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Authors

Mesfin, Woldmariam F.
Atnafu, Solomon
Ghinea, Gheorghita

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OPEN AIR MARKET AND MOBILE MONEY INFORMATION SYSTEM REQUIREMENTS

Woldmariam F Mesfin, Solomon Atnafu
IT PhD Program

Addis Ababa University,

Addis Ababa, Ethiopia
mesfinfw@gmail.com, satnafu@gmail.com

Gheorghita Ghinea,

School of Information Systems, Computing & Mathematics,
Brunel University, UK
george.ghinea@brunel.ac.uk

Abstract -existing mobile money architectures overlooked value storage and everyday money practices of individuals. They mainly deal with payment related issues and procedures based on bank accounts. They also targeted urban people, who have banking and technology know-how. Based on this knowledge gap, this research intends to explore, analyze, and identify design concepts for mobile money information system development that can support rural communities in developing countries who transact in open air market. Majority of our study population cannot write and read even their names; they identify currency notes based on color and size not based on values written on them, which raises the question how could such illiterate rural individuals transact in electronic payment ecosystem. In this context, the purpose of this study is to thoroughly analyze and understand the characteristic nature of cash transactions and usage scenarios among study participants in open air market and identify design concepts and provoke discussions on this issue. Methodologically, we used qualitative methods, where data is collected through observation, discussions, and interview with key market participants and the data is documented through photograph and video. We found that almost all merchants: (1) use color of currencies to identify one from the other, (2) some merchants want to merge their sells while some want to keep their daily, (3) due to their transaction practices, merchants have many problems and make many errors and mistakes, (4) merchants who have no formal education expressed that they would like to have devices that operate by sound, and (5) sellers & buyers set prices of certain items through negotiation. The output of this study contributes towards the development of cashless transaction based on mobile phones.

Keywords- open air market, mobile money, cashlessness, smart society, mobile information systems, mobile payments

I.   INTRODUCTION

The rapid growth and penetration of mobile phone technologies in developing countries have attracted the attention of many telecommunication companies, development and aid NGOs like (DFID), World Bank's International Finance Corporation (IFC), Consultative Group to Assist the Poor (CGAP), Bill & Melinda Gates Foundation, Innovation for Poverty Action (IPA), research centers like the Institute for Money, Technology, & Financial Inclusion (IMTFI), and governments in hope of providing an alternative means to enable the rural community access financial services. These organizations are urging IT firms to design mobile devices that are capable of acting like piggy banks or full-fledged saving accounts, which require the integration of mobile money systems into consumers' economic live [1].

Following developments in mobile technologies on one hand and financial service problems on the other hand, individuals of developing countries started to link their monetary practices to new technologies in new and innovative ways [2] [3]. For example the success of mobile money systems, like GCASH in Philippines and M-PESA in Kenya, can clearly indicate the future success of mobile money. This revolution signifies a transformation in which money becomes gradually less material and increasingly digital [2] [4] [5], (http://futureofmoney.com) and societies are turning towards cashless [6]. With this transformation, the need for personal information systems to manage everyday transactions arise [7]. But as of to date, researchers and designers have not yet developed concrete framework and strategies for designing in this space [3] [8].

In general there are no standardized mobile information system development guidelines, models, or frameworks that developers and researchers can use [9] [10] [11]. In addition to the lack of study methodologies for mobile money information systems, there are lack of studies that link everyday money practices with mobile system design. For example, from an analysis of 43 research papers (about need/requirement assessments, design of systems, adoption and adaptation, and impact assessment) of mobile financial inclusion by [12], only one study directly addressed the assessment of financial needs in the areas of mobile money.

