

See discussions, stats, and author profiles for this publication at: <http://www.researchgate.net/publication/266657628>

# An introduction to mobile payments: market drivers, applications, and inhibitors

ARTICLE · JUNE 2014

DOI: 10.1145/2593902.2593921

---

READS

198

1 AUTHOR:



[Mark Sherman](#)

Carnegie Mellon University

29 PUBLICATIONS 195 CITATIONS

SEE PROFILE

# An Introduction to Mobile Payments: Market Drivers, Applications, and Inhibitors

Mark Sherman  
Software Engineering Institute  
Carnegie Mellon University  
4500 Fifth Avenue  
Pittsburgh, PA 15213  
United States  
412-268-7700  
msshernan@sei.cmu.edu

## ABSTRACT

This paper provides a market view of mobile payments. It starts with a discussion of the variety and growth of payments being made with mobile devices. The relationship between mobile payments and their core business drivers, mobile banking and mobile commerce, are explored. How mobile devices reduce costs, increase reach and enable omnichannel business processes are discussed. The disintermediating effect of mobile payments on existing payment processes is explored. Finally, a review of some of the inhibitors for mobile payments growth is considered.

## Categories and Subject Descriptors

K.4.4 [Electronic Commerce]: Digital cash, Distributed commercial transactions, Payment schemes

## General Terms

Economics, Human Factors

## Keywords

Mobile payments; mobile banking; mobile commerce

## 1. THE GROWTH OF MOBILE PAYMENTS

The growth in mobile payments is quite impressive. Mobile payments are expected to grow to over \$1.3 trillion worldwide by 2017, a growth of over 400% since 2012 [1]. Breaking down how mobile payments are being used gives some insight into the role of mobile devices as a payment vehicle. Figure 1 separates out the ways that payments are really being made [2,3]. The vast majority of mobile payments – \$726 billion in 2015 – are being used for purchases that appear on phone bills. Historically, this has included games, ring tones and screen savers. More recently, the ability to purchase other goods and services via a phone bill has been a driver in the growth of using a telecommunications company as a bill paying vehicle for mobile payments.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [Permissions@acm.org](mailto:Permissions@acm.org).

MOBILESoft'14, June 2–3, 2014, Hyderabad, India  
Copyright 2014 ACM 978-1-4503-2878-4/14/06...\$15.00  
<http://dx.doi.org/10.1145/2593902.2593921>

The next largest application of mobile payments – \$217 billion in 2015 – supports person-to-person payments. Part of this growth comes from the substitution of existing transfer services like Western Union with mobile payment systems offered by conventional banks and companies like Dwolla. A substantial amount of person-to-person payments has also come from the use of mobile payment systems as a substitute for cash, as seen in places like Kenya using M-PESA.

Merchant purchases using the mobile device as the payment device or through a mobile payment service is the third most popular application – about \$177 billion in 2015. An example is the use of PayPal from a mobile device to make purchases from an on-line commerce site. Some of the more highly publicized, other uses of mobile devices for payments, like Octopus in Hong Kong for transit tickets, represent a very small fraction of mobile purchases.

## 2. MOBILE PAYMENTS ARE ONE PART OF MOBILE MONEY

While mobile payments are rapidly growing, mobile payments are part of a larger change in commerce and payments. Worldwide GDP is growing at about 38% from 2010 to 2020. The total increase in payments, mobile and conventional, would be expected to grow at the same rate.

However, worldwide payments – trackable transactions as opposed to anonymous cash, gift card and barter transactions – are growing at about 140% during the same period [4]. This means that trackable transactions are being substituted for anonymous transactions. Mobile device ubiquity, having the ability to tie a transaction to a payer and recipient, is a leading vehicle for this conversion, especially in mostly cash-based economies.

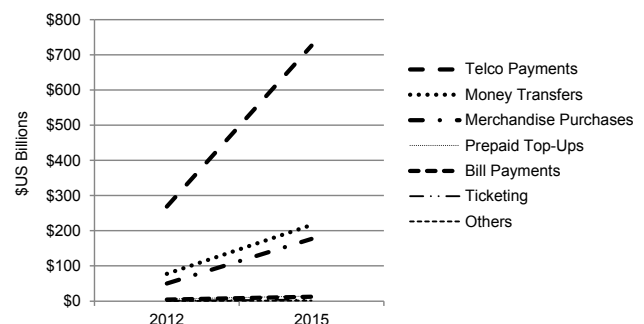


Figure 1. Growth in mobile payments

Mobile devices are rarely used solely as a substitute for a credit card or cash. Mobile payments exist in a payment, finance and commerce ecosystem that starts with mobile payments and mobile point-of-sale, but quickly expands to mobile commerce and mobile banking. In turn, these additional applications lead to mobile versions of bill payments, loyalty cards, receipts, coupons, tickets, entry and exit transit tracking, digital goods and microfinancing. Mobile payments are not offered in isolation but always include one or more of these other capabilities.

