# An Innovative Information System that Provide Financial Inclusion

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## ABSTRACT
New applicative methods have to be studied and implemented in the area of information technology to provide qualitative, fast and secure financial services for all. Many researches' results show that broad access to financial services helps reduce poverty. The present paper analyzes various data collected by request and from face-to-face interviews to identify the underserved population in Albania in terms of financial services. Traditional techniques are applied in the last Living Standards Measurement Survey to identify the needs of underserved population about financial services and their living conditions. The information is of great interest to identify the most appropriate information system which provides secure financial services for all. Reliable financial services are of crucial importance. Further investigations are made to identify the most secure application that works out on a standard phone. Study of the most appropriate user interface and way of communication led us to the conclusion that the use of the SIM Application Toolkit, which offers a simple menu stored on the SIM to the user, is the most secure way to communicate as the best end-to-end security is achieved through it. The functional requirements were created and business process modeling was made. Services needed by users are created using java card programming language. Agents and mobile operators will make a major contribution in the proposed information system.
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## Keywords
Information system, new technology, financial services, ICT innovation.

## 1. INTRODUCTION
There is much evidence to show that broad access to financial services helps reduce poverty [1], [2], [3]. However, there is also a difference between access to and use of financial services. There are two groups of people who don't use such services: i) individuals excluded involuntarily due to insufficient and irregular income or high-priced services, and ii) individuals who have access to financial services but who exclude themselves voluntarily and do not benefit from them. An involuntary excluded individual from the use of financial services, it is considered as he has no access to financial services. Voluntary exclusion is difficult to measure because it is not directly observable. So, researchers rely on indicators to estimate an approximation of access. The application of various methods to measure access to deposit services enables calculation of savings and payment services. The most appropriate measure of the use of deposit services is the number of unique depositors in a country, as the number of accounts does not provide clear information (a single person or single household could have more than one deposit account). The most appropriate measure of use of credit services is the number of unique loaners, while the most appropriate measure of the delivery of financial services is outreach of financial access points [4].

According to CGAP the percentage of the families that has at least a deposit account in a formal institution in Albania is less than 25%. As the figure 1 [5] depicts the use of financial services in Albania – measured as having at least a deposit account in a formal institution – is less than 25%.
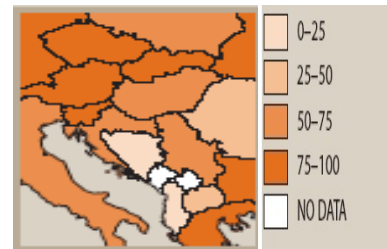


**Figure 1: Percentage of the families that have 1+ deposit account [5]**

In addition, the total number of loans distributed by commercial banks per 1,000 adults is 107.53, while the number of commercial branches per 100,000 adults is 22.29. The data are in total for Albania and their distribution either in urban or rural areas remain unknown.

Poverty is defined as not currently having enough of some dimension of well-being such as income, consumption, health, education and assets ownership. Monetary or non-monetary measures are a means to address the measurement of poverty. In terms of estimation of monetary measures of poverty both income and consumption are considered indicators of well-being. Monetary measure and the consumption indicator are tools to measure poverty in Albania.

Poverty lines are used to classify poor people. In terms of consumption, the poverty line is a certain level of consumption that separates the poor from the non-poor (people whose consumption is below the poverty line are classified as poor). Absolute way, which is used also in Albania, is one of the ways to set the poverty lines. For monetary measures, absolute poverty lines are often based on estimates of the cost of basic food needs, i.e., the cost of a nutritional basket considered minimal for the health of a typical family, to which a provision is added for non-food needs [6]. The monetary absolute poverty line in Albania is set at 4,891 Albanian Lek (at 2002 prices) per capita monthly consumption [7]. The incidence of poverty (also called the headcount index) is calculated from the poverty rate, which in terms of consumption is the percentage of the population whose consumption is below the poverty line (found by

dividing the number of people below the poverty line by the total population). Based on data from LSMS 2008 [8], it is calculated [7] that the total poverty rate in Albania is 12.4 per cent; the poverty rate in urban areas is 10.1 per cent and in rural areas is 14.6 per cent.

