

# Developing Business Process Architecture using Business Process Modeling: The ATM system in HSBC Egypt

Rasha Abd El Aziz and Rasha Fady

**Abstract**—As the user experience is an important prerequisite for the success of e-banking applications, the main subject of the research study reported here is the use of Automated Teller Machine (ATM) in Egypt. Data was collected using an unstructured interview with a senior staff member in HSBC Egypt. Data was then analyzed using process modelling. In this paper, we will develop an initial process architecture diagram but will not go on to depict the internal structure of individual processes. Some ATM problems in Egypt were discovered, which enabled the researchers to make recommendations to ATM decision makers in Egypt on ATMs.

**Index Terms**—Process modeling, Process Architecture, Automated Teller Machines, Unit of Work.

## I. INTRODUCTION

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

Although the world is moving towards cashless societies and despite the advances in the Egyptian banking system, Egyptian society still seems to prefer cash; as almost 80% of the money held by banks is used for short term lending. This reflects the inclination to hold cash. ATMs have nevertheless been very popular in Egypt since their introduction, and electronic payment systems have developed over the last decade due to the rapid development of telecommunications and IT networks [1].

Egypt has a great potential to expand in retail banking activities due to its high population. Main towns in Egypt have ATMs that are linked into major international networks. To understand ATM usage in reater depth, more needs to be known about how people in fact use and perceive ATMs and their characteristics, and at the same time about how decision makers in banks make decisions regarding ATM characteristics and how users perceive them on the other side. Although Egypt has upgraded its networks [2] and some banks in Egypt have recently recognized the importance of ATMs, yet most of the ATMs are often out of service, some of them are not well located, and users are even unaware of the services provided via ATMs [3],[4].

Manuscript received April 10, 2012; revised May 12, 2012.

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As the leading business sector in Egypt, banks need to work hard to adjust their process model to satisfy their customers, who are becoming more powerful every day. Switching from a bank to another is not a difficult process any more, and it is the banks job to maintain their clients, as well as attracting new customers.

## II. AUTOMATED TELLER MACHINES

ATMs are banking terminals in public places, connected to data system and related equipment. Although the first ATM was only introduced in June 1967, by the end of the 60s there were 750 ATMs installed all over the world. In the period between 1978 and 2001, the number of ATMs has increased from less than 10,000 machines to around 324,000, processing more than 1.1 billion transactions on a monthly basis. Now, there are 1.6 million cash machines worldwide that handle around £172 billion a year [5]. Whitehead has also reported that one third of all banking transactions are conducted using ATMs [6].

ATMs play an important role in enhancing the firm's competitive position; as they were first introduced in an attempt to lower bank costs. They also enable banks to offer their customers high levels of convenience; and in turn capture or protect their market shares and generate more revenue [7]. ATMs have also been popular among customers for their convenience and accessibility. They like ATMs because they can access their account from anywhere at any time [8]. As clients value their time, they would appreciate a reliable ATM that would help them save their time in conducting routine banking activities.

### A. ATMs from a technical Perspective

Technology could be regarded as a catalyst for change. It may sometimes make businesses more efficient and productive but it has to be properly managed [9]. As technology evolves, customers will expect financial institutions to provide high level of convenience through their ATMs. Therefore, banks will need to model their ATM processes, so as to better understand their activities and detect inefficiencies. This becomes a necessity because, although some business processes in an organization may arise due to the business nature [10], others might be due to an organization imitating another, regardless of whether they are appropriate for their business or not [11]. In this case Business Process Modelling (BPM) visualizes the flow of work and the flow of information between different processes and individuals. Accordingly, the need for process modification becomes clear, relating the process design to its implementation [10]. This is because, although ATMs are

highly appreciated, they still need to be convenient and reveal high-quality user experience, consumer confidence, and be perceived as a value derivative to consumers [12].

As automation of manual processes requires process reengineering, it calls for Information technology [13], which, should be linked to the overall business strategy in a coherent manner [14]. Technical challenges include infrastructure and poor maintenance. Low tele-density, is also a major technical problem, when for every 100 people, there are only seven telephone lines [15]. In the business field, the flow of work is normally dynamic and uncertain; which necessitates change. Process modeling becomes important when an organization wants to change the way of doing its activities [16]. Although, business process modeling is difficult because of the complexity of business, a process model provides a way to facilitate understanding the nature of business. Accordingly, an abstract model that captures a high-level picture for different business processes in an organization could lead to a better understanding of the business as a whole.