In rural areas (where there is problem of electricity and lack of financial services), the use of automatic teller machine (ATM) and agent network business model do not look feasible[1]. ATM requires electricity, filling it with cash everyday is impractical as rural individuals live in scattered manner, and thefts and robbers of ATM are problematic too. Using agent network business model has problems like (1)

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[1]   [1] www.mobileactive.org/mkesh. Retrieved on November 22, 2011.

liquidity (http://www1.ifc.org), (2) it requires ubiquitous telecommunication infrastructure (which is a problem in developing countries). As transactions in open air market require face-to-face, and due to the above problems, we need to research for a new business model that enable people transact digitally without the need for reconverting digital money into paper and coin, like M-PESA is doing this days. To do this, it is essential to understand the monetary practices of individuals who live in a cash economy and make almost all their purchases in open air markets. And then critically analyze, if electronic payment systems are to replace currency objects like coins and notes, and then what should be the functionalities of such system?

The rest of this paper is organized as follows: section two (related works) briefly summaries major research works in the areas of mobile payment architectures and identifies the research gap, section three deals with the methods used to collect data and settings of research sites, section four outlines and discuss key findings relevant for the design of mobile money information system, section five summarizes the possible functionalities of mobile payment systems, and section six concludes the contribution of the paper and future works.

II. RESEARCH GAP

Reviewing literatures in the areas of mobile payment architectures reveal that almost all of them are bank account based and studied in the context of developed nations, who have the knowledge and know-how of banking and technology. For example, the architectures by [13] [14] [15] [16] [17] are based on the context of developed nations. These architectures require customers and merchants to have bank accounts, subscribe to mobile payment service provider(s), and existence of telecommunication service provider(s).

In developing countries (like Ethiopia), from the development of technological and financial service infrastructures perspectives, such bank account based architectural solutions and approaches have some shortcomings:
(1) By nature, mobile payments require telecommunication network signals to be available on the mobile devices. In developing countries, this is not always the case; there exists frequent interruptions of telecommunication network due to reasons like electricity. It is also common not to have telecommunication signals and services while at underground buildings, during national and religious holidays due to network congestions. These factors make SMS based mobile payment architecture to be impractical in open air markets, where payment is expected to be real time [18].
(2) Existing architectures require transacting parties to have bank accounts, which is not easy in developing countries, as majorities of the poor and rural people have no access to financial institutions [2] [12] [19] [20] [21]. In addition to this, using bank accounts for micropayments is infeasible and inappropriate [15].
(3) The cost of subscribing to payment service providers (mobile network operators, banks, or any other third

party) can also be a discouraging factor for people, particularly who live in less than $2 a day[18].
(4) Existing bank account and mobile network operator (MNO) centric payment models are also inappropriate for proximate payments. We do agree that there is no need of incurring SMS costs for proximate money payments and transfers.
(5) Even though, international trials have proved that near field communication (NFC) based mobile payments are both efficient and convenient in the eye of the consumer, there are no trials in the African continent [22]. Moreover, existing NFC based applications do not considered money practices of transacting parties as indicated in section four of this document

Payment methods and architectures that are telecom or bank centric than end-user centric, lack user acceptance and satisfaction [23] and appears to be inappropriate, due to the above reasons. Hence it is important to research and look for solutions that address the above infrastructure related shortcomings and problems related to the nature of cash based transactions discussed later in this document. There is no user centered architecture that considered and integrated mobile value storage, payment, transfer etc in the context of cashless mobile commerce/ transaction. Existing mobile payment architectures require users to convert their digital money into paper money at one of the agents, (agent network model). In this regard the work of [24] is an important forward move. It considered mobile payment solutions that do not require the involvement of banks, telecom service providers, and payment service providers and identified the characteristic nature of such payment solutions. But the shortcoming of their work appears to be considering mobile payment procedures to be uniform across different user types, preferences, and practices, which is not the case from [7] work perspective. The later highlighted how different user groups (young teenagers, young adults, mothers, and business persons) have different requirements, which the above architectures have overlooked. Hence, research is needed that considers everyday money practices of individuals and design user centric payment, transfer, and value storing systems. Towards this direction, the current study is concerned with the exploration of the everyday money practices of individuals in open air market and identifies possible design concepts from the point of view of cashless societies and cashless transactions. Particularly:

Research Question: *If money is digital (mobile money), what has to be the characteristic nature of mobile money information system architecture (functionalities) in the context of illiterate rural communities who transact in the open air market?*

III. METHODS

This paper follows a human-centered design (HCD) thinking framework as developed by [25] that focuses on analyzing how stakeholders interact and organize themselves during transacting in the open air market. It enables to document individuals' practice about how they organize their money, problems they encounter, how they identify currency notes, errors they make, and the procedure of price negotiation, and the feature of technology they would like to

have, if there are any. In addition to observation, discussions, and interviews, qualitative insights and compelling examples were also captured through photograph and video, which are informative [26] of the practices and procedures in the open air market and get informed about what new technologies can be designed.

This study was conducted among major participants in open air market in rural areas of Ethiopia from 4 different sites from September to end of November 2012. Every open air market place has basically two transacting days, which could be from Monday-to-Sunday. One of the two days is considered to be the busiest day. Through random selection, respondents are of different religions (Christians and Muslims), with different age (16-95) years old, having different educational level (0 grade- BA degree), with different years of business experience (0.5 year – 30 years), and different market segments (fruits & vegetables, for cereals, for clothes, for species, for sheep & goats, for oxen and cows) were considered in the study.

IV. FINDINGS

In order to address the above research question, the study addressed specific questions, typically it explored (1) what are the different transaction related problems people have in the open air market? (2) What are the procedures of buying, selling, paying, and receiving payments in an open air market? (3) Are there any transaction procedures which cannot be digitized? (4) How will these procedures be affected if cash is replaced with mobile money? (5) How do participants deal with errors and mistakes related to cash transactions? And (6) how do individuals refund or return wrong payment amounts?

Accordingly, this section outlines and discusses the common practices that merchants (sellers) and buyers (customers) perform during open air transaction.

Currency Identification

From the research respondents, it was found that both sellers and buyers, with no formal education identify currency notes based on currency's color. These individuals cannot write and read any numbers, cannot make any mathematical computations by writing. But for example, they know the sum of 10 birr[2] and 5 birr will give 15 birr and yet do not know how to spell these numbers. When they are also asked to pickup currencies of say 50 birr note from a lump sum of money notes with different denomination, they easily identify through color. Thus, it could be said that the color of money notes is a means to identify currencies as well as for mathematical computations. One can understand how individuals can sort money notes based on color from fig 1 below.

How Merchants Organize Themselves

Examining how merchants organize themselves revealed that some merchants prefer the use of single common money handling bag (figure 2) while some others prefer to use separate money bags per item (figure 3). The following summarizes the perceived advantage and disadvantages of organizing daily sells into separate and or common money bags.

Retail merchants engaged into selling items like charcoal, fruits & vegetables, species, clothes, and cereals as well as sellers in the animal market place prefer to use single common money bags. They confirmed that the use of common bag has advantages like: gives convenience to control and manage money, reduces problem of changes during transaction, to avoid loses as the result of putting money here and there in different bags and in case of mass conflict in the market, it is easy to collect and run away with the money. But, it has also some limitations (as per the respondents) e.g.; when money is in one bag it attracts thefts and even can result in death. It is also difficult to know the profit and or lose from each item categories.

Fig. 1, individuals sort and identify currency notes based on color

There are also merchants that prefer the use of separate money bags. These merchants are usually interested to know the profit and or lose from each item category they sell. They also want to minimize risks of loses by putting money into one bag. The problem with this way of organizing money is that, in case of hurry time (say conflict in market happen); they may not get enough time to collect their money and run away.

Fig. 2: Use of single money bag

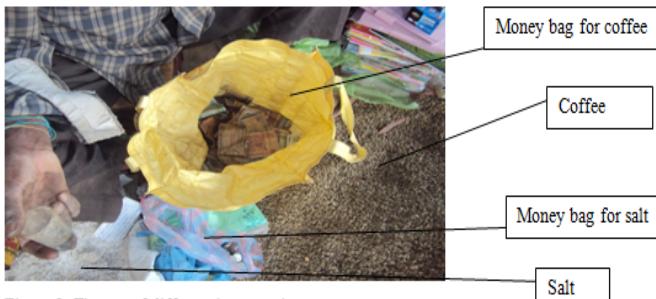[2] Birr is Ethiopian currency. It has denominations of 1, 5, 10, 50, and 100.