Different research studies showed that a broad access to financial services helps reduce poverty. Consequently, new tools and techniques of applications in technology for financial services inclusion have to be studied and implemented as poverty still exist in Albania. With the help of non-traditional solutions the necessary financial services could be delivered to the community which could not reach these services with the traditional ones. Implementation of the most appropriate non-traditional solution for financial inclusion it will be difficult because it is a new way of conducting financial services and as a result:

- The users have to want it and use it. In order to achieve this, the system has to be also easy to use and secure.
- The possible providers (which except banks or financial institutions could be telecoms or third parties) need to have the right environment to offer the financial services with a non-traditional solution and the users and agents need to feel protected (they have to feel secure that their money will not be lost).

The present paper aims to identify the needs of the population prevented from access to financial services and the innovative information system that provides them the most secure financial services in formal institutions.

## 2. METHODOLOGY

Many methods and information sources have been combined to study and present an innovative information system that can offer financial services for underserved populations. The latest data provided by important institutions such as CGAP and World Bank, help create an overview of the current situation of access to financial services in the country. Data on the distribution of bank branches ATMs and POSs from Bank of Albania were compared with the information gathered through interviewing bank representatives and by requests to INSTAT, providing at the same time information about the geographical distribution of financial access institutions such as bank branches, ATMs or POS. A traditional technique was applied for the data provided by LSMS 2008, including information on revenues [9] and data on migration, which institutions such as INSTAT and Institute of Public Health [10] provided, helping identify the needs of underserved people with regards to financial services and the characteristics of their living standards. It is analyzed the potential of enhancing financial services to areas where underserved population lives. By studying world experiences, the living conditions of the population which has no access to financial services with traditional ways and the possible banking infrastructures it is identified a suitable solution to include underserved population in financial services in a way that is affordable and convenient. The data from different sources of information like white papers, standards and the information gathered with the interviewing method to the mobile operators' representatives have helped on creating an overview of the world' existing mobile technologies used in Albania. Knowing the world' existing mobile technologies used in Albania and having the work experience with the implementation of the mobile network' value added services are presented the possible user interfaces and wireless communications channels in the non-traditional solutions for

financial inclusions that need a mobile network. Using our experience and the information gathered with the interviewing method to the mobile operators' representatives are identified the benefits and carriers of the implementation of these technologies in Albania. The data, the possible user interfaces and wireless communications channels are analyzed and the most appropriate one is presented. Finally it is presented an innovative information system that provides access to financial services to everyone in a way that is not only convenient and affordable but also safe. As in any information system an application is needed to make possible the delivery of the customer requests to the provider of the service and the fulfillment of them by the provider. This application will be a mobile one and will offer an additional service to mobile subscribers. By having the experience in the planning and the implementation of value added services for the subscribers of a mobile operator it is analyzed and presented the development of a mobile application that will allow the customers to conduct financial services in a safely way.

## 3. STUDY FINDINGS

### 3.1 Actual Situation

The banks' network was extended over the years. The branches and agencies are increased in number year by year. Figure 2 [11] depicts the geographic distribution of bank agencies and branches by prefecture.
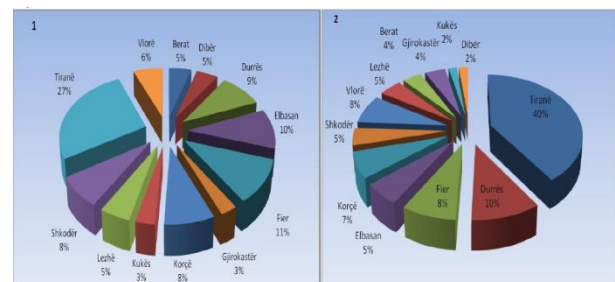


**Figure 2: Geographic Distribution of resident population (1) and network branches / agencies of banks (2), by prefectures [11]**

No data concerning the distribution of financial access points either in rural or urban areas is provided. The representatives of Banks say that banks market is saturated in urban areas. Easy access to transfer and payment services could easily be provided by Internet either at home, Internet café or a post office (all post offices offer Internet service).

