Mobile Banking for the Unbanked Poor without Mobile Phones: Comparing Three Innovative Mobile Banking Services in India

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Abstract

Mobile banking has created a new channel to reach over 2.5 billion unbanked poor in developing countries. Conventional mobile banking services require clients to be able to own a mobile phone and know how to operate it. However, a majority of the unbanked poor in developing countries are illiterate or semi-literate earning fluctuating incomes, often less than USD2.00 a day, and live in remote rural areas without reliable technology infrastructure. We evaluate three companies providing innovative mobile banking services, ZERO, FINO, and ESE, which do not require the poor to own a mobile phone or know how to operate it. All three companies employ human agents equipped with combinations of mobile technologies like NFC and smart cards, who meet the poor in their villages to conduct financial transactions. We reflect on the economic impact, market opportunity, and other issues related to innovative mobile banking services in the concluding section.

1. Introduction

Most commercial banks do not serve the poor, especially in remote locations in rural areas of developing countries, for several reasons: high cost of establishing a rural financial network, tiny profits from a small loan or savings account with a small balance, and inability of poor people to furnish collateral to secure a loan and/or complete the paperwork. As a result, three quarters of the world’s poor earning less than USD2.00 a day do not have a bank account according to a study released in April 2012 by the World Bank [1]. More than half of the population in developing countries is unbanked compared to just 10% in developed economies. A 2009 study by the Consultative Group to Assist the Poor (CGAP), a donor consortium affiliated to the World Bank, found that there were only 8 bank branches per 100,000 adults in developing countries compared to 24 in developed countries. For instance, although India has the fourth largest banking infrastructure in the world, 94% of its 600,000 odd villages do not have a single branch leaving 120 million households without access to a bank.

In the last decade, branchless banking emerged as a viable alternative in developing countries where banks deploy last-mile technologies to serve the unbanked poor through two distinct avenues. One is through ATM networks and point-of-sale (POS) devices such as bank card readers at retail outlets, both of which require customers to travel to the location for financial transactions (e.g., Prodem ATMs in rural Bolivia). The other avenue uses mobile technologies for mobile banking which does not require customers to travel to branches.

The phenomenal growth of mobile phones in the developing world paved the way for mobile banking, a new channel to reach the more than 2.5 billion unbanked poor in developing countries. As of 2013, 123 mobile banking services were operational worldwide of which 27 were launched in 2013 alone [2]. Currently, conventional mobile banking services such as M-Pesa in Kenya, Wizzit in South Africa, and G-Cash in Philippines dominate the mobile banking landscape. An inherent requirement for customers to use conventional mobile banking services is ownership of a mobile phone along with the ability to operate it. Both of these requirements pose barriers for using mobile banking. The poor, who earn fluctuating incomes, often less than USD2.00 a day, may not be able to pay for a mobile phone, or make repayments for the phone purchased on installments, or be able to pay the recurring phone bills. For instance, the high cost of a mobile phone in India, USD25.00, is well beyond the reach of the 490 million people living below the poverty line of USD1.25 a day. Further, a majority of the unbanked poor in developing countries are illiterate or semi-literate, and live in remote rural areas without reliable technology infrastructure, which hamper the use of mobile banking. Barriers to ownership of mobile phones and operating them have been documented by other studies as a major obstacle for ongoing usage of
mobile banking services by the unbanked poor [2].

We distinguish two options for mobile banking that we have labelled “Conventional Mobile Banking” and “Innovative Mobile Banking.” Our paper focuses on innovative mobile banking services that do not require the poor to own a mobile phone or be able to operate it. The targeted segment for the paper is identified in Figure 1.

Figure 1. Customers Served by Innovative Mobile Banking

We evaluate three companies, ZERO, FINO, and ESE, which employ human agents equipped with combinations of mobile technologies like NFC and smart cards, to meet the poor in their villages to conduct financial transactions. Our secondary research indicates that these three companies are the only ones operating in the category of innovative mobile banking services.

Two research questions are addressed in this paper:

- How do ZERO, FINO, and ESE serve the unbanked poor who do not own a mobile phone or know how to operate it?
- What are the differences in the business models of the three companies?

