2015, p.1).
Guatemala	Reglamento Para La Prestacion De Servicios Financieros Moviles – JM-120-2011 (Regulations for the Provision of Mobile Financial Services	2011	*Bank-based*. "Banks are the intermediaries authorized to provide [mobile financial services]. Credit card management companies may also supply MFS" (Alliance for Financial Inclusion, 2014, p. 7).
Guinea	Drafted		*Operational model not specified*. "Electronic money and mobile financial services regulations are expected to enter into force..." (Maya Declaration, 2014, p. 24).
Haiti	Lignes Directrices realtives a la Banque a Distance (Guidelines of Branchless Banking)	2010	*Bank-based*. Banks are responsible for recruiting and monitoring agents, to some extent precluding participation by smaller entities because of associated costs. Allowance of "mini-wallets (with lower KYC requirements and transaction limits) has created significantly more flexibility in customer acquisition" (Simon, 2012c, p. 7).
Honduras	None	--	*Operational model not specified*. Honduras does not regulate e-money transactions (Simon, 2012d).
India	Guidelines for Licensing of Payments Banks	2008/2014	*Non-bank based*. Updated regulations move India from bank-based to a non-bank approach that allows MNOs to offer deposit accounts and payments. "Deposits will be covered under India's Deposit Insurance Corporation and accounts will be eligible for the RBI's simplified know-your-customer (KYC) norms" (Kumir & Radcliffe, 2015, p. 1).
Indonesia	Bank of Indonesia Regulation on Funds Transfer* & Regulation on Electronic Money 16/8/PBI/2014	2013 & 2014	*Non-bank based*. Indonesia recently removed regulatory hurdles that prevent agents from performing "cash-out" services, allowing agent networks to proliferate (Camner, 2013). Regulation requires e-money issued by branchless banking providers to be backed in a pooled account (Stapleton, 2013).

Kenya	National Payment Systems Regulations	2014	*Non-bank based*. Until issuance of 2014 regulations, only "letters of no objection" from Kenya's central bank governed MM. With the new regulations, agents may contract with multiple service providers. Funds in excess of KES 100 million (US $1.14 million) have to be spread so that they are held in at least two strong-rated institutions (Muthiora, 2014).
Lesotho	Guidelines on Mobile Money	2013	*Non-bank based*. Current guidelines outline KYC, and designate that e-money should be backed in a pooled account. However, interest accruing in this account cannot be paid back to MM subscribers. Agent recruitment is unregulated (Jefferis & Manje, 2014).
Liberia	Mobile Money Regulations – No. CBL/RSD/003/2014	2011/2014	*Non-bank based*. 2014 reforms moved Liberia away from the bank-based model. Funds must be 100 percent backed in an account. To use interest that accrues in the account, the MM provider must submit a letter to the Central Bank which designates how its use will benefit customers. MNOs or other authorized institutions recruit, contract, and monitor agents (Central Bank of Liberia, 2014).
Madagascar	Drafted	--	*Operational model not specified*. "Mindful of the potential impact mobile money can have for financial inclusion, the Central Bank of Madagascar is in the process of adapting regulations on branchless banking" (Riquet, 2013).
Malawi	Guidelines for Mobile Payment Systems	2011	*Non-bank based*. MM guidelines open room for non-banks and banks to operate. Additional regulations outlining the role of agents, KYC requirements, and protection of customer funds are moving through draft/approval stages (Buckley & Malady, 2014).
Malaysia	Not specified	--	
Mexico	Regulation name unknown	2011	*Bank-based*. However, special licenses can be granted for non-banks that allow them to integrate as "niche banks," a kind of limited bank, in the already existing banking infrastructure. To form these banks requires US $14 million in capital, four times as much as what is required of e-money issuers elsewhere in Latin America. As a result, "Mexico's regulatory environment is not considered fully enabling for mobile money services" (Almazán & Frydrych, 2015).
Mozambique	None	--	*Operational model not specified*. "In the absence of an explicit regulatory framework for non-bank payment service providers and e-money issuers, [Bank of Mozambique's] approval of Carteira Movel mKesh product has created some confusion in the market, particularly with regard to its regulatory status (is this a bank or not?)" (Bankable Frontier Associates, 2012, p. 36).
Myanmar	Mobile Banking Directive 4-2013	2013	*Bank-based*. Banks must obtain permission from the central Bank in order to implement mobile banking services. Services may include cash-in/cash-out through agents, bank branches, ATMs, or branches of a mobile operator; and payments made to a business by individuals (or vice-versa) (Dharamsi & Vanderbruggen, 2014).
Namibia	Determination on the Issuance of E-money	2012	*Non-bank based*. Funds must be kept in a pooled account equal to 100 percent of the value of e-money issued (Bank of Namibia, 2012).
Nepal	Unified Directive 2067	2010	*Bank-based*. Current guidelines are limited. International transfers are not allowed. Banking agents are permitted to open mobile wallets for customers (IFC, 2013b).
Nicaragua	Norma Para La Autorización y Funcionamiento de	2011	*Non-bank based*. Regulations allow non-bank entities to provide e-wallet activation and peer-to-peer transfers without any bank partnership. The sole MM operator in Nicaragua operates as a third party that partners with banks and MNOs (IFC, 2011b).

	Entidades que Oeran con Dinero Electónico		
Nigeria	Mobile Money Regulatory Framework for Mobile Payments	2009	*Bank-based*. Regulations restrict MNOs role to providing a platform for bank-driven MM operations. Agents can contract simultaneously with multiple banks (IFC, 2012).
Pakistan	Branchless Banking Regulations: For Financial Institutions Desirous to Undertake Branchless Banking	2008/2011	*Bank-based*. Mobile services that can be offered include bill and merchant payments. Person-to-person transfers are permitted, as are transfers from account to non-account holders (Branchless Banking Regulations, 2011). Strict KYC rules that require agents to photograph account applicants (and their IDs) are a barrier to access given the cost of equipping agents with cameras (Radcliffe, 2013).
Papua New Guinea	None		*Operational model not specified*. Papua New Guinea does not have mobile money regulations (Hubert, 2015).
Paraguay	Resolution 6	2014	*Non-bank based*. Funds are safeguarded through regulations that ensure operators set up a trust account of equal value to funds issued. Unique features of the regulation include that "balances on accounts that have been inactive for 90-days or more must be automatically transferred to a savings account at a formal financial institution" (GSMA, 2014, p. 5).
Peru	Law 22985: Law regulating the basic features of electronic money instrument of financial inclusion	2013	*Non-bank based*. Regulations create a new entity—known as an "e-money issuing company." To back e-money, payment institutions must set up an account that is equal in value to money issued within the system (Almanza, 2013).
Philippines	Circulars (471 & 649)	2005 & 2009	*Non-bank based*. Regulations are permissive enabling multiple models to operate. Circular 471 permits remittance agents to perform "cash-in/cash-out services. KYC requirements only need to be verified once, and customers may use any one of 20 types of ID documents, lowering inclusion barriers (GSMA, 2012).
Rwanda	Law No. 55-2007 & Law No. 7-2008 & Regulation no.03-2011	2007 & 2008 & 2011	*Non-bank based*. Generally, regulations in Rwanda present few barriers to entry for MNOs and non-banks (Evans & Pirchio, 2015). Banks are required to hold funds equal to e-money issuance in an account at a commercial bank, however "a legal framework to protect these deposits from the MNO (particularly in the case of bankruptcy) is not yet in place" (Argent, Hanson, & Gomez, 2013, p. 2).
Senegal	Not specified	--	
Sierra Leone	Operating Guidelines for Mobile Financial Services	2015	*Non-bank based*. Separate regulations for bank-based and non-bank models, both of which may operate in Sierra Leone. Agents utilized in the non-bank model must "be a registered business with a physical address." Agents have cash-in/cash-out capability (Bank of Sierra Leone, 2015, p. 14).
South Africa	None	--	*Operational model not specified*. South Africa's Reserve Bank has not issued directives related to mobile money or payments (Lawack, 2013).
Sri Lanka	Payment Cards and Mobile Payment Systems Regulations No. 1/2	2013	*Non-bank based*. Sri Lanka issued separate guidelines for bank (No.1) and non-bank (No.2) models that were later cemented in formal 2013 regulations. Banks may use agents for cash in/out purposes, while non-banks can use agents only for "wallet-only" services. Non-banks should maintain a trust account in equal value to mobile money issued (Stefanski, 2013).