Financial access points could be also ATMs or POS. CGAP and the World Bank Group [5] state that in Albania the total number of ATMs per 100,000 adults is 31.11 and 27.04 per 1,000 km2. In addition, they state that the number of POSs per 100,000 adults is 183.45 and 159.49 per 1,000 km2. According to Bank of Albania [12] ATMs and POSs are situated in main regions Tirana, Elbasani, Shkodra, Korca, Gjirokastra and Lushnja. According to bank representatives ATMs and POSs are mainly situated in urban areas. Even though urbanities can more easily access financial services than rural residents, not all of them use these services. Both state and private company employees have an account in formal institutions, but some city households do not benefit from credit services or deposit services due to either insufficient or non-regular income, furthermore such households seek no benefit from financial services. Low-charge accounts and low cost per transaction are an appropriate strategy to be applied on the proposed solution in

order to give the possibility to use financial services also to this category. The Authority of Postal and Electronic Communications [13] state that in Albania fix broadband per household is 19.46 per cent. Consequently, they have home Internet access and benefit from money transfers and payment services. Meanwhile, LSMS 2008 [8] provides information about the access of rural populations to financial access points. According to data from INSTAT [14] nine per cent of rural households have a bank agency or branch in their community, 28.7 per cent a post office, and 15.6 per cent an Internet café.

Figure 3, based on data from INSTAT [14], depicts the means of transport taken in rural areas to go to different service points.
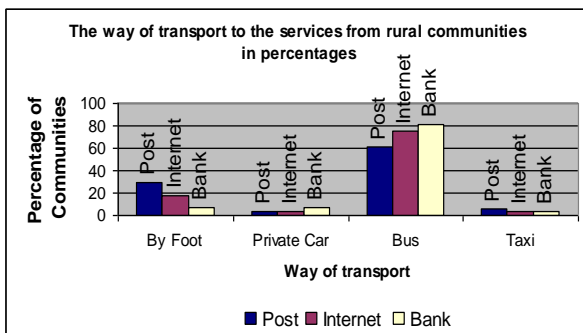


**Figure 3: Means of transport taken to obtain finance services in rural communities**

Thus most of the population living in rural areas does not have financial access points in the community where they live, more time and money is spent on accessing financial services in rural areas than in urban areas, and to compound this difference rural incomes are considerably lower than the incomes of people living in urban areas.

There has been in Albania a huge demographic movement in the last two decades. According to Albania Demographic and Health Survey [10] the percentage of families with members who have emigrated, either abroad or within the country, is 48.2 per cent for urban areas and 54.6 per cent for the rural areas. Consequently, a person-to-person transfer service would be beneficial in such cases, a service that could be applied for the aforementioned cases.

Daily workers have low wages, and moreover their work position is unstable. Meanwhile, there is a lack of medical insurance. A savings service would be of great benefit for such people. LSMS 2008 [8] provides data on landowners and farm animal owners. Information about the number of households that have land and animals using an ad hoc inquiry method is extracted from these data. In the survey, there were 1,581 landowner families, 1,382 animal owner families and 1,286 families who own both land and animals. Thus, 1,677 have either land or animals. In all, 3,600 households were interviewed face-to-face. For that year, 53 per cent (1,908) of the population lived in rural areas, while the number of urban households was 1,692. Consequently, 87.89 per cent of rural inhabitants are either land-owners or animal owners (Figure 4). Moreover, most rural households are small farmers and their incomes are highly seasonal. Reliable financial institutions provide reliable financial services to the population. Reliable savings services would be of a great benefit to the rural population.
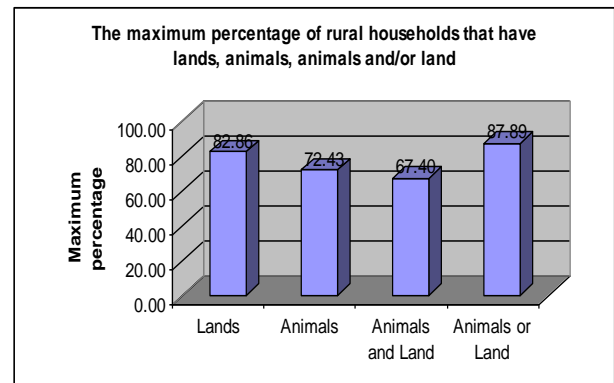