The findings can inform both conventional and innovative mobile banking services to better serve billions of poor in developing countries.

The paper is organized as follows. The second section synthesizes the major barriers to use conventional mobile banking services in developing countries. The third section presents the lens for evaluating ZERO, FINO, and ESE, which we drew from the business process management literature. The fourth section presents our methodology and the comparative evaluation of the business models of the three companies. The fifth section discusses implementation challenges for innovative mobile banking services and how they were handled by the three companies. We reflect in the last section on several issues related to innovative mobile banking services, including the economic impact and market opportunity for such services.

2. Barriers to conventional mobile banking in developing countries

Mobile banking requires customers to be digitally and financially literate. Hence it is very likely that the illiterate or semi-literate poor may not use the services even after initial adoption, or use them only intermittently. The adoption and ongoing usage of mobile banking services depends on how the various barriers are addressed.

The unbanked poor in developing countries face a multitude of financial, technological, human-computer-interaction-related, and psychological barriers for using conventional mobile banking services.

Financial barriers stem from the low income levels of the unbanked poor. Technological barriers arise from a lack of 24/7 electricity supply. Mobile phones cannot be charged or used whenever desired. Inconsistent mobile signal strength also limits the ability of customers to use mobile phones anywhere anytime.

Several challenges related to human-computer-interaction (HCI) affect the use of mobile banking services:

- Mobile user interfaces in a foreign language like English are compounded by lack of experience in working with complex menu sequences on a small screen and tiny buttons. Inconsistencies in locations and logos of menu items and sub-items required to access mobile banking services deprive illiterate or semi-literate customers to derive the benefits of mobile banking right from their initial adoption. The learning curve for using the interface of a mobile phone and a mobile banking application has to be factored as a pre-requisite for overcoming this barrier [3].
- Another HCI problem: account numbers of mobile banking services are not displayed on the exterior (widget) of mobile phones. If the mobile phone is password protected, customers may find it difficult to retrieve account information since they had forgotten their passwords [4].
- The user interfaces of mobile banking services change rapidly due to fierce competition in the mobile phone industry, dynamic standards of network technology, and infrastructure differences
across the globe [5]. The poor may find it difficult to cope with these changes.

Psychological barriers related to poor customers, especially women and senior citizens, lacking confidence to operate their device for using mobile banking services. Even if customers own mobile phones, they may not be able to conduct electronic transactions on their own. Another potential problem is the inability of the poor customer to resolve minor technical issues when they use mobile phones, which may inhibit them from using the full range of mobile banking services. Poor customers may not also be financially literate to use mobile banking services on their own. These barriers can be overcome through a human agent to help poor customers conduct banking transactions. The human agent could also reassure the poor customer that their system was secure and safe to use [6].

3. Lens for evaluating the business models of ZERO, FINO, and ESE

We propose a lens based on three components informed by the literature on business process management – People, Process, and Technology.

People and Process are critical for improving or transforming a business process to respond to market pressures. Technology is the means for achieving this transformation. However, technology alone will not be effective if it automates a bad business process. We adapted the three components for branchless banking as follows:

- **The People Component**: Three players have to be distinguished in this category: Customer, Human Agent, and Bank.
- **The Process Component**: The three companies deploy door-step banking which requires human agents to visit the poor customers in remote areas instead of them having to come to the branch.
- **The Technology Component**: It is the specific combination of mobile technologies used by each company such as biometric identification, RFID, Near Field Communication (NFC), magstripe cards, mobile phones, PDAs, and smart cards.

Mobile banking is a dynamic industry in developing countries. The supply side consists of players like banks, mobile network operators, mobile handset manufacturers, government regulators and policy makers, whereas the demand side is influenced by the needs of the unbanked poor. Rapid advances in mobile devices, interface technologies, application and software development, and telecommunication and security standards, enable the supply side to meet the needs of the poor for a range of financial services, including insurance, domestic and international remittance, and bill payment. We limited our comparative evaluation of the three companies to People and Process, which are instrumental in improving or transforming a business process to respond to market pressures. We also considered Technology as the third component of our lens since it is the means for achieving the required business transformation.