Swaziland	Mobile Money Transfer (MMT) Practice Note No. 1	2015	*Non-bank based*. Agent rules are permissive. Payment service providers and third parties can use agents (Central Bank of Swaziland, 2015).
Tanzania	Electronic Payment Schemes Guideline.	2007	*Non-bank based*. "Banks and non-banks are allowed to apply for an electronic payment scheme license" (Evans & Pirchio, 2015, p. 12). Tanzania drafted more specific regulations around mobile money in 2012, however these regulations have not yet been enacted (Mondato, 2015).
Thailand	Electronic Money Transaction Act & Royal Decree on Monitoring Electronic Business	2001 & 2008	*Non-bank based*. Regulations are cited for their openness. E-money held in accounts must be backed by a fund containing an equal amount. There is no limit on transaction sizes. Agents are not regulated (IFC, 2011d).
Uganda	Mobile Money Guidelines	2013	*Non-bank based*. There are currently no official regulations that allow banks to use agents, nor can MNOs operate except through partnerships with banks. Despite these challenges, the Bank of Uganda has issued letters of no objection to allow MNOs to partner with banks to provide services. Uganda's Mobile Money Guidelines take these letters a step further by acting to make "the relationships between MNOs and partner banks more transparent. What formerly existed only in confidential legal agreements now exists in publically available documentation" (Staschen, 2015, p. 1).
Zambia	Drafted	--	*Non-bank (not specified in regulation)*. "Although it has allowed non-banks to issue e-money, BOZ is currently preparing a specialized regulatory framework for e-money products and issuers… [Bank of Zambia], in practice, has imposed additional requirements (in line with international practice) on mobile money operators such as Airtel Money and MTN Mobile Money. (Bwalya et al, 2012, p. 40).
Zimbabwe	Internal Guidelines (unpublished)	--	*Non-bank based*. "The Central Bank uses a set of internally developed operational guidelines and policy frameworks, to regulate MM products" (Bara, 2013, p. 5). Mobile money is said to be regulated similarly to Kenya's model, however additional information is unavailable because Zimbabwe's guidelines are unpublished (ibid.).

4.2 Basic Characteristics of Regulations

We find that 37 of the 46 countries we review have documents pertaining to regulation of mobile money, including four with regulations that are in the draft stage. Document types include formal regulations or laws, and less formal agency actions such as guidelines, directives, circulars, and other documents (practice notes, resolutions, or determinations). In general, regulations and laws are binding rules, while guidelines and other published agency policies "are designed to provide information concerning how the agency intends to administer its programs," without having the force of law to back them (Anderson & Breer, 2001, p. 2).

Figure 5. Types of Mobile Money Documents

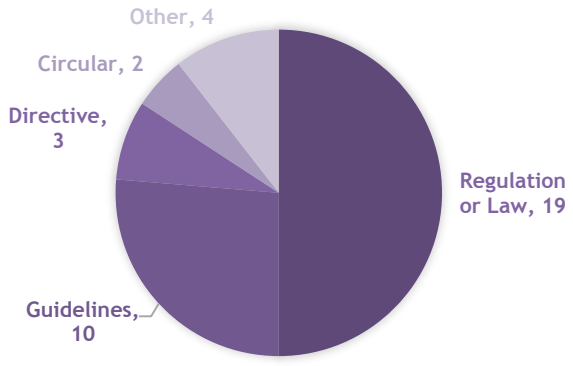


Figure 5 breaks down the prevalence of each type of regulatory document. Formal mobile money regulations and laws are the most common type of document (19 countries), followed by guidelines (10). Some countries have more than one type of

regulatory document, such as Thailand where the Electronic Money Transaction Act (2001) and a Royal Decree on Monitoring Electronic Business jointly govern the mobile money industry.

The presence of formal versus informal regulations may be expected to impact decision-making of mobile money actors; however, anecdotal evidence in our search suggests otherwise. As Anderson & Breer (2001) point out about similar "informal" regulations in the United States: "once an agency has acted and issued or adopted an interpretation (even if the interpretation is adopted very informally), the interpretation can take on considerable substance" (p. 18). Indeed, in Uganda, mobile money operators are responsive to guidelines in ways similar to regulations backed by force of law. Staschen (2015) writes that in Uganda, the absence of laws that allow for the direct licensing of mobile network operators could have prevented the early launch and take-off of services during the early days of mobile money in 2009. To prevent this from occurring, the Central Bank of Uganda began issuing "letters of no objection" that allowed MNOs to partner with banks. These agreements were confidential. By 2011, four MNOs in Uganda offered mobile financial services. When laws still had not been enacted in 2013, the bank released guidelines to provide clarity on rules. The guidelines made "the relationships between MNOs and partner banks more transparent. What formerly existed only in confidential legal agreements now exists in publicly available documentation" (Staschen, 2015, p. 1). Guidelines can therefore outline a sphere of possible action, so that the private sector can proceed without fear that legal recourse will render investments obsolete.

Given that mobile money operators may respond to both formal and informal types of regulation, it is difficult to conclude that the particular type of regulatory document plays a role in the outcome of mobile money systems. Other factors, like the timing of regulation, may also be important. For instance, in Kenya and the Philippines mobile money growth took place before any regulation was in place. Both countries' banks released "letters of no objection" "…as an interim means of permitting mobile money services to operate…allow[ing] for an incubation period where mobile money providers and regulators [could] work together to assess levels of risk and determine what [was] the best regulatory fit for a particular jurisdiction" (Webb Henderson, 2014, p. 2). Later, both countries implemented more permanent regulatory frameworks (*ibid.*). This process—allowing dialogue between public and private mobile actors, followed by a slow, "layering in" of regulations as evolving markets are observed—is sometimes termed "lean regulation" (Bishko & Chan, 2013).

In addition to timing, what regulations regulate is also important. Sections 4.3-4.5 discuss how regulations on mobile money operational models, on safeguarding funds, and on agents can affect mobile money operations.

4.3 Operational Models: Bank-based vs Non-bank-based

Permitting non-banks to issue electronic money and manage mobile money accounts is believed to impact the growth rate of services. Overall, MNO-operated mobile money services demonstrate much higher growth rates than services that are operated by banks (Scharwatt, et al., 2015).