### *B. Process Modelling*

In the banking system, processes are interrelated and affect one another. The flow of work would then be better understood by modelling the banking processes. Process modeling identifies business processes in two different ways; an abstract model and a detailed model. The purpose of modeling is to link the process design with the implementation. In the abstract model an overall picture about the organization's processes would be drawn. However, in the detailed model, every process could be explained in terms of actions and interactions performed by different parties called roles. The generated model could then be used to produce a prototype for the flow of work and the flow of information; consequently, improvements could be easily managed [17]. Organizations that perform business process modeling put them in a formal shape to be more understandable [16].

This kind of formalization is useful in supporting process improvements such as removing unnecessary processes, adding new ones or introducing automation wherever it is feasible. Automation also enhances the performance of the activities under each process, reduce the time between the interrelated activities, and combine the results of independent processes. It also helps in reducing the number of people involved, while at the same time increasing productivity.

People would mainly be involved in problem solving, by performing activities manually and then delivering the results to be completed automatically. It is also possible using BPM to control and manage processes by producing audible processes.

### *C. ATMs in Egypt*

Egypt in particular has a great potential for retail banking; as it has the highest population among the Arab countries [1]. Banks started to expand their branch networks and increase the provision of delivery channels, such as ATMs, which have been very popular and are rapidly increasing in number since their introduction. Egyptian banks are already engaged in expanding their ATM networks [18]. In the period

between 1998 and 2002, the number of ATMs in Egypt has increased by more than 600 machines [2]. In 1956, the Egypt had a total of 32 banks; they were all foreign except for the National Bank of Egypt and Bank Misr. Banks are Commercial, Business and investment, or Specialized. Banks can also be classified as public sector, private or joint venture [1].

A study shows that most desirable ATM features for Egyptian users are convenient location and reliability of service [19]. Although Egyptian users are satisfied with ease of use, safety, accuracy, and range of services of the ATMs, they were dissatisfied with the reliability of ATMs at their banks - finding them too often out of service. Users were also somewhat dissatisfied with the location of their own banks' ATMs [19].

### *D. Hongkong and Shanghai Banking Corporation (HSBC)*

HSBC is one of the largest banks in the world, which was established in 1865. HSBC's international network extends in 86 countries all over the world. HSBC Bank Egypt was established in 1982 as Hong Kong Egyptian Bank. In January 1994, the Bank was renamed Egyptian British Bank. HSBC Bank Egypt is one of the largest banks with a network of 70 Branches, 13 Units and 249 ATMs in 16 different cities.

At HSBC ATMs in Egypt you can deposit Cash/Cheque, make payment to your Credit Card(s), transfer funds between your own accounts, withdraw cash up to EGP 4,000 per day (Up to EGP 8,000 per day for HSBC Premier), obtain a balance enquiry, request for a mini-statement, change your personal identification number (PIN), and change the ATM language. Locally, the HSBC ATM Card enables you to withdraw cash from any HSBC ATM in Egypt and provides you with access to all 123 Network ATMs. Internationally, the HSBC ATM Card enables you to withdraw cash from more than 800,000 ATMs worldwide.

### *E. Business Process Modelling*

The Riva method of business process modelling is business-oriented rather than software-oriented, in that it focuses on the management of business entities through the actions and interactions of different roles, rather than on a reduction of business to logic. The method combines two forms of diagramming, process architecture diagramming that shows several or all of the business processes in an organisation, and how they relate to one another, and a role activity diagram shows, for a single process, the activities within roles and the interactions between them. In this paper, we will develop an initial process architecture diagram but will not go on to depict the internal structure of individual processes. In process architecture diagramming, the aim is to find and draw those processes which act on key objects or entities that the organisation must deal with. These objects called Essential Business Entities (EBEs). An EBE could be a product or service provided by the organisation, an internal or external customer, or it could just be things the organisation has to deal with during its day, or otherwise 'cannot get away from'. Ould suggests that organisations in the same line of business have to deal with the same EBEs. Organisations are also occupied with objects that are not fundamental to the business, but rather arise out of the way an

organisation chooses to do its business. These Ould calls Designed Business Entities (DBEs). These may well differ between organisations in the same line of business.