4. Comparative evaluation of ZERO, FINO, and ESE

Our analysis is based on a wealth of data points generated from multiple sources, including annual reports, case studies, and websites of the three companies. The business models of the three companies were compared by coding the data points we had collected using the three components of our lens: People, Process, and Technology.

We examined barriers to conventional mobile banking services from studies published by the World Bank, United Nations, IEEE, GSMA, and over 40 peer-reviewed journals in development, information science, and information systems.

4.1. Vignettes of the business models

ZERO, is a platform developed by A Little World (ALW) in 2006 by leveraging Near Field Communication (NFC) mobile phones, contact-less RFID smart cards, and an integrated biometric authentication system with a printer. The NFC-enabled mobile phone, which was developed by NXP Semiconductors, formerly a division of Phillips Electronics in Europe, is connected to a transaction server at the back-end which updates the customer's and the bank’s books, in effect replacing a bank branch by a “bank-in-a-box”. Lack of power is not an impediment as the device works on a battery that can be charged using a solar panel. Internet connectivity is also not required for enrolling customers or carrying out transactions. The human agents of ALW recruited from local areas meet the customers at a central location in the village to assist them in conducting banking transactions. ALW named this innovation ZERO because the number zero was believed to have been invented by the Indian mathematician, Aryabhatta, in the sixth century.

The key components of ZERO operate as follows:

- Mobile phone acts as a core bank branch.
- Mobile phone is used for opening accounts on the spot by local human agents.
- Biometric identification requires a customer to...
press his/her thumb on the black glass surface at the bottom of the mobile printer to authenticate the customer.

- A confirmation slip is generated from the mobile printer at the end of each transaction.

The graphic in Figure 2 shows the ZERO Platform Kit and Smart ID.

![ZERO Platform Kit and Smart ID](image)

ZERO established a partnership with India’s leading bank, State Bank of India (SBI), for acting as an intermediary with the poor customers. A variety of banking services is available to its customers: electronic payments from the government’s social security program and welfare schemes; disbursement of loans and collection of loan installments; and, third-party collections such as payments for utilities, mobile recharge, and deposits for purchase of fuel, fertilizers, and other products. The use of the ZERO Platform has grown to cover all the states in India since its launch in 2006.

Financial Inclusion Network & Operations (FINO) employs a point-of-transaction (POT) terminal equipped with a fingerprint reader, a receipt printer, and a SIM card port for communication over mobile networks. FINO established a partnership with SBI and other leading banks in India to offer a full range of banking services. FINO has also tapped opportunities in non-financial businesses such as mobile recharge, rail/bus ticket booking, collection of insurance premiums and utility bill payments. Its core banking system at the backend can be connected to the frontend for generating reports required by government and funding agencies. FINO also has a dashboard at headquarters to monitor the performance and incentivize/reward local human agents. Since its founding in 2006, it has become the market leader in India with a pan-India presence in 25 states.

FINO’s human agents are also recruited from the local area they serve, and go to the door-step of the poor for conducting financial transactions (See Figure 3). Door-step service to the customer is a benefit in contrast to ZERO which requires the poor customer to come to a specific location in the village. An additional cost for FINO to provide door-step service is the need for a smart card costing USD2.70 for each customer.

![A FINO Agent Providing Service to a Rural Customer](image)

The third company, Electronic Services Everywhere (ESE), exemplifies a different type of innovation with a significant advantage over ZERO and FINO. It can be deployed in remote rural areas with severely limited bandwidths. ESE was launched by SourceTrace Systems, a company based in the US, in April 2006, with offices in India and Costa Rica. The Soros Economic Development Fund provided seed capital of USD1.8 million because the ESE platform enabled banks to reach the unbanked poor at a much lower cost than a branch, and expand their geographic reach to cover larger numbers of the poor. The ESE Platform is composed of six components: remote software, Java 2 Enterprise Edition (J2EE) enterprise server software, global dashboard software, back-office software, which is a hosted ASP solution, a management console, and a mobile designer compatible with smart cards. ESE’s secure, scalable, turnkey middleware utilizes POS devices and wireless handsets over existing low-bandwidth networks. The ESE technology may be characterized as “complex simplicity” where the system has millions of lines of code but its simple-to-use user interface was developed for human agents hired from the low-income communities they serve. These agents are walking ATM machines, who visit the poor in their communities, reducing the transaction cost for banks.