Despite some evidence that MNO-led operations achieve higher growth, many countries have strict regulations in place that permit only a bank-based model to operate. A **bank-based model** is one in which "(i) the customer has a contractual relationship with the bank and (ii) the bank is licensed or otherwise permitted by the regulator to provide financial services(s)" (Alliance for Financial Inclusion, 2012, p. 3). We find **nine countries that permit only a bank-based model (**Bangladesh, Cambodia, Guatemala, Haiti, Mexico, Myanmar, Nepal, Nigeria, and Pakistan).

Regulatory trends, however, are shifting toward more open, competitive markets that allow both banks and MNOs to deploy mobile money schemes (Di Castri, 2013). Our evidence shows that **since 2014 three countries have passed transitional reforms** from a bank-based to a non-bank based model (Ghana, India, Liberia). The Bank of Namibia's Determination on the Issuance of E-Money in 2012 provides an illustrative example of drivers behind such changes. Explaining the reasoning to "allow both bank *and* non-banks to become E-Money issuers," the Deputy Director of Payment Settlement Systems cited a need to allow for "greater competition and innovation," as well a belief that it would enhance the mobile money sector's ability to connect to rural populations (De Sousa, 2012, p. 1).

The Bank of Namibia's Deputy Director's comments may be rooted in two common challenges that bank-based mobile money programs face. First, banks' existing business models typically do not cater to low-income populations, and many

are reluctant to change given ample growth opportunities that already exist in catering to growing developing country middle classes (Di Castri, 2013, p. 12). Second, bank-MNO partnerships do not always make commercial and operational sense. For instance, the MNOs "already think profit margin needs to be divided across two parties (a bank and an MNO) […] and a reduced profit margin can impede serious rollouts in some cases" (*ibid.*, p. 14).

In total, we find that **24 out of the 33 countries with existing mobile money regulation currently permit "non-bank" models of operation** alongside bank-based ones. Sri Lanka, for instance, issued separate guidelines for bank-based (No.1) and non-bank-led (No.2) services in 2011. Language in Guideline 2 states that the guideline is a specific "measure to broaden the regulatory framework" to allow mobile service providers to operate alongside banks in offering mobile payment systems (Central Bank of Sri Lanka, 2011). The guideline is cited as having a direct effect on a Sri-Lankan mobile money operator's (Dialog) ensuing deployment of an ezCash mobile wallet and payment service (Stefanski, 2013).

4.4 Regulatory Safeguards

Non-bank models of operation require specific regulatory safeguards in order to ensure the protection of customer funds given that existing bank regulations do not apply to them. Funds are safeguarded through three common types of regulation:

1. **Liquidity requirements** – At all times, 100 percent of the e-money issued must be held in a separate fund in order to back money in digital circulation.
2. **Restrictions on use** – E-money issuers cannot use the funds except for explicitly rendered purposes.
3. **Fund isolation** – Customer funds remain in a separate account that facilitates access by customers in the event of "bank runs" that require mass withdrawal or the event of issuer failure (Breloff & Tarazi, 2010).

In our literature review, we find evidence that **17 out of 24 non-bank countries[36] have liquidity requirements.** Those requirements mandate that 100 percent of all e-money in a non-bank's mobile finance operation must be backed in a separate bank account of equal value. In addition, some countries have put in place more stringent requirements to protect customer funds. Kenya, in certain instances, requires funds to be kept in multiple accounts, instead of one. For a given e-money issuer in Kenya, when "trust funds balances are in excess of KES 100 million (US $1.14 million) the funds will have to be placed in at least two strong-rated institutions" (Muthiora, 2014, p. 1). In India, pooled funds are further backed by India's Deposit Insurance Corporation (Kumir & Radcliffe, 2015).

Our review does not focus specifically on restrictions on use or fund isolation, and thus we do not provide a count of their incorporation across countries. Still, we do find several interesting examples of each. Liberia, for instance, has strict a protocol in place to ensure **restrictions on use**. Mobile money providers must receive approval from the Central Bank on any plans to use the interest that has accrued on the pooled fund. This ensures that uses are in customers' interest (Mobile Money Regulations, 2014). In Paraguay, funds from inactive customer accounts (90 days) are automatically transferred to a formal banks savings account, and if the customer doesn't currently have one, then the mobile money operator is required to follow the necessary protocol to open one (Scharwatt, et al., 2015).

In Rwanda, we find that **fund isolation** is not adequately addressed by the existing legal framework. If a mobile network operator were to go bankrupt, there is no law in place to ensure that the pooled customer funds kept in a separate account are protected and will be returned to customers (Argent, Hanson, & Gomez, 2013).

4.5 Agents

Agents are an integral part of expanding networks to encompass low-income areas. Banks traditionally do not have formal branches in these areas given the cost of expanding infrastructure to service individuals who offer low profit margins (Breloff & Tarzai, 2011). Agents, however, can operate at a low-cost, and proliferate by operating at already existing outlets like retail shops, lottery outlets, or postal offices. Allowing agents to offer cash-in/cash-out services strengthens

[36] Afghanistan, Brazil, Cambodia, DRC, India, Indonesia, Kenya, Lesotho, Liberia, Malaysia, Namibia, Paraguay, Peru, Philippines, Rwanda, Sri Lanka, and Thailand.

the usefulness of mobile money by giving users a physical location at which they can change electronic currency to physical currency, and vice-versa (Mas & Siedek, 2008).

Our review does not focus specifically on agent regulation, and did not use search terms which would reveal their full extent in the reviewed countries. Still, in accordance with the other literature that suggests most countries' regulations allow cash-in/cash-out services (Breloff & Tarzail, 2011), we find no evidence that any of the country regulations *do not* allow agents to provide this service. However, we do find that Indonesia only updated its regulations to enable this service in 2014 (Camner, 2013). In addition, Thailand does not regulate the use of agents at all, and the role of agents in Malawi is currently not prescribed (IFC – Thailand, 2011; Buck & Malady, 2014). Thus, there is no regulation prohibiting agents from offering cash-in/cash-out services, but there is also no regulation that enables them to.

Pakistan provides an interesting example of how stringent agent regulations can limit mobile money growth. There, agents are required to photograph individuals who wish to register for a mobile money account. The high cost of equipping agents with cameras to meet the regulation requirement is preventing high rates of mobile account sign-ups (Radcliffe, 2013).

5. Interoperability for Mobile Money

Interoperability of mobile money systems "enables users to make electronic payment transactions with any other user in a convenient, affordable, fast, seamless and secure way via a single transaction account" (ITU Focus Group on Digital Financial Services, 2015).

In this section, we review the status of interoperability regulations across 46 countries. Next, we review how many countries have fully interoperable mobile money systems, and also detail the extent to which other varying degrees of interoperability exist for mobile money systems. We then compare how a given country regulates interoperability against the level of mobile money interoperability that exists in practice within the country. While our analysis focuses on interoperability of mobile money systems, *Appendix 4* includes an overview of the status of interoperability for non-mobile money payment schemes in the countries we review, based on the evidence from our literature search.

5.1 Types of Interoperability Regulations

Eighteen of the 46 countries we review have regulations regarding mobile money interoperability. Under the umbrella of mobile money interoperability regulations, we identify three subsets of regulation for mobile money interoperability.

1. Interoperability is mandated, meaning that a country requires all mobile money systems to be interoperable.
2. Technical capacity for interoperability is mandated, or MNOs must have a plan to interoperate.
3. Interoperability is encouraged or permitted by regulators, but specific approaches are left up to the market.

Table 4 shows countries that have regulations for mobile money interoperability and whether the regulation mandates, plans, or encourages interoperability. In addition it shows **ten countries where we find specific evidence that states that interoperability is not regulated**.