Business entities become units of work for an organisation, in the Riva method, when they are tracked and followed. A unit of work (UOW) diagram shows how different units of work are involved with one another, or generate one another. Building from the UOW diagram, each unit of work can then be treated as a case process within which roles, activities and interactions can be delineated in a role activity diagram. At a higher level, information flow and dynamic relationships between processes can be represented in a process architecture diagram. In addition to each unit of work being modelled as a case process, the flow of work units also needs to be modelled, as a case management process. Case processes, case management processes, and the interactions between them, are modeled in the process architecture diagram. Once a process architecture diagram has been drawn for a business (or part of one) on the basis of the business entities it handles, it becomes possible to consider whether any improvement or streamlining of the business looks possible. Perhaps some processes could be enhanced, or dropped, or re-ordered. Perhaps departments could be restructured or responsibilities reallocated. The diagram permits a debate about change to commence. If sufficiently detailed, and given sufficient software support, the diagram could also serve as a basis for the enactment of new or changed processes in the organisation.

### III. RESEARCH METHODOLOGY

#### A. HSBC Egypt: Interview Data

First, the client is required to have an account at the HSBC in order to have an ATM card. It takes the client two visits to the bank to receive the ATM card; where he opens the account and fills in a form applying for the card during the first visit, and receives his card on his second visit to the bank branch at least after five working days. The client's account is created either by transferring the salary to the account, or by depositing a minimum of 5,000 Egyptian pounds in the account. When the account is opened, the information related to this account is entered on the computer system by the designated employee, where the system is connected to all other HSBC branches in Egypt. ATM accounts could be either local or global accounts. The information required from the client is: ID, place of work, occupation, salary, expected activity on the account and other personal information. Any client can open the account in three different currencies, but the currency of the withdrawn money will be the country's currency.

The card number is generated in a certain format; the first three digits specify the branch, the following six digits specify the client's number, and the last three digits specify the kind of account whether saving or current and the currency. In case of creating an account with minimum limit of L.E. 5,000, the client has to pay 30 Egyptian pounds if the balance goes below L.E. 5,000 which is equivalent to 2,000 dollars. The maximum amount of withdrawal is L.E. 5,000 per day for global accounts and L.E. 4,000 for local accounts.

The client is able to withdraw money from any HSBC ATM for free, but if the machine is not HSBC, the client has to pay a fee for the money transfer from his account.

HSBC has its ATM maintenance team, the custodians. When problems persist they are escalated to the operation head then to the branch manager and then to the area manager. Maintenance is done twice per day in the morning and at the end of the day. In the morning, deposits and retained cards are taken from the machine while in the evening, the machine is replenished and money is added to the machine. ATM services are balance inquiry, money withdrawal, deposit, transfer, and balance inquiry. Clients can either visit the bank, use the phone banking department, calling the branch directly or by Internet banking department, which is redundant and inconsistent. Clients' requests are sent to the related branch by e-mail. Mobile ATM machines are also seasonally used.

#### B. Problems with HSBC ATM System

The starting language is English and it could be changed to Arabic. That makes it difficult for people who do not understand English to use it easily. Besides, money withdrawn from the HSBC ATM using HSBC ATM card but not cashed due to any problems is refunded directly to the account. However, money withdrawn from HSBC ATM using other bank's ATM card is not refunded directly. It takes long time for the card holder's bank to call HSBC bank in order to resolve the problem. Same thing applies if the card holder is from HSBC and using another bank's ATM. Moreover, Sometime the client might not find enough money in the ATM, so cannot withdraw money from the machine. Furthermore, Clients who want to change the pin code have to use the issued pin code by the bank at least once before they set the new code. Many clients are not aware of this procedure so that when they want to set the pin code at the first time the card allows them three trials and then the card is taken into the machine.

#### C. Modelling the HSBC ATM System

Using Riva method, two business models or diagrams could be produced; the first one is a process architecture diagram (PAD), a high level diagram which is an abstract model that reflects the flow of work between business processes and the second one is the Role Activity diagram, a more detailed model which opens each business process and depicts it in details.