Based on the proven ability of the ESE Platform for rural banking operations in Latin America and Africa, the World Bank selected it in 2009 for its first-ever effort to assist India’s rural banks in partnership with India’s National Bank for Agriculture and Rural Development.

ESE has a dashboard for reporting the performance
of banks serving poor customers in remote rural areas to the central bank of the country, a feature not available in ZERO and FINO. ESE also facilitates the use of PDAs in addition to mobile phones, another advantage compared to ZERO and FINO. This feature is valuable for businesses whose human agents use PDAs to transact sales and transmit the information to the branch office seamlessly and connect with the back-office without any human intervention. ESE is hence able to support the non-financial service industry such as pharmaceuticals and agricultural equipment and multinational companies which see growth opportunities in rural markets of developing countries.

4.2. Evaluation of the People component

The People component involves three players: customers, human agents, and banks. The roles of these three players in the three companies are described below.

- Customers: They are the unbanked poor in rural areas for all three companies. ESE has the additional feature of being able to reach poor customers in rural areas with severely limited bandwidth.

- Human Agents: In the case of ZERO, customers come to a central location in a village to get assistance from two women, who are recruited with the help of local authorities. FINO and ESE recruit human agents from the local areas they serve, and meet customers at their doorstep, which is more convenient for customers than ZERO where the poor have to come to a central location in the village.

- Banks: Banks offer a full suite of financial services to the poor through the human agents of ZERO, or FINO, or ESE.

4.3. Evaluation of the Process component

The Process component involves three activities:

- Register the customer
- Train the human agents, and
- Serve the customer

Table 1 evaluates the way in which these activities are carried out by the three companies.

<table>
<thead>
<tr>
<th>Activities in the Process</th>
<th>ZERO</th>
<th>FINO</th>
<th>ESE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register the Customer</td>
<td>Hand impression of six out</td>
<td>Similar to that of ZERO</td>
<td>Thumb impression of a</td>
</tr>
<tr>
<td>Train the Human Agents</td>
<td>Three-day training for the women for enrolling customers, followed by training for two days for conducting financial transactions</td>
<td>Agents are trained in groups for one full day, followed by two training sessions a month</td>
<td>No data available</td>
</tr>
<tr>
<td>Serve the Customer</td>
<td>Service provided at a central location in a village</td>
<td>At the door-step of the customer</td>
<td>At the door-step of the customer</td>
</tr>
</tbody>
</table>

4.4. Evaluation of the Technology component

We evaluate the combinations of mobile technologies used by the three companies in terms of specific features listed in Table 2 below.

<table>
<thead>
<tr>
<th>Type of Tech.</th>
<th>ZERO</th>
<th>FINO</th>
<th>ESE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC-enabled mobile phone, contactless RFID smart card, biometric scanner, and transaction server</td>
<td>Ingenico’s BIO930G wireless handheld terminal, RFID smart card, biometric scanner, and transaction server</td>
<td>Remote software, enterprise server software, global dashboard software, back-office software, a mgmt.</td>
<td></td>
</tr>
<tr>
<td>Cost of Platform</td>
<td>server</td>
<td>console, and a mobile designer</td>
<td>Not available</td>
</tr>
<tr>
<td>------------------</td>
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<td>--------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Type of Smart Cards</td>
<td>Contact-less RFID smart cards with 4GB memory required only for payments</td>
<td>Java-enabled smart card with 32K memory</td>
<td>Java-enabled contact and contactless smart cards</td>
</tr>
<tr>
<td>Appln. of Smart Card</td>
<td>To verify photo and 9-digit ID number for each financial transaction – smart card not required to identify customers</td>
<td>To verify ID for each financial transaction – serves as a passbook and/or deposit card</td>
<td>To verify ID for each financial transaction Smart card is like a credit card to facilitate all financial transactions</td>
</tr>
<tr>
<td>Method of biometric ID</td>
<td>Impression of six out of 10 fingers, photo, ID number, and voice of a customer</td>
<td>Impression of 10 fingers of a customer</td>
<td>Thumb impression of a customer</td>
</tr>
<tr>
<td>Voice prompt</td>
<td>Required for registering customers and conducting transactions</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>Mobile data service</td>
<td>General Packet Radio Service (GPRS), known as 2.5G Technology, backs up on an hourly</td>
<td>Protocols of Global Systems for Mobile Communications (GSM) – 2G and 3G</td>
<td>3G</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to work with low bandwidth?</th>
<th>No</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Storage basis</td>
<td>NFC-enabled mobile phone can store data for all customers in a village like a bank branch</td>
<td>Smart card with customer and transaction server</td>
<td>Smart card with customer and transaction server</td>
</tr>
<tr>
<td>Fraud detection alert?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Security Standard</td>
<td>Not available</td>
<td>SSL, and HTTPS</td>
<td>SSL3 and 3DES ECB</td>
</tr>
</tbody>
</table>