Figure 3: The use of different bags per item

In the open market situation the micro business people who sell different items maintain different cash collection bags. For example they keep all sells from coffee in a purse, sell from salt in another purse, sells from spices still in another purse etc. When they even make a change for the sale of an item, they use the change from that respective purse. But, if they have no change in that purse for that moment, they take from another purse and replace the amount later. When asked why they do so, they replied that keeping separate enable them to easily know the daily sales from each items, the net profit of each items and know the most profitable items in their portfolios. At the end of the transaction day, almost all merchants arrange their cash money according to its denomination, count (calculate) the sale from each item categories, and then aggregate the grand total.

Common mistakes or errors merchants make

Merchants are also asked about errors & mistakes they make during transacting. The lack of queuing of customers (Fig 4) and lack of prepackaging of item make merchants to be busy during pick hours. This results in making errors and mistakes like, not sure who has paid them and who did not, how much money was received and whether changes were made or not etc. Merchants who use separate cash collection bags also put sales of an item into the wrong bag.

Besides these errors and mistakes, merchants also have some difficulty emanated from the nature of cash. Some customers are not willing to accept old cash (for change), even if it is valid and can function, merchants can get lost their cash by wind, cash can stick together and be under counted (during change), They might accept forgery money notes and unable to differentiate from the legal currency, lack of changes (during transactions) etc. There are also situations when some customers leave without paying (intentionally-while the merchant looks busy and unintentionally-when they are busy themselves). Some customers also try to cheat by folding

money notes so that the merchant over count it. As the buying and selling has no queuing and the activities are not documented, disagreements between merchants and customers regarding how much was accepted, whether changes were made or not is a common everyday phenomena. There is also no objective way of resolving such disagreement.

Merchants also indicated that they work on trust bases with disabled individuals (blind and handicap). For example, "if the customer is a blind person; he/she can pay by identifying money notes based on its size. But, if the visually impaired cannot do this, the merchant usually tap his hand into the pocket of such person and take the amount of the sale. This deal entirely requires mutual trust between them. "I will take the purchase sum from the disabled person's money pocket on trust bases" said a 60 year old woman. The interesting question is what does this mean for mobile money design?

As far as problem of conflict in the market is concerned, the researchers come to understand that almost all individuals have a lot of worry. If in case it happens, it is distracting and many merchants and customer lose many of their properties while trying to run away.

Feature of automated tools merchants would like to have, if any

This is mainly asked in order to provoke responses about future needs and starting a point for new concepts. Thus retail merchants were asked the feature of an automated tool they would be interested in, if they are given any, as related to their practices of open air market. Accordingly, it appears from their response that they have diverse need and interests. But most of them indicated that they are interested on machines (tools) that protects their money from thefts, used to handle money easily, able to identify the profit & lose from each item categories, identify cheaters. For example a 66 years old woman told "I very much appreciate if I can get a tool that calculate profit, lose, cost, and sales, that controls thefts even in case of conflict in the market, and capable of protecting others from taking away money from it, if in case I lost the device".

In addition to these, many of the respondents with the age of 40 and above, who have no formal education expressed the kind of devices they are interested in, as "machines that cannot be stolen, that can tell balances by sound, which does financial mathematics (sales, costs, profit & lose, changes), a machine that is able to tell when making mistakes, can be integrated with mobile phones for alerting purpose, a machine that is capable of counting money. "As I am too old, I prefer a machine that can identify and tell the money customers pay (the amount, whether it is legal or forgery), that counts, able to identify customers who try to cheat" said a 95 years old man. Respondents also went on expressing on ease of use. They specifically indicated they want such machines to be easy to use, cheap, durable, easy to carry on, operates by sound, able to generate changes during transacting, inaccessible to thefts, if in case it is stolen and send signal about its location to their cell phone.