***Table 4**. Mobile Money Regulations for Interoperability by Country*

Country	Interoperability is mandated	Technical capacity for interoperability is mandated, or MNOs must have a plan to interoperate	Interoperability is encouraged or permitted	Interoperability is not regulated	Registered mobile money users as % of the adult population
Afghanistan		X			
Bangladesh			**X**		22.8%
Brazil		X			
Colombia				X	7.1%

DRC				X	7.5%
Ghana				X	35.9%
India		X			
Indonesia		X			14.5%
Kenya			X		102.2%
Lesotho		X			
Liberia			X		
Malawi	X				
Mexico	X				3.4%
Myanmar				X	
Namibia		X			
Nepal				X	
Nigeria	X				7.5%
Pakistan			X		3.7%
Paraguay	X				
Peru				X	
Rwanda	X				59.4%
Sierra Leone			X		
South Africa				X	7.3%
Sri Lanka				X	7.4%
Swaziland		X			53.6%
Tanzania				X	117.1%
Uganda		X			90.8%
Zambia				X	4.9%
Total	**5**	**8**	**5**	**10**	

Note: We do not find categorical information on interoperability regulation for the following 18 countries: Argentina, Cambodia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Guinea, Haiti, Honduras, Madagascar, Malaysia, Mozambique, Nicaragua, Papua New Guinea, Philippines, Senegal, Thailand, and Zimbabwe.

Of the eighteen countries that have regulations for mobile money interoperability, five (Malawi, Mexico, Nigeria, Paraguay, and Rwanda) have **mandated interoperability for mobile money services**. Requirements in three of these countries require MMOs to connect to a national switch. For example, the Central Bank of Nigeria's (CBN) memo "Timeline for Interoperability and Interconnectivity" states: "In furtherance of the CBN's efforts at ensuring effective and robust mobile payments system, all Mobile Money Operators are hereby directed to fully connect to the National Central Switch (NCS) on or before February 28, 2013, to ensure interoperability and interconnectivity of their schemes" (Central Bank of Nigeria, 2012, p. 1). Banco de Mexico and the National Bank of Rwanda also mandate that MMOs connect and route services through the national switch, setting hard deadlines for compliance. Alternately, the Reserve Bank of Malawi and the Central Bank of Paraguay mandate interoperability, but allow industry to define and lead the transition towards interoperable mobile money markets without a set timeline (Greenacre, Malady, & Buckley, 2014; Almazan, 2014). Two countries (Ghana and India) once mandated interoperability for mobile service providers, but these mandates have since been superseded by newly enacted regulation.

In eight countries (Afghanistan, Brazil, India, Indonesia, Lesotho, Namibia, Swaziland, and Uganda), the **technical capacity for interoperability is mandated, or MNOs must have a plan to interoperate** in the future. At the most basic level, this category encompasses Brazil, where to attain a license MMO operators are required to provide a "clear roadmap of how [they] will eventually interoperate with the wider financial ecosystem" (Tellez-Merchan, 2013, p. 1). Remaining countries' regulations contain vague language asserting that MMOs are required to use technology, systems, and standards that presently—or in the future—allow for interoperability with other systems. Lesotho and Swaziland, for instance, require MMOs to submit a technical plan that demonstrates how the infrastructure they use includes interoperable functionality in order to attain a license (Central Bank of Lesotho, 2013; Central Bank of Swaziland, 2015).

Finally, five countries (Bangladesh, Kenya, Liberia, Pakistan, Sierra Leone) **encourage, or simply permit, mobile money service providers to become interoperable**. For example, Bangladesh Bank's Guidelines on Mobile Financial Services for Banks permits interoperability: "Banks may link their mobile financial services with those of other banks for the convenience of the users" (Bangladesh Bank, 2011, p. 4). The Central Bank of Liberia encourages interoperable services: "All Authorized Institutions should endeavor to render systems interoperable with systems provided by other Authorized Institutions, in such a way that transactions between Authorized Institutions are executed to allow a real-time customer experience for customers of both Institutions, as the services mature" (Central Bank of Liberia, 2014, p. 20). For these five countries (and others that do not directly regulate interoperability), laissez-faire style regulation essentially lets the market decide how and when/if to become interoperable.

5.2 Existing Interoperable Mobile Money Payment Schemes

Twenty-one countries have mobile money markets that are interoperable in some form. These countries have either implemented or are in the process of establishing platforms, infrastructure, and/or interconnections between operators to enable interoperability. Based on the available evidence, in *Table 5* we group examples of interoperability into four categories:

1. **Account-to-Account (A2A) interoperable markets** - Mobile money schemes that allow money transfers between customer accounts with different mobile money operators, and between accounts at mobile money schemes and bank accounts (Scharwatt et al., 2015).
2. **Government-led banking switches or settlement systems** – Schemes that use the technical infrastructure provided by national switches or RTGS systems to facilitate transfer of funds between parties.
3. **Third party platforms or agents** – Third party platforms that allow subscribers to join a single network that can connect multiple mobile money operators within a country, or involving the use of agents for "off-network" transactions between users of different MNOs.
4. **Other** – Countries with some form of interoperability that cannot be placed in one of the other categories based on available evidence, such as countries with interoperable systems that appear to be operational for a single provider but not a wider system.

These categories provide a framework within which to group *similar* systems. However, interoperable mobile money markets are highly varied, due in large part to differences in defining what it means to be "interoperable." These variations, which include existing regulations and system limitations, make it difficult to gauge the extent to which interoperability exists in a given market. In addition, the evidence identified in our literature search likely does not fully capture the nature of mobile money interoperability in the reviewed countries. Search terms were not targeted to capture nuances of each country's infrastructure, mobile agreements, or third party platforms.

Table 5. Country-by-Country Interoperable Mobile Money Schemes by Category

Country	Account-to-Account (A2A) Interoperability	Government-led National Switch or RTGS connect to process mobile money	Non-Government Third Party Providers (platforms or agents) that provide interoperable mobile money services	Other	Registered mobile money users as % of the adult population
Afghanistan		X			
Bangladesh			X		22.8%
Haiti		X			10.4%
India		X			
Indonesia	X				14.5%
Kenya			X	X	102.2%
Lesotho			X		
Malawi		X			
Mexico		X			3.4%
Mozambique		X			

Namibia		X			
Nepal			X		
Nigeria		X	X		7.5%
Pakistan	X				3.7%
Peru			X		
Philippines			X		13.2%
Rwanda			X		59.4%
South Africa				X	7.3%
Sri Lanka	X				7.4%
Tanzania	X				117.1%
Zimbabwe		X	X		47.9%
Total	**4**	**9**	**9**	**2**	

Account-to-Account (A2A) interoperable markets have the following capabilities (GSMA 2014):

- To make direct transactions between mobile wallet accounts at different Mobile Money Operators (MMOs);
- To make direct transactions between mobile money accounts and bank accounts; and
- To settle funds for transactions across mobile money schemes and between schemes at banks.

As of 2014, only four countries had established A2A interoperable models: Indonesia, Pakistan, Sri Lanka, and Tanzania (Scharwatt et al., 2015). In 2013, Indonesia became the first country to offer interconnected mobile money services when three major mobile money operators (Telkomsel, Indosat, and XL) announced their plans to allow customers to send and receive mobile money across each other's networks (Camner, 2013). Following Indonesia's example, mobile money operators in Pakistan, Sri Lanka, and Tanzania launched A2A interoperable mobile money schemes in their respective countries (Scharwatt et al., 2015).