### 5. Implementation challenges for innovative mobile banking services

Some of the implementation challenges arise from poor customers not trusting new technologies or their financial illiteracy. We confine our discussion in this section to five issues relating to technology and HCI, and how each issue was handled by ZERO, FINO, and ESE.

1. **Authentication of Poor Customers**: Biometric identification is a necessity for authenticating poor customers. A major challenge in using biometric technologies is, for example, day-to-day variations in face. It could look different depending on the expression, and lighting and could also change over time, if, for example, a person grows a beard. Another factor is that the sound of a voice could be different, if, for example, the customer has a sore throat [9]. ZERO, FINO, and ESE rely on fingerprints of customers to authenticate their identity, which is one of the most reliable authentication techniques in the world. For instance, false match (acceptance) rate and false non-match (rejection) rate is typically less than 0.01 and 0.06 percent for a fingerprint-based biometric authentication device [10]. These false match and non-match rates are the least among all other biometric authentication techniques.

2. **Hardware Issues for the Mobile devices carried by Human Agents**: Applications using mobile devices are subject to the inherent limitations of hardware such as low-power processing, a fixed-point
architecture, and limited memory [9]. ZERO, FINO, and ESE suffer from these hardware issues which restrict the human agents to serve only a limited number of poor customers at a time.

3. Security Issues Related to Mobile devices of Human Agents: The mobile devices carried by human agents for door-step banking can be lost or stolen. Another risk relates to the passwords for accessing the mobile devices and for running the application on the devices. The human agents of ZERO, FINO, and ESE are vulnerable to these security issues.

4. Security Risk for Customer Data Stored on Smart Card: Customer data stored on contactless RFID smart card can be compromised since data can be read by an RFID antenna. Smart cards used by ZERO, FINO, and ESE deploy passive RFID tags which can be read by only active RFID antennas paired with the tags.

5. Multilingual Requirement for User Interface of the Human Agents’ Mobile phone: The user interface of the mobile phones used by the human agent cannot be only in the English language. In India, the languages vary according to the state, which requires the user interface to be multilingual. However, due to the additional cost for developing multilingual versions, the interfaces of mobile phones used by the human agents of ZERO, FINO, and ESE are in English. The three companies are hence forced to recruit human agents, who are literate in English.

6. Our reflections on innovative mobile banking services

Innovative mobile banking services are targeted at poor unbanked customers who do not own a mobile phone or are able to operate it on their own. We present our reflections under the following heads:

- Economic impact
- Market opportunity
- Value of door-step banking
- Trusting human agents
- Potential value of human agents
- Whither innovative mobile banking services

6.1 Economic impact

Access to finance is a pre-requisite for economic development. An empirical study established a positive correlation between an index to measure access to finance in 160 countries and economic development [11]. Over 2.5 billion adults representing more than half of the world’s working adults are excluded from the formal financial sector [12]. The UN study cited earlier pointed out that more than 80% of the unbanked adults live in the developing world and earn less than USD2.00 a day. In the absence of banking services, these poor people are forced to rely on informal financial sources such as local land owners and moneylenders, who charge usurious interest rates as high as 100% to 400% a year. The unbanked poor are hence forced into a vicious cycle of debt. Failure to pay rising debts has led to suicide among the poor borrowers. The high suicide rate among small farmers, the backbone of the agrarian economy in India, is a serious challenge for the country [13].