Practices of market assignments by customers

On the other hand discussions and observations regarding the practices of customers reveal that, they delegate each other. As the open air market places are too distant from their home, it is not possible for everyone to go to market and buy items of their need. As the result, they delegate/assign someone to do the purchase and sells on behalf of them. From this field study, it was found that delegates usually confuse about how much of what items to buy, and the amount of money received for this purpose. To avoid such confusions illiterates keep their personal money separate from delegate's money, similar to the use of separate bags by some retail merchants discussed above. When making the purchases and payments, such individuals also make the payments separately one after the other, collects changes separately, if any, and do not add with their personal transactions/purchases and payments. Regarding the accuracy of the total payments and changes, these individuals also rely on what is told to them by the merchants. But sometimes they also ask for help from someone around.

On the other hand relatively educated individuals keep all monies together keeping some sort of reminders, writing the lists of items to be purchased on a piece of paper, (similar to merchants who use common bags above). Accepting such assignments and delegations from many people, which could increase the amount of money at his/her hand (say pocket/bag) will put him/her under risk by thefts, robberies, accidental lose etc, as per the research respondents.

Price Negotiations

Regardless of what is being bought, sold, or exchanged, transaction is the method by which value exchange takes place between two or more parties. Regarding the experience and practice of customers and merchants in setting prices, it was found that price negotiation plays an important role in markets particularly animals, cereal, clothes etc. Unit prices of these items are relatively higher than markets of species, vegetables, and fruits. In the former market places, prices are determined by bargain, where a buyer and seller take active roles in setting the selling price. They set the price after several rounds of negotiations before bargaining to sale items. In these market places, the procedures and practices of negotiations and bargaining are similar.

Procedurally first, sellers make a first offer by naming somehow higher price, expecting that the buyer will bid by offering somehow lower price. Then during negotiations, the seller starts offering relatively lower price while expecting the buyer to raise the bid. Then the buyer offers (*this time orally*) somewhat lower amount and observe the reaction from the seller. If the seller is furious indicating the offer is too low, the buyer will offer somewhat higher amount (*this time by handing over cash*) and see if the seller agrees. If the seller agrees on the price offered, then the two parties can conclude the transaction. But after counting the bid, if the seller is unhappy on the offered price, the seller returns the sum back to the buyer. Then the buyer receives his money and walks off, hoping that the seller will call back and sell on the offered bid. But if the seller does not call back and

if the buyer is interested on the item, the buyer himself/herself can come back and make a new price offer, relatively higher amount. The negotiation keeps on until they agree to buy and sell or do not agree totally. So the interesting question to think about is given a cashless transaction (based on mobile money), how do we design a system that supports the practices of oral and cash based negotiation.

Lastly, at the end of the day, if the items were not soled sellers usually regret for not selling early for the reason that the offer made early on is quite better than offers made towards the end of the day. Thus, by some means, the seller is missing the opportunity of better sells and the buyer is also missing the item he/she is interested on.

V. CONCLUSION

As illustrated above, we have documented everyday practices related to open air market. We have found many provocative technology/system design concepts and functionalities of mobile money information system in the context of open air market. The study found that almost all merchants: (1) use color of currencies to identify one from the other, (2) some use separate while some others use common bag to organize their daily sells, (3) have many problems and make many errors and mistakes, (4) individuals who have no formal education would like to have devices that operate by sound, and (5) sellers & buyers set prices of certain items through series of (cash and or oral) negotiations. Now, our interest (contribution) is to provoke what these practices means for the design of mobile payments in the context of cashless societies.

VI. FUTURE WORK

The practices of individuals' discussed in this paper indicated that NFC based solutions seems to be appropriate in order to make proximity payments for goods and services using mobile devices. But NFC enabled mobile payments is a fairly new area of study (particularly in the context of rural people of developing countries). Hence, we intend to explore different ways of mapping the above design concepts into technical features in the context of NFC.

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