Interoperability in A2A markets does not imply interconnection across all providers. For example, Indonesia has three mobile money operators who did not participate in the announced 2013 connectivity agreement (Bank Mandiri, mCoin, BTPN), and we find no evidence that those operators have since been integrated into the A2A system. In Tanzania, there are established separate agreements for interconnection for person-to-person transfers between Tigo and Airtel, and Tigo and Zantel (International Finance Corporation, 2015). This only represents three of the five operators in the country.

Government-led national banking switches or Real-Time Gross Settlement Systems (RTGS) are a common foundation for interoperable systems in the countries we review, with nine countries currently linking—or planning to soon link—them to mobile money services. National switches are a technological platform that enable interoperable transactions, provided that MMOs and banks agree to (or are required to) participate (Musa, Niehaus, & Warioba, 2015). India, Malawi, Mexico, Namibia and Nigeria all currently use a national switch to handle switching, clearing, and settling transactions, while Haiti planned to complete their platform for 2013-2014[37] and Afghanistan is expected to complete its system in 2016 (World Bank, 2014b).

In Mexico, the regulations requiring banks to connect mobile money services to the nation's banking switch for mobile money transactions passed in 2014. The regulation is intended to achieve interoperability among all mobile payment products by mandating that all banks use the Interbanking Electronic Payment System (SPEI) operated by the Banco de Mexico. The SPEI systems will allow customers to associate their mobile number with multiple payment accounts, allowing seamless interoperable payments across different banking institutions (Banco de Mexico, 2014).

India uses a similar model with assigned mobile numbers. The Immediate Payment Service (IMPS) was piloted in 2010 to handle electronic payment services. It evolved from the Interbank Mobile Payment Service as it expanded functionality beyond mobile phones (Winn, 2015). The IMPS is governed by the National Payments Corporation of India's (NPCI) and works through the existing NFS switch (*ibid.*). The system allows for instant electronic fund transfer services through mobile phones as an alternative to the National Electronic Funds Transfer (NEFT) which has limited processing capabilities

[37] No evidence is found on whether the platform was ever completed and/or is operational

(National Payments Corporation of India, n.d.). Users are given a Mobile Banking Personal Identification Number (MPIN), which identifies mobile payments and accounts along with Mobile Money IDs (MMID) (Let's Talk Payments, 2014). IMPS provides interoperability for sixty-four banks and several other institutions that use the system. Altogether it covers 98% of banking customers and users of mobile money in India (*ibid.*).

Mozambique and Zimbabwe also use RTGS systems to facilitate mobile money transactions. In Mozambique, both MMOs (mCel and Vodacom) are permitted to settle through RTGS (Dermish, Dias, & Sanford, 2012). In Zimbabwe, the RTGS platform is used for all electronic payments, though the pressure of high volumes led to the establishment of a third party platform (described below).

Nine countries also have **non-government third party providers (platforms or agents) that provide interoperable mobile money services.** Third party platforms allow subscribers to join a single network that can connect multiple mobile money operators within a country, effectively resulting in interoperable mobile money services. Bangladesh, Peru, and Zimbabwe all have some type of third party platforms that facilitate mobile money transactions. In Bangladesh, bKash is a payment platform that allows different mobile network operators to join a single network and use bKash for mobile money transaction (Lehman & Ledgerwood, 2013). In Peru, Asociacion de Bancos Del Peru (ASBANC) created an open, interoperable "ecosystem" for all banks and telecom operators in 2014, in which customers can access a range of mobile financial services through the cooperation of both banks and MNOs (Bourreau & Valletti, 2015). In response to the pressure of electronic payments on the RTGS system in Zimbabawe, third party private company Zimswitch developed the new platform Zimswitch Instant Payment Interchange Technology (ZIPIT) open to financial institutions to facilitate transactions between bank accounts and mobile phones (Dermish, Hundermar, & Sanford, 2012).

Alternatively, some mobile money operators allow customers to send mobile money to anyone, but only if they go off of the electronic network to visit a physical agent location. Agents complete the transaction for a fee. This definition of interoperability is broad, and does not take into consideration aspects of seamlessness, convenience, speed, and affordability that are a part of the ITU Focus Group's definition of interoperability. In Lesotho, Vodacom M-Pesa and Econet EcoCash allow subscribers to send money to any other individual, who can then withdraw this as cash from a mobile money agent (Jeffris & Manje, 2014). Kenya, Nepal, Nigeria, the Philippines and Rwanda are other examples of agent-based interoperability. These industry-led services create limited interoperable services for mobile money customers.

The **two other systems with interoperable characteristics** are Kenya and South Africa; we find evidence of interoperability within the mobile money market, but cannot determine from the available information how these systems fit within a national context. In Kenya, the dominant mobile money operator Safaricom (M-PESA) is not interoperable with other providers (Benson & Loftesness, 2012). If users transfer money to an account in another network, an agent must be used to withdraw the funds, like examples with other third party provider platforms (*ibid.*). A new service provided by Equitel is said to be fully interoperable. "Users will not only be able to securely send and receive money on the Equitel network but also from other banks and mobile money platforms such as Airtel Money, Orange Money and MPESA" (Hanford, 2015). While this system seems interoperable, a 2014 article in *The Economist* (2014) argued that "Kenya does not have genuine interoperability—in which funds can be sent from one system to another without punitive charges"[38] and it remains unclear what the protocols are concerning users transferring funds between different MNOs and banks. In South Africa, WIZZIT is often cited as an example of a mobile money operator that offers interoperable services. It allows for account to account transactions across mobile network providers to other Wizzit users (Dolan, 2009). However, we did not find evidence that demonstrates how it interoperates with mobile money schemes of other MMOs. These two examples highlight the difficulty of assessing the extent of mobile money interoperability.

5.3 Comparing Regulation and Market Types for Interoperable Mobile Money Schemes

Although several countries have regulations on interoperability (sometimes even mandating it), they do not necessarily have interoperable markets or services. Likewise, some countries offer highly interoperable mobile money services, but

[38]While "punitive charges" do not necessarily discount affordability, we cannot determine financial burden on the user caused by the tariffs. Additionally, we cannot look at fee structures across the countries we review for comparative analysis due to limited information.

have little regulation regarding or mandating interoperable markets. *Table 6* presents a comparison of the type of regulations and type of markets for all 32 countries that have either a regulation for mobile money and interoperability, or an interoperable mobile money scheme.

Table 6. Interoperability Regulation and Types of Interoperable Markets

	Interoperability is mandated	Technical capacity for interoperability is mandated, or MNOs must have a plan to interoperate	Interoperability is encouraged or permitted	Interoperability is not regulated	Not Specified
Account-to-Account (A2A) Interoperability		Indonesia	Pakistan	Tanzania	Sri Lanka
Government-led National Switch or RTGS	Malawi Mexico Nigeria	Afghanistan India			Haiti Mozambique Zimbabwe
Non-Government Third Party Providers (platforms or agents)	Nigeria Rwanda	Lesotho Namibia	Bangladesh Kenya	Peru Nepal	Philippines Zimbabwe
Other			Kenya	South Africa	
Not Specified	Paraguay	Brazil Swaziland Uganda	Liberia Sierra Leone	Colombia DRC Ghana Myanmar Zambia	

From the available evidence, we find no direct links between the types of interoperability regulation and the existing interoperable market types. Information was incomplete for 18 of the 32 countries. Within countries that mandate interoperability, there is a range in the types and extent of interoperable services. Malawi and Mexico both use a government-led national switch to process transactions and help facilitate transfers between users of different providers. Nigeria uses both a government-led national switch and third party agents. The Nigeria Inter-Bank Settlement System (NIBSS) handles all switching, clearing, and settlement, but agent networks are still used by mobile money users for depositing and retrieving funds (International Finance Corporation, 2012). Finally, Rwanda's interoperable services rely entirely on third party agents: funds can be transferred from one user to another with a different provider, but agents must be used to withdraw cash (Argent, Hanson & Gomez, 2013). Similar levels of variation can be found across all categories, as illustrated in *Table 6*.