## 2.1 Mobile Banking

Mobile banking has become nearly ubiquitous. Over 75% of banks provide some kind of mobile banking capability to their customers [5]. Nearly 50% of smart phone owners used mobile banking in the last year, while nearly 30% of all mobile phone owners have used mobile banking in the last year [6]. Mobile banking has become so important to customers that a recent survey measured that 1 in 6 people who are switching banks did so because of a poor mobile banking experience [7].

## 2.2 Mobile Commerce

Mobile commerce is rapidly expanding along with mobile payments. As illustrated by the bars in Figure 2, mobile commerce is growing from about \$14 billion in 2011 to \$87 billion in 2017 [8]. Another significant trend shown by the line in Figure 2 is that mobile commerce is being substituted for electronic (PC-based) commerce. Mobile phones are playing substantial roles in the commerce experience beyond payments [6, 9]:

- 42% of smartphone users have used their phone to comparison shop at a retail store
- 32% have used it to scan a product’s barcode to find the best price for the item
- 64% of shoppers who use their phones to comparison shop in a retail store have changed where they purchased the product
- 75% of mobile shoppers take action after receiving a location based message

While the purchase is not made with the mobile phone, the mobile phone plays an important role in the entire commerce cycle.

## 2.3 Mobile Device Participation in Multichannel and Omnichannel Transactions

Support for mobile devices in banking, commerce and payments has evolved over time. Initially, mobile devices were an isolated

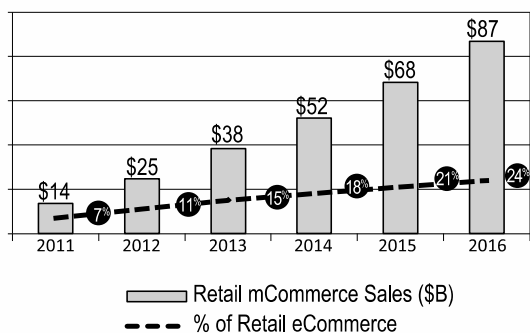


Figure 2. Growth in mobile commerce

means to accomplish some function with a bank or a merchant, such as to find an ATM or list store hours. Mobile devices became an additional channel to reach customers, albeit a channel with very limited capabilities. Over time, banks and merchants enriched their mobile application to provide a functional experience rivalling an online experience, and sometimes exceeding the online experience through exploitation of mobile-specific capabilities, such as location tracking and real-time offers. The ability to deliver bank or merchant services through a choice of an online application, a mobile application or a physical experience, is referred to as multichannel support.

Banks and merchants have grown beyond multichannel support. Initially, a complete transaction would be carried out within a single channel. A customer would peruse a merchant’s web site for a good, make a selection and pay on line, and a delivery service would bring the purchase. Today, because mobile devices are always within reach, they frequently play some role in a transaction. For example, a buyer checks the price of an item on their phone, purchases it on line, and collects the purchase in the physical store. In banking, customers can generate one-use codes on their mobile devices that can be used at an ATM to withdraw funds. According to one survey, 86% of shopping transactions start on one channel and use at least one other channel [10]. Similarly, 46% of all banking transactions use more than one channel to complete. A transaction that spans multiple channels is labelled an omnichannel transaction. Typical mobile applications that rely on matched back ends do not support the shared state needed for omnichannel applications.

## 3. MOTIVATIONS FOR MOBILE MONEY

The ultimate drivers behind mobile banking, mobile commerce and mobile payments are reduced expenses and increased revenues. Each is explored below.

### 3.1 Reduced Costs

Banks have several motivations for providing mobile banking and mobile payments. Beyond customer retention, banks can also improve the cost of providing services. As shown in Table 1, the cost for a simple transaction is over an order of magnitude less expensive when carried out over a mobile device than with a branch [11]. Even ATM transactions are 60% more expensive than a mobile transaction.

### 3.2 Increased Reach

Over 2.5 billion people in the world do not have a financial account of any kind [12]. Although 2.2 billion of these individuals live in the growing economies [18], nearly 20% of the US population is considered underbanked having only the most simple access to the financial system [6]. From the banks’ perspectives, these individuals represent a large pool of potential customers that they would like to reach.