**Figure 4**: **The maximum percentage of rural households that have lands, animals, animals and/or land**

According to data from INSTAT [9] pensions make up thirteen per cent of the income of households. Consequently, a government-to-person payment service would be beneficial.

Information on the use of mobile telephony by family is provided in LSMS 2008. Ad-hoc inquiry found that i) 83.56 per cent of families living in the Coastal area use a mobile phone, ii) 86.53 per cent in Central Albania, iii) 87.43 per cent in the Highlands, and iv) 87.34 per cent in Tirana. Overall, 85.7 per cent of the Albanian families use a mobile phone. The differences between rural and urban areas in mobile phone use are very slight, but some aspects are nevertheless interesting.

As it is seen from the statistics the maximum usage of the mobile phones per family is in mountain area. Compared to 2005, the year 2008 did not mark any reduction in the poverty rate for these populations. However, in rural areas in the Highlands the poverty rate was at least 98.6 per cent higher than in other regions of the country, while in urban areas in the Highlands the poverty rate was at least 37 per cent higher than in other regions of the country.

Revenues in mountain areas are lower than in other areas. According to data from INSTAT [9] the total monthly revenues per family in mountain regions is at least 25 per cent lower than in other regions, while the monthly revenues per family in rural areas of the mountain region is at least 23.6 per cent lower than in other regions. The population living in mountain areas have barely sufficient incomes. Nevertheless they mark the greatest percentage of mobile use. Even the mountain areas are poorer and with lower income they have the maximum usage of the mobile phones per family because they needed the mobile services the most. There is no evidence about the type of the phone mobile users have. However, we want the financial services to be used by all and because a considerable percentage of population is poor or with low income they probably have a standard (basic) phone. According to data from APEC [13] in 2008 the mobile phone penetration rate in Albania was 92.29 per cent, while in the end of 2011 it was 185 per cent. Consequently, almost all families in Albania use at least one mobile phone.

## 3.2 Solution
A reliable savings service, person-to-person transfers and a government-to-person payment service are of great importance to the population of Albania. An appropriate solution concerns saving both time and money. However setting up either bank agencies or branches in every village is highly costly. As depicted in Figure 5, agents play an important role in bridging the gap between clients and service

providers. A card-based model and a cell-phone based model are both successfully implemented elsewhere in the world. The first case relates to the application of a POS terminal in the communication process with the provider. Consequently, a card similar to a bank card could be used. In the second case, cell-phones help communicate with the provider. A cell-phone is a means to address the use of the system. In addition, a basic cell-phone could be used by agents and customers. Usage of a POS terminal by the agent has a higher cost than the use of the cell-phone by the agent. Use of a POS terminal consists of an additional start-up cost, which comprises POS terminal cost and installation including POS terminal and communications lines. But there is no start-up cost for the agent in the cell-phone based model except the cost for training and marketing, which are also costly in the case of use of a POS terminal by the agent.
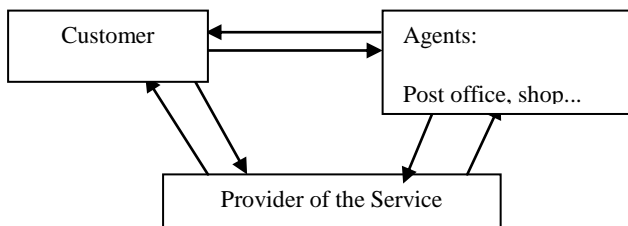