6. Conclusion

Mobile money and digital banking are still relatively new, with widespread entrance into the markets of developing countries dating back only a few years (GSMA, n.d.). Countries where mobile money has quickly penetrated the market, like Kenya and Tanzania, show great potential especially as the adoption of different platforms and frameworks are being tested. However, only eight percent of the mobile phone connections in the world are estimated as being used for mobile money (Scharwatt et al., 2015). While the number of registered accounts continue to grow as more mobile money schemes

are deployed, attention is shifting to how regulations and interoperability can increase financial inclusion and accelerate the use of digital banking (Evans & Pirchio, 2015; Scharwatt et al., 2015).

The types and level of mobile money regulation within countries are commonly cited for their potential influence on market uptake (Scharwatt et al., 2015). Specific guidelines regulating the mobile money transactions within a country's payment scheme are common among the countries we review, though the level of enforcement and impact on the market remains unknown. Regulators and providers are increasingly considering the benefits of interoperable platforms for mobile money and incorporating foundations for interoperability into regulatory documents (*ibid.*). Standards of interoperable services remain varied between countries, though functional definitions and guiding principles are beginning to develop, such as A2A interoperability (Clark & Camner, 2014). Increasing regulation and attention to interoperable platforms may help form a standard of interoperability across countries, though barriers to interoperability such as cost and MMO cooperation remain a factor in widespread adoption (*ibid.*)

Mobile money and digital banking are growing quickly and evolving as a sector. Accurate, comprehensive analysis of mobile money and national payment schemes depend heavily on the availability of updated data and information that encompass the most recent developments in expanding financial markets. The analysis in this review is based only on information in publicly available academic and grey literature. Consistent data, indicators, and in-country verification is necessary to credibly draw associations between factors such as the presence of regulations or interoperability and the relative success of a mobile money scheme in a country, including financial inclusion and an overarching look at general trends and evolutions within the scope of digital financial services.

Please direct comments or questions about this research to Principal Investigator Leigh Anderson at eparx@u.washington.edu.

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Appendix 1. Summary of Body of Evidence

Country	Number of Documents Reviewed	Documents Reviewed Include:				
		GSMA State of Industry: Mobile Financial Services for the Unbanked 2014	International Finance Corporation (IFC) Mobile Money Scoping Report	Country-Specific GSMA Report	World Bank 2008 Payment Systems Snapshot Worldwide	Central Bank Documents From the Country
Afghanistan	6	X	X			X
Argentina	1	X				
Bangladesh	6	X	X			X
Brazil	5	X	X			
Cambodia	3	X				
Colombia	3	X		X		
Costa Rica	2				X	
Dominican Republic	5	X	X		X	
Democratic Republic of Congo	6	X		X	X	
El Salvador	4	X	X		X	
Ghana	12	X			X	X
Guatemala	4	X	X		X	X
Guinea	3	X				
Haiti	4	X	X			
Honduras	3	X	X		X	
India	12	X	X		X	X
Indonesia	14	X		X	X	X
Kenya	31	X		X		X
Lesotho	4	X			X	
Liberia	5	X	X			X
Madagascar	3	X			X	
Malawi	9	X				X
Malaysia	4	X			X	X
Mexico	11	x	X		X	X
Mozambique	5	X			X	
Myanmar	5	X			X	
Namibia	5	X			X	X
Nepal	4	X			X	X
Nicaragua	3	X			X	
Nigeria	9	X	X			X

Pakistan	9	X			x	x
Papua New Guinea	4	X				x
Paraguay	6	X				x
Peru	10	X	X			
Philippines	21	X			x	
Rwanda	9	X	X			x
Senegal	4	X				
Sierra Leone	3	X	X			x
South Africa	12	X			x	x
Sri Lanka	9	X	X	x	x	x
Swaziland	6	X			x	x
Tanzania	12	X		x	x	x
Thailand	8	X	X		x	x
Uganda	13	X			x	x
Zambia	13	X			x	x
Zimbabwe	5	X			x	

Appendix 2. Review Framework Questions

- Does the country have a mobile money scheme? (Y/N)
    - Date first mobile money schemes was launched
    - Number of mobile money providers
    - Name(s) of mobile money providers
    - Describe
- Are indicators of mobile money development found for a given country? (Y/N)
    - What is the number of registered mobile money users as a percentage of mobile phone users?
    - What is the number of active mobile money users as a percentage of mobile phone users?
    - What is the number of registered users of mobile money as a percentage of a country's adult population?
    - Are there more registered mobile money accounts in a country than bank accounts? (Y/N)
    - What is the amount of mobile money transactions as a percentage of a country's GDP?
    - What is the number of active users of mobile money as a percentage of a country's adult population?
    - Does literature indicate mobile money growth within the county?
    - Are there any other indicators of the current status of mobile money within the country?
- Does the country have established interoperability for mobile money? (Y/N/Planned)
    - Describe (e.g. short description, date of launch, etc.)
- Does the country have established interoperability for other payments schemes? (Y/N/Limited/Planned)
    - Type(s) of payment scheme (e.g. debit cards, credit cards, credit transfers, direct debits)
    - Describe (e.g. short description, date of launch, etc.)
- Does the country have a national payments law? (Y/N/Planned)
    - Describe (e.g. source, date of enactment)
- Does the country have a national payments strategy? (Y/N/Planned)
    - Describe (e.g. source, date of enactment)
- Does the country have laws around provision of payment services by non-bank providers? (Y/N/Planned)
    - Describe (e.g. source, date of enactment)
- Does the country have regulations on mobile money? (Y/N/Drafted)
    - Describe (e.g. source, quote specific law, date of enactment)
- Does the country have regulations for financial interoperability? (Y/N/Planned)
    - Describe (e.g. source, quote specific law, date of enactment)
- Is interoperability referred to in national payments law or strategy? (Y/N/Planned)
    - Describe (e.g. quote specific part of law)

Appendix 3. Complete Indicators of Mobile Money Development by Country

Country	Launch of First Mobile Money Scheme[39]	# of MMOs[40]	Registered Mobile Money Users as % of Mobile Phone Users[41]	Active Mobile Money Users as % of Mobile Phone Users[42]	Registered Users as % of the Adult Population[43,44]	Active Users as a Percent of Adult Population[45]	Registered Mobile Money Accounts Compared to Bank Accounts[46]	Transactions as % of GDP[47]	Indication of Growth	Other
Afghanistan	Oct. 2008	3								"While the mobile money program in Afghanistan is in its nascent stages, the factors that helped M-Pesa to succeed are generally lacking" (Brown, 2014)
Argentina	Apr. 2012	1								
Bangladesh	Nov. 2006	9	22.2% (2014)	10.5% (2014)	22.8% (2014)			1.0% (2013)	From Jan. - Dec. 2013, volume of transactions nearly tripled from US$300m to US$900m[48]	