Governments also want to expand access to financial services as a way to accelerate economic growth. Access to financial

Table 1. Transaction costs for different bank channels

Channel	Simple Transaction cost (US\$)
Branch	1.34
ATM	0.16
Call Center	0.13
Mobile	0.10

**Table 2. Importance of mobile banking to consumers**

Country	Important or very important
Brazil	60%
India	55%
China	46%
US	23%
Global average	33%

instruments, such as savings accounts, loans, insurance and demand (checking) account is an enabler of economic growth. Strictly cash based environments are more susceptible to physical theft and embezzlement. Lack of access to credit limits the ability to grow beyond current cash flow.

Against the backdrop of limited access to financial services is a nearly universal access to mobile devices. Of the 2.2 billion unbanked people in the growing economies, about 1.7 billion have a mobile phone [13]. Even within the United States, 90% of the underbanked have access to a mobile phone [6].

Financial access is desired not only by the banks and governments. Individuals recognize the opportunities that mobile banking and mobile payments can provide. Table 2 shows the great interest in having mobile banking in the growing economies where the cost of banking services through branches has limited access [14].

### 3.3 Omnichannel Transaction Capture

Omnichannel transactions are more easily consummated and can drive additional business for banks and merchants. With the easy access to mobile devices, customers will use them as part of their daily lives, including transactions. As a result, a significant number of transactions will be driven by the special capabilities that a mobile device adds to the omnichannel experience. Specifically, Gartner has predicted that \$85 billion of commerce will be driven by mobile and the back end analytics fed by mobile devices [15]. In banking, an Accenture study has concluded that the conversion rate for a financial service transaction doubles when supporting mobile as part of an omnichannel customer experience [16].

### 3.4 Transaction Fee Capture and Analytics

The current credit card industry has established a process by which payments are approved and distributed. There are a series of parties who aggregate and disaggregate bundles of payments as they flow from a merchant to the bank who loans the money to the purchaser. A simplified version of the process is illustrated in Figure 3.

Initially, the cardholder presents a card to the merchant for the purchase. The merchant takes all of the transactions made, bundles them together and sends them to an acquirer, sometimes called a merchant bank. The acquirer receives bundles of purchases from many merchants. The acquirer separates the transactions into different card networks. The card network collects bundles of transactions from acquirers and separates them into bundles to be processed by the banks that issued the credit card.

The issuer, card network and acquirer receive two benefits in this process. First, each party takes a fee for performing its part of the process. Second, each party collects data about the transactions which are aggregated and sold. They sell the aggregated data to

other participants who use the data to gain insight into industry trends and compare their performance.

Mobile payments offer an opportunity to disintermediate existing payments processing participants. This is a core driving motivation behind many mobile payment providers and telecommunication providers. A simplified version of the revised process is shown in Figure 4.

A mobile payment account holder presents their account information to the merchant. The merchant presents this information to the mobile payment provider instead of an acquirer. To process the purchase, the mobile payment provider need not move funds from one institution to another. The total funds involved are unchanged – the sum of the accounts of the merchant and its customer are invariant. Only updates to internal account records for the merchant and its customer are performed within the mobile payment provider.

There are a variety of details that have been omitted which complicate the process:

- There needs to be a way to get cash in and out of the system.
- There needs to be a way to extend credit when an account does not have sufficient funds to perform a transaction.
- There needs to be a way to connect with existing payment systems for when either merchant or its customer do not have an account with the mobile payment provider.

Despite these complications, the lucrative nature of the change is driving the tremendous growth of organizations like PayPal and the rapid rise of telecommunications billing as the leading mobile payment processing scenario.

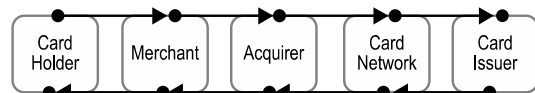
## 4. INHIBITORS

While the projections of growth are impressive and the current adoption seems to be accelerating, there are numerous barriers that need to be addressed for mobile money to meet all of its potential.

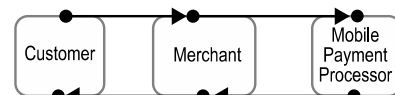
### 4.1 Authentication

A core issue for reliable mobile payments is authentication. Merchants and banks need assurance that the party at the mobile end of a transaction is who they appear to be. Three general strategies have emerged to improve authentication.

First, the use of authentication technology used by other payment processes is being promoted. One example is EMV, implemented in mobile devices through NFC. The experience with the EMV technology has provided a risk profile that banks and merchants have been able to accept. Second, multifactor authentication is being developed. Specifically there is work looking at how to incorporate various kinds of biometrics into the authentication



**Figure 3. Conventional credit card processing**



**Figure 4. Mobile payment processing**

process, such as voice identification, iris scans, gesture recognition and finger print analysis. Third, there is deployment of back end analytic identification prediction, sometimes called continuous authentication or frictionless authentication.