**Figure 5: Actors in the solution**

There is an extra operating cost per month that is the cost for Satellite Communication Line and Equipment maintenance when an agent uses a POS terminal compared to the cost in the cell-phone based model that has a cost for marketing materials only. Once a new customer meets the solution, an extra cost for card issuance and maintenance in the card-based model is estimated. There is an up to three per cent commission per POS transaction, an additional cost per agent using POS in Albania. For this reason, there will be not so much spread of usage of this scenario. In terms of accessibility at the moment, everyone could use a cell-phone anywhere and in any time. There is a difference in accessibility between POS and cell-phone. POS terminals are located in the main districts of the country only. On the other hand there are currently four cell-phone operators in Albania covering altogether 100 per cent of its territory. Provision of financial services through mobile phones requires at least one mobile phone per family. The data show that 85.7 per cent of Albanian families use mobile phones. In addition, this figure could reach 100 per cent during 2013. Consequently, the cell-phone based model is the most appropriate model for Albania to address access to financial services.Acceptable systems could easily provide services. A reliable intelligible system has to offer to the customers the following functional services.

Person-to-person transfer, which concerns money transfer from one account to another. Once money transfer will be carried out, a confirmation has to arrive both to sender and receiver for example via a SMS with the names and numbers of the sender and receiver and the amount the receiver. Consequently, the costumer is informed of the situation. The transaction has to be uniquely identified.

Savings service Customers need to have the possibility to save the money. The agent has to play an important role in the process of exchange cash for e-money. A depositing transaction confirmation has to arrive to depositor and agent. Once confirmation containing the previous and current balances, the transaction amount, the names and numbers of the depositor and agent arrives, the customer has to give the

money to the agent. The confirmation has to state the balance was before the new balance, the amount of the transaction the name and the number of the depositors the name and the number of the agent
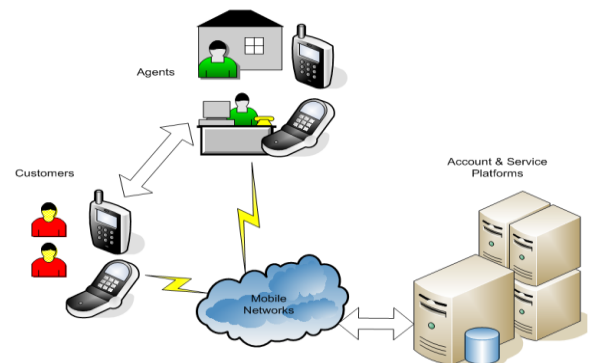


**Figure 6: The proposed system for financial services inclusion**

Government-to-person payment service concerns money transfer from a government account to the customer's account. The transaction has to be notified to the government representative and the customer, providing information on the previous and current balances, transaction amount, and name and phone number of the recipient and of the government representative

Cash withdrawal, which concerns the exchange of e-money for cash. A withdraw transaction confirmation providing information about the previous and current balances, the transaction amount, name and number of withdrawer and agent has to be sent to the withdrawer and agent.

The system has to provide end to end security and for the customer two additional non-functional services: i) checking the account balance and ii) seeing the list of transactions.

The mobile operator, as previously mentioned, plays an important role in the area of financial services. Consequently, a mobile network would be unavoidable. The minimum inclusion of the mobile operator provides at least the application environments. Maximum inclusion of the mobile operator relates to an account and services platform. The regulative and legislative environment has to be updated in order to allow a mobile operator to be a provider of the services. The current Albanian law allows only banks or some financial institutions to provide saving services to clients.

Various risks exist with the inclusion of agents in the system, and the regulative environment has to eliminate the existing risks for the institutions and customers. The agent helps withdraw the money (getting the cash after a transfer, when the cash saved is needed or when a payment is received from government) and deposit money (savings service). In addition, a reliable agent with a great amount of money helps meet the needs of clients. To be safe a secure mechanism has to be created in the communication between the customer and the agent, who could be, for example, a post office in the community or retail outlet in a village.