[39] GMSA, n.d.
[40] *Ibid.*
[41] Evans & Pirchio, 2015, unless stated otherwise
[42] *Ibid.*
[43] *Ibid.*
[44] Sources from World Bank consider "adult" population to be 15+
[45] Almazan, & Frydrych, 2015, unless stated otherwise
[46] Scharwatt et al., 2015
[47] Evans & Pirchio, 2015 unless stated otherwise
[48] Evans & Pirchio, 2015

Brazil	Jan. 2007	5								
Cambodia	Dec. 2008	1						5.9%[49] (2013)		Turned a profit in 2013 - of the 150 deployments that year, only 9 broke even (Mondato, 2014)
Colombia	Feb. 2009	5			7.1%[50] [51] (2015)				Mobile banking grew 334% in 2014 (BBVA Innovation, 2015)	
Costa Rica	Sept. 2011	1								
Dominican Republic	Feb. 2014	1								
DRC	Jan. 2012	4	9.5% (2013)	1.3% (2013)	7.5% (2013)		More mobile money (2013)	0.8% (2013)		
El Salvador	Oct. 2011	2				Top 15% of markets (90-day)				
Ghana	Apr. 2009	5	19.3% (2014)		35.9% (2014)					
Guatemala	Jan. 2011	2								
Guinea	Aug. 2012	2					More mobile money (2014)			
Haiti	Oct. 2010	2	9.8% (2013)	0.8% (2015)	10.4% (2013)					
Honduras	Jan. 2010	1				Top 15% of markets (90-day)				
India	Jan. 2007	15		1.0% (2013)						
Indonesia	Nov. 2007	6	7.9% (2013)	1.2% (2011)	14.5% (2013)					
Kenya	Feb. 2007	7	83.7% (2014)	39.9% (2014)	102.2% (2014)		More mobile money (2013)	49.3% (2013)		
Lesotho	Feb. 2011	3					More mobile		60% increase in transcations	3% of the population (260,000 users) registered within 3

[49] Mondato, 2014
[50] BBVA Innovation Center, 2015; World Bank, 2015
[51] Approximate: refers to the number of individuals who "manage their money digitally"

							money (2014)		every month (Southwood , 2013)	months of Vodacom M-Pesa launching (2013) "Growth is beginning to slow down" (Southwood, 2013)
Liberia	Aug. 2011	1								
Madagascar	May 2010	3	20.6% (2013)	1.7% (2013)	12.9% (2013)		More mobile money (2013)			
Malawi	Jan. 2012	3								"Mobile money is gathering steam now that a second mobile network operator, TNM, has launched its mobile money product" (Bankable Frontier Associates, 2015)
Malaysia	Apr. 2007	2								"Malaysia's mobile payment market has developed modestly but uptake remains limited." (Ernst and Young, 2009)
Mexico	Mar. 2012	3	2.6% (2013)		3.4% (2013)					
Mozambique	Aug. 2011	2								"Although mobile money use is thus limited as a means of collecting revenues, the potential is there if one considers that 400,000 users came on board within six months. The situation can change within a short period of time" (infoDev, 2014a)
Myanmar	Dec. 2014	1								
Namibia	Aug. 2010	3								"Current mobile money solutions… have very limited contribution to financial inclusion as they tend to rely on existing and limited infrastructure such as ATM or prerequisite bank accounts or limited use like payments or remittances only"

										(Brouwers, Chongo, Millinga et al. 2014).
Nepal	Nov. 2009	3								
Nicaragua	June 2010	1								
Nigeria	Jan. 2011	19	5.4% (2013)	0.3% (2013)	7.5% (2013)					
Pakistan	Sept. 2009	7	3.3% (2014)	1.5% (2014)	3.7% (2014)			5.1% (2013)		
Papua New Guinea	June 2011	5							"In July 2013, the number of e-money accounts for mobile payments reached 386,000. However, recent BPNG data for March 2014 reveal a lower number of 208,089" (Hubert, 2015)	
Paraguay	Jan. 2008	2		0.9% (2012)		Top 15% of markets (90-day)	More mobile money (2014)			
Peru	May 2012	2								
Philippines	Sept. 2004	2	7.8% (2013)	5.2% (2013)	13.2% (2013)			2.0% (2009)		
Rwanda	Jan. 2010	6	53.0% (2014)	25.4% (2013)	59.4% (2014)		More mobile money (2014)	2.6% (2013)		
Senegal	Aug. 2008	5								
Sierra Leone	Aug. 2009	3								"Splash has been in the market for over 3 years, but is experiencing mixed results" (Ngahu and Firpo, 2012)
South Africa	Oct. 2004	6	3.5% (2012)	0.3% (2012)	7.3% (2012)					
Sri Lanka	May 2012	2	4.9% (2013)	1.0% (2013)	7.4% (2013)			0.1% (2013)		

Swaziland[52]	Feb. 2011	2	62.3%[53] (2015)	21.9% [54] (2015)	53.6%[55] (2015)	18.8%[56] (2015)	More mobile money (2013)	3.02%[57] [58] (2015)		
Tanzania	Mar. 2008	5	115.9% (2013)	40.1% (2013)	117.1% (2013)		More mobile money (2013)	53.3% (2013)		
Thailand	Nov. 2004	3			10.8%[59] (2012)			0.02%[60] [61](2012)		
Uganda	Feb. 2009	7	106.2% (2014)	9.0% (2012)	90.8% (2014)		More mobile money (2013)	39.7% (2014)		
Zambia	Oct. 2008	5			4.9% (2010)		More mobile money (2013)			
Zimbabwe	Jan. 2011	4	30.1% (2013)	19.5% (2013)	47.9% (2013)		More mobile money (2013)	22.0% (2012)		

[52] All percentages represent MTN provided services only, approximate
[53] (Mdluli, 2015)
[54] *Ibid.*
[55] *Ibid.*
[56] *Ibid.*
[57] (Mdluli, 2015) and (World Bank, n.d.)
[58] US $41.12 million per month (converted to USD on 9/4/15)
[59] Leishman, n.d.; World Bank, 2015: Approximate
[60] *Ibid.*
[61] Approximate: US $900 million per year