## 4.2 Commercial Infrastructure

Though NFC has been popularized, the technology is not ubiquitous enough to be relied on. First, many phones do not support NFC, notably feature phones and iPhones. Second, most point of sale devices throughout the world are not enabled to accept NFC signals. Third, there is a commercial battle among merchants, card issuers and telecommunication companies for control of the secure element which is used by NFC.

## 4.3 Regulations

The regulatory agencies have not kept up with the growth in mobile payment processing. At one extreme, some regulatory bodies have decided to let mobile payments go largely unregulated. This strategy was implemented in Kenya in the roll out of M-PESA and helped the rapid uptake of M-PESA. The other extreme is to place the entire collection of banking and financial service regulations on any new entrant in the mobile payments space. This is the approach being used in India. No consensus exists on the appropriate compromise.

## 4.4 Cash Endpoints

One of the biggest challenges in implementing a mobile payment system is providing a way to deposit and withdraw cash from an account. Mobile phone operators already have a network of offices that accept cash. In India, the role of a “business correspondent” acts as an independent agent who can perform the cash-in or cash-out function for a set of banks and mobile payment operators.

In the United States, those with bank accounts can move funds between a mobile payment account and a conventional bank account. Another approach is being implemented by retailers to exploit an existing physical infrastructure – specifically using store cash registers as tellers.

## 5. SUMMARY

The ubiquity of mobile devices has enabled the application of mobile technology to payment processing. Mobile payments are rapidly growing throughout the world. Mobile payments do not stand alone but are integrated with mobile banking and mobile commerce called mobile money. Mobile money is improving the efficiency of banking, enriching the buying experience and empowering the unbanked to increase their participation in worldwide economic growth. Despite historic growth and notable successes, technological, regulatory and cash infrastructures can limit the introduction and expansion of mobile money.

## 6. ACKNOWLEDGMENTS

This material is based upon work funded and supported by the Department of Defense under Contract No. FA8721-05-C-0003 with Carnegie Mellon University for the operation of the Software Engineering Institute, a federally funded research and

development center. Parts of this material is based on work funded by IBM. References herein to any specific commercial product, process, or service by trade name, trade mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by IBM, Carnegie Mellon University or its Software Engineering Institute. This material has been approved for public release and unlimited distribution. Carnegie Mellon® and CERT® are registered marks of Carnegie Mellon University. DM-0000916

## 7. REFERENCES

- [1] Juniper Research, “Mobile Payment – Check It Out” (August 2012), p. 3.
- [2] Portio Research, “Mobile Payments 2012-2016 Analysis and Forecasts for the Worldwide Market for Mobile Payment Services, Including NFC Technology”, 2011.
- [3] Gartner Forecast, “Mobile Payments, Worldwide, 2008-2015” (May 12, 2011)
- [4] Grealish, Mohr, Rutstein, Schwarz, Storz and Urban, “Winning After the Storm - Global Payments 2011,” Boston Consulting Group (February 2011) p. 30.
- [5] Stephen Greer and Bart Narter, “What App, Doc: An Updated Biannual Evaluation of Mobile Banking at the Top US Banks,” Celent (January 18, 2013) p. 5.
- [6] Board of Governors of the Federal Reserve System, “Consumer and Mobile Financial Services 2013” (March 2013) p. 1-2.
- [7] Google, “Mobile Banking Trends” (October 2012) p. 2.
- [8] eMarketer Press Release, “Tablets, Smartphones Drive Mobile Commerce to Record Heights” (January 9, 2013).
- [9] JiWire, “Mobile Audience Insights Report” (Q42011).
- [10] Google, “The New Multi-screen World: Understanding Cross-platform Consumer Behavior” (August 2012).
- [11] Sybase, “Business Case for Mobile Banking” (2010) p. 8.
- [12] Demirguc-kunt and Klapper, “Measuring Financial Inclusion,” World Bank (April 2012) p. 2.
- [13] Christopher P. Beshouri and Jon Gravrák, “Capturing the Promise of Mobile Banking in Emerging Markets,” McKinsey Quarterly, (February 2010) p. 2.
- [14] Datamonitor FSCI survey (June 2010).
- [15] Gartner, “Context-Aware Computing Industry Heat Map” (March 2011).
- [16] Accenture, “Banking 2016” (2012).
- [17] Innovation Observatory, “Billing and Payments for Online Content” (October 2011).
- [18] Alberto Chaia, Aparna Dalal, Tony Goland, Maria Jose Gonzalez, Jonathan Morduch, Robert Schiff, “Half the World is Unbanked,” Financial Access Initiative Framing Note (October 2009).