This paper will introduce only the PAD for the ATM of the HSBC bank. In order to produce the PAD, first the UOW diagram has to be developed which shows the dynamic relationships between the essential entities of an organisation.

Accordingly, the list of EBEs of the ATM system would be defined as follows:

- 1) Entities that represent services offered by the organization:  
ATM service: is a service provided to the client concerning the account.
- 2) Entities that represent external customer to the organization: Client: he person who requests ATM service and opens the account.
- 3) Entities that the organization keeps on in its information

system: Account: contains information related to the owner of the account.

- 4) Entities that the customer has or want to do that might be EBE for the organization: Client complaint: unsatisfactory result produced to the client is considered to be a complaint.
- 5) Transaction: deposits, withdrawals, money transfer, phone call, etc.
- 6) Entities that the organization makes: ATM card: is a plastic card issued to the client with the account number printed on it to allow the client to withdraw money from the ATM.
- 7) Entities the organization deal with day in, day out: Machine maintenance: ATM daily maintenance.
- 8) Entities the organization cannot get away from: Security rule: rules set by the bank on the ATM usage to protect the clients.

Each business entity is examined to discover whether it is derived from the essence of the business or not. Ould suggest some tests for distinguishing EBEs from secondary entities. First, it should be possible to write 'a' or 'the' in front of an EBE. Then, entities designed by the organisation as a way of carrying out its business are not EBEs. Entities which are roles or departments in the organisation are not EBEs. Using Ould's test, client will be taken out as it is a role. Then the list of EBEs will be as in Table I:

TABLE I: HSBC ESSENTIAL BUSINESS ENTITIES

HSBC EBEs
Main channel
ATM Service
Account
Client complaint
Transaction
ATM card
Machine maintenance
Security rule
Assistant channel

TABLE II: HSBC ESSENTIAL UNITS OF WORK

HSBC Essential UOW
Main channel
ATM Service
Account
Client complaint
Transaction
ATM card
Machine maintenance
Security rule
Assistant channel

The next step is to determine the UOWs using the list of EBEs. EBEs that have a life time and the organization is looking after them become UOWs. ATM card and security rule are not UOWs for the ATM system though they are required, they could be UOWs for other departments to look after them. As Ould mentioned that changes in each UOW might create a new UOW, Changes to account is a UOW that shows any change that takes place in the account information which needs to be added to the list. Fig. 2 shows the list of

UOW at HSBC bank.