Appendix 4. Status of Interoperability for Non-Mobile Money Payment Schemes

Country	Status of Interoperability For Non-Mobile Money Payment Schemes
Afghanistan	Afghanistan plans to develop an interoperable payment switch to include payment cards and banking initiatives. As of early 2014, Afghanistan had no interbank card system (Biallas et al., 2013).
Argentina	--
Bangladesh	Bangladesh bank launched National Payment Switch in 2012. As soon as all Bangladeshi banks join the service, a customer will be able to use a credit or debit card from any bank to withdraw cash form any ATM or POS in the country (Uddin et al., 2014).
Brazil	Brazil has established the Brazilian Payments System (SPB), which is a network used by banks, clearinghouses, the Central Bank, and other supervisory authorities, to transfer money and to process and clear payment orders. (Martins de Almeida, 2013)
Cambodia	--
Colombia	Pagos Seguros en Linea (PSE) is Colombia's interoperable e-payment platform for the country's banks (Better Than Cash Alliance, 2015b).
Costa Rica	As of 2008, Cost Rica had limited interoperable ATM and POS services (The World Bank, 2008b).
Dominican Republic	Dominican Republic reports having an interoperable ATM network (The World Bank, 2008b)
DRC	There are no interoperable banking services between customers at different banks. There are a few POS terminals at large retail outlets and hotels. Only a few banks support internationally issued credit cards (American Express, Visa, and Master Card) (The World Bank, 2014).
El Salvador	El Salvador has limited interoperability for retail payments. Most banks have their own POS and ATM services that are partially interoperable due to ATH and Credomatic switching services (Aguirre et al., 2009; Simon, 2012b).
Ghana	In 2008, the Ghanaian government developed eZwich, an interoperable branchless banking services that features a payment card and POS banking solution for Ghanaians. The Bank of Ghana wants to mandate banks to issue cards and launch eZwich-compliant point-of-sale (POS) devices and ATMS (Mckay, 2011; CGAP, 2011).
Guatemala	Guatemala reports that it offers a successfully interoperable ATM network (World Bank, 2008).
Guinea	--
Haiti	Haiti is planning for an interoperable banking system. Currently regulations mandate that all POS, ATM, ATMs, payment cards and mobile payment phones must be compatible with the BRH payment processor (Simon, 2012c).
Honduras	Honduras reports that it offers a successfully interoperable POS network (World Bank, 2008).
India	In 2008, the National Payments Corporation of India (NPCI) created the immediate payment service (IMPS) using NPCI's platform, which links mobile phones to bank accounts and ATMS. In 2010, India launched RuPay card, which offers similar services as those offered by Visa or Mastercard but at a more affordable rate (The Economic Times, 2015).

Indonesia	As of 2013, Indonesia had plans to launch three interoperable ATM switches, which would also include POS networks (Shrader, 2013). Full interoperability exists for ATMs, but not for POS networks (World Bank, 2008b).
Kenya	The ubiquity of mobile money influences other interoperable payment schemes In Kenya. Between 2008 and 2012 M-Pesa partnered with Equity and Commercial Bank of Africa (CBA) to link mobile money withdrawals to ATM machines (not deposits) and some other mobile banking services, including savings and credit. The most notable of these services is M-Shwari, a joint venture between Safaricom and Commercial Bank of Africa. M-Pesa along with other mobile money service providers also allows participants to pay utility bills and housing payments with mobile money (Muthiora, 2015).
Lesotho	Three South African banks have their own ATM machine networks but have interoperable payment cards that are all Maestro- or Visa based and are EMV-compliant. However, the Lesotho Bank (LPB) does not have interoperable systems (Jeffris et al., 2014).
Liberia	--
Madagascar	Madagascar reports that it does not have interoperable ATMS and POS systems (World Bank, 2008b).
Malawi	In 2015, Malawi launched a national switch with assistance from the World Banks' Financial Sector Technical Assistance Program (FSTAP) in an effort to create interoperable payment systems in the country (Bankable Frontier Associates, 2015). Prior to this switch, the top banks in Malawi were interoperable through a private Visa network, and the bottom banks were interoperable through MALSWITCH. The new switch is planned to work independent from MALSWITCH and create a fully interoperable solution in Malawi (Dermish et al., 2012).
Malaysia	The Malaysian Electronic Payment System offers the Shared ATM network (SAN). In 2011, the network expanded, allowing nearly all account holders' access to any ATM through a single interoperable network (World Bank, 2013).
Mexico	Interoperable services are available for most ATMs and POS terminals (Maya Declaration, 2014; IFC, 2011a).
Mozambique	Mozambique is planning SIMO – a national switch – for free interbank transactions. VISA withdrawals and checks are interoperable through Bank of Mozambique. VISA deposits and bill payments are not interoperable. Interbancos is a non-bank multibank switch that include 8 out of 15 banks (Bankable Frontier Associates, 2012; Dias et al., 2012).
Myanmar	--
Namibia	Bank of Namibia has plans for an interoperable payment system, including EMV compliancy for ATMs, POS terminals, debit and credit cards (Bank of Namibia, 2010). As of 2014, Namclear launched an interoperable payment platform for retail and bulk payments, including checks, EFT, credit and debit cards and ATM (IT News Africa, 2014).
Nepal	Nepal has outlined plans in the country's Payment System Development Strategy for an interoperable payment system, which would include ATM and POS terminals. When the strategy was written there were no automated interbanking systems for retail transactions, although several commercial banks have invested in automated systems. (Nepal Rastra Bank, 2010).
Nicaragua	--

Nigeria	ATM and POS devices are interoperable in Nigeria and are all cleared through the national switch (NIBBS) (IFC, 2012).
Pakistan	In 2002, Pakistan mandated banks to connect to one of two switches (CGAP, 2012) Both of these switches are required to be interoperable with one another (CGAP, 2012; World Bank, 2010). Banks are also encouraged to comply with international standards for interoperability. POS interconnectivity and an automated clearinghouse is being planned (World Bank, 2010).
Papua New Guinea	--
Paraguay	Paraguay reports that it has interoperable ATMS and POS systems (World Bank, 2008). In 2014, the National Financial Inclusion Strategy for 2014-2018 included provisions for a Payments Working Group to focus on interoperability (Garcia Mora et al., 2014).
Peru	ATM networks have limited interoperability. Peruvian banks have been unable to agree upon a shared system (IFC, 2011c).
Philippines	Philippines offers fully interoperable ATMs. POS terminals are not interoperable (World Bank 2008b).
Rwanda	--
Senegal	--
Sierra Leone	ATMS are not interoperable, and there is limited use of checks and internet banking in Sierra Leone. There is no electronic bulk payment scheme (Firpo & Ngahu, 2012).
Sri Lanka	The Central Bank of Sri Lanka requires banks to connect to the interbank payment system (SLIPS), and is planning on expanding the capability to connect retailers to SLIPS (Stefanski, 2013). Overall, Sri Lankans have little access to electronic payment schemes, such as debit and credit cards, because of the lack of ATMs and POS devices (Di Castri, 2013).
South Africa	SASWITCH is the nation's banking switch (SOURCE). South Africa reports offering interoperable ATM and POS networks (World Bank, 2008b).
Swaziland	The Central Bank of Swaziland supports interoperable payment schemes for ATMs, payment cards, and POS terminals. These payment schemes are expected to comply with international standards for interoperability (Central Bank of Swaziland, 2010).
Tanzania	In Tanzania, there is one domestic card switch and several mobile payment aggregators. The Bank of Tanzania is in the process of establishing a clearinghouse for payments (International Finance Corporation, 2015).
Thailand	In 2006, the Bank of Thailand stated intentions in the country's Road Map for Thai Payment Systems of establishing an interoperable platform (ITMX) to facilitate inter-bank transactions, payments, and e-commerce. ITMX would include ATM, credit and debit transfers (Hataiseree & Pariwat, 2006). In 2008, Thailand reported to have an interoperable ATM network (World Bank, 2008b).
Uganda	Uganda reports having an interoperable POS network (World Bank, 2008b).
Zambia	Zambia has a national switch (Zamlink), but few banks participate in Zamlink rendering the system largely ineffective (Dermish, Dias, & Sanford, 2012).

Zimbabwe	ZimSwitch is privately owned company, established in 1994, that manages the inter-connectivity between ATMs and POS devices in the country. The Reserve Bank of Zimbabwe and ZimSwitch also offer the Zimbabawe Electronic Transfer and Settlement System (ZETTS). Zimbabwe also has Visa and MasterCard payment systems in the country. Hyperinflation has complicated national payment systems in Zimbabwe (Dermish, Dias, & Sanford, 2012).