6.2 Market opportunity

Both ZERO and FINO have been used for non-banking operations to facilitate third-party collections, including payment of utility bills, mobile recharge, and rail/bus ticket booking. FINO also added a new application called “FINO Dairy Card”, which demonstrates the extensibility of the FINO Platform to serve the dairy industry through a “last mile” technology solution. A farmer who supplies milk to the Dairy or the “Pourer” is given a smart card that records the quantity supplied to the Dairy and the payment received. FINO’s integrated technology solution connects the Pourers with the Dairy and the bank, thus benefitting all the stakeholders in the process. In particular, the Pourer gets a good price for the milk supplied, quick and correct payment, and loans for running his business. Evidence for the replicability of the ESE platform is its implementation in the non-financial services industry. The ESE Platform enables use of PDAs in addition to mobile phones for communicating sales transactions from field-sales officers, and connects with the back office without any human intervention. This unique feature of the ESE Platform makes it feasible for companies in the non-financial services industry to use it.

The market opportunity for providing financial services to the unbanked poor in developing countries is significant. A 2007 study by World Resources Institute, a non-profit arm of the International Finance Corporation, pointed out that: “The 4 billion people living at the base of the pyramid (BOP) – all those with incomes below $3,000 in local purchasing power – live in relative poverty…Yet together they have substantial purchasing power; the BOP constitutes a $5 trillion global consumer market” [14].

There is a significant latent market opportunity for such IT innovations to serve the unbanked poor in developing countries. IT professionals would do well to tap the market in developing countries because they
“are high-growth….and they have lower competition. BOP markets represent the next frontier for IT” [15].

6.3. Value of door-step banking

FINO and ESE serve the unbanked poor at their door step unlike ZERO which requires the poor to come to a central location in a village. A majority of these poor customers in developing countries are engaged in agrarian activities that keep them working on farms, away from their homes for almost the entire day. Daily wage earners including farm labor cannot afford to miss their work and take a break to visit a bank branch or a central location in their village as required by ZERO. Also, they could end up wasting their work-time in a long queue at the bank branch or the central location in a village. In contrast, door-step banking helps customers by serving them at a convenient location and time, a valuable service for these poor people.

6.4. Trusting human agents

ZERO, FINO, and ESE have to recruit, train, and retain a sales force of human agents to assist poor customers in conducting financial transactions. Trust is a major factor affecting the relationship between the poor customer and the human agent. This problem is alleviated by recruiting local agents, who should be literate in English for handling the interface of the application, to assist the poor in conducting banking transactions. Female agents are perceived to be more punctual, sincere, honest, and trustworthy than male agents, a point that ZERO has considered in its recruiting policy.

6.5. Potential value of human agents

Human agents are an additional player in the business models of ZERO, FINO, and ESE, compared to the business models of conventional mobile banking services. The agents could create a competitive advantage since customer acquisition and retention in mobile banking is far more challenging and sophisticated than traditional banking [2]. Human agents recruited from the same village as that of customers are likely to attract more unbanked poor customers, who could remain loyal to the company depending on the level of trust developed by the human agents with the illiterate or semi-literate customers.

6.6. Whither innovative mobile banking services

The market opportunity and size of mobile banking market will fuel technological advances such as increased computational power of mobile devices, CPU speed, memory size, storage capacity, and network speed. The HCI will also be facilitated by innovations in mobile user interfaces to better serve billions of poor customers in developing countries [16].

Our lens for assessing innovative mobile banking services could also be expanded with Information as the fourth component in addition to People, Process, and Technology. The mobile banking service should provide actionable information of value to customers. The addition of the Information component to the lens would enhance the evaluation of companies providing innovative mobile banking services.

7. References