D. UOW Diagram at HSBC Bank

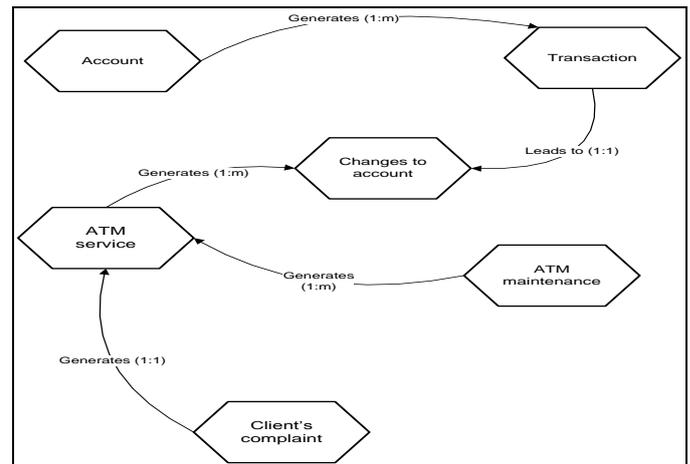


Fig. 1. HSBC UOW Diagram

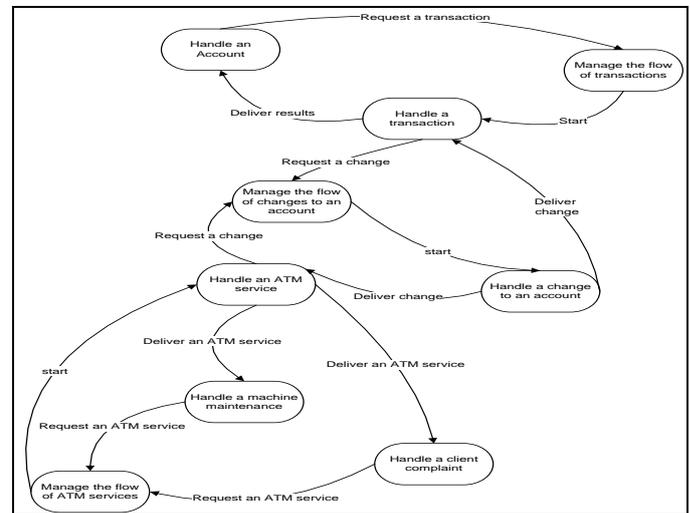


Fig. 2. First-cut processes architecture

E. Second-cut process Architecture

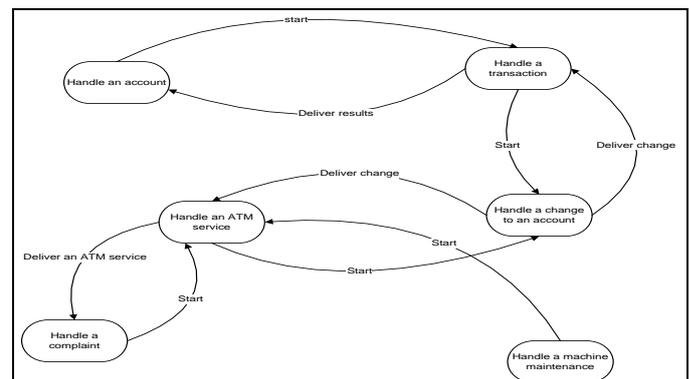


Fig. 3. Second-cut process architecture

IV. CONCLUSIONS AND RECOMMENDATIONS

Addressing customers' needs is a vital issue and has been the concern of a number of studies [20], [21]. Rugimbana [22] has concluded that people's perception of ATMs is a powerful predictor of ATM usage and that a strategy of stressing the most important ATM attributes is essential. As

banking in general and ATMs in particular are regarded of great importance in Egypt, decision makers in the banking industry should pay attention to the ATM process inefficiencies. Based on the fact that ATM features regarded by the Egyptian users as unimportant are well provided, while those they regarded important are not well provided [3], it seems that decision makers should pay more attention to maintenance and servicing of ATMs, together with the provision of more ATMs in the appropriate locations, instead of installing more complex machines. Accordingly, some recommendations for Egyptian banks are listed below:

First, starting language has to be the first language, rather than a foreign language; especially in Egypt, where there is over 20 million illiterate adults (Iskandar, 2005). HSBC Egypt should install ATMs with 'Arabic' as the default starting language. The fact that, money withdrawn from HSBC ATM using other bank's ATM card is not refunded directly, and that it takes a long time for the card holder's bank to call HSBC bank in order to resolve the problem is considered a clear inconvenience problem. HSBC has to solve this problem by providing just in time settlement with other banks. The same solution should apply in the case where, the card holder is from HSBC but using another bank's ATM. This is critical because solving this problem means facilitating the use of foreign machines, and thus increasing the availability of the bank's service through enabling their clients to use more ATMs, which are located in a variety of different locations.

Another issue is that so often clients cannot use the ATM because it is out of service, and sometime the client might not find enough money in the ATM. This normally increases the customer frustration and negatively affects his/her perception regarding ATMs reliability. This problem should be solved with the maintenance company, which in most of the cases is the ATM supplier. HSBC should modify their contract to include a higher level of maintenance, and add on a feature in the software installed on ATMs that allows the machine to send an alert when the amount of money goes down to a certain limit.

Finally, clients who want to change the pin code have to use the issued pin code by the bank at least once before they set the new code. Many clients are not aware of this procedure so that when they want to set the pin code at the first time the card allows them three trials and then the card is taken into the machine. In this case HSBC should make sure that all clients are fully aware of this problem when receiving their issued ATM card, or should make clients set their own initial password before leaving the bank's branch.

To sum up, we would say that although technology advances seem tempting, technology adoption should consider the customer's nature and preferences. Moreover, ignoring client's priorities will certainly lead to a system failure. One of the first steps to problem solution is to model the systems process in order to better understand the current activities and practices and accordingly detect and adjust any inefficiency that may cause customers to switch to other providers of the service.

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