The provider of the system should offer an account and services platform. The provider of the system could be a bank that cooperates with a company that provides the distributed agents, for example Albanian Post, which has post offices and mobile operators that have distributor channels. A financial

institution could be also a provider of the system. The legislative and regulative environment is established for banks and financial institutions.

Potential user interface and possible ways of communication between users and service providers in non-traditional solution for financial inclusion that needs a mobile network are.

- Interactive Voice Response
- Unstructured Supplementary Service Data
- Short Message Service
- SIM Application Toolkit

There is no additional security, end to end security, when using IVR, SMS or USSD communication channels they rely on the security of GSM system. Figure 7 shows e schema of security when using IVR, SMS, and USSD communication channels. There could be some threats and risks on GSM including GPRS and EDGE networks that expose some vulnerability on the GSM security and as a result when using IVR, SMS or USSD as communication channels.
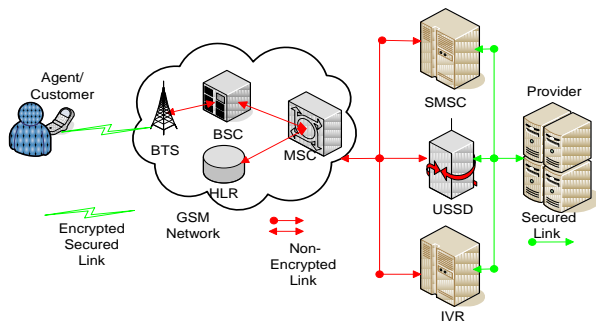


**Figure 7: Security on IVR, SMS, and USSD communication channels**

ASMONIA 2011 [15] provides more information on risks and threats on GSM networks. The UMTS network it is not considered because its implementation is expensive and is intended for customers that could use advanced applications like video calls that request the support of the user equipment too. We want to propose an information system that offers the financial services for all. People with low incomes or poor people have to be served too and they normally have a standard mobile phone that could support just basic services that are offered with GSM networks.

In order to provide end to end security when using one of the above communication channels in the solution it is needed another application that provide end to end security.

SIM Application Toolkit (SAT) is a set of applications and related procedures which may be used during a GSM session. SIM Toolkit applications are stored in the SIM which is a Smartcard that stores data for GSM network customers so could be used for applications that require high security such as financial services applications. The customer or the agent could access a menu which is created with SAT and is stored on the SIM. They could initiate commands to the provider like transfer money to a specified account or their handset like display menu etc with the confidence that is a secure communication channel. All the mobile phones actually available in the market support SIM Toolkit. The communication security when using SAT Application Toolkit it is shown in figure 8.

Hardware Security Module (HSM) offers cryptographic operations [16]. As a result when a HSM is implemented on

the server of the solution the SIM which is a smart card and as a result offers cryptographic operations could communicate in a secure way with the HSM. In this way the SIM can communicate with the service provider safely since traffic between them is encrypted using these keys.
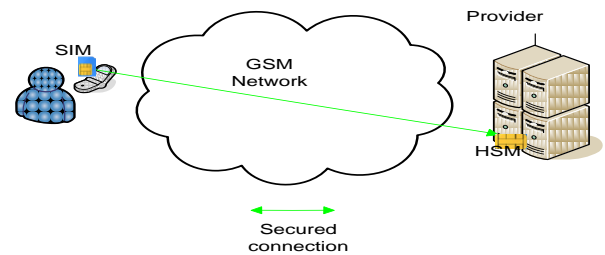


**Figure 8: Security on SIM Application Toolkit communication**

The best solution given that security is very important in financial services is the SIM Application Toolkit.

## 3.3 Application

As in any system information an application is necessary to make possible the sending of requests from customers and fulfilling of them from service providers. The user in the most appropriate solution presented above that provide financial services to all has to use a SIM card to communicate with the provider of the service. Security is really important when someone perform financial services. As a result will be one of the main requirements during the study and building of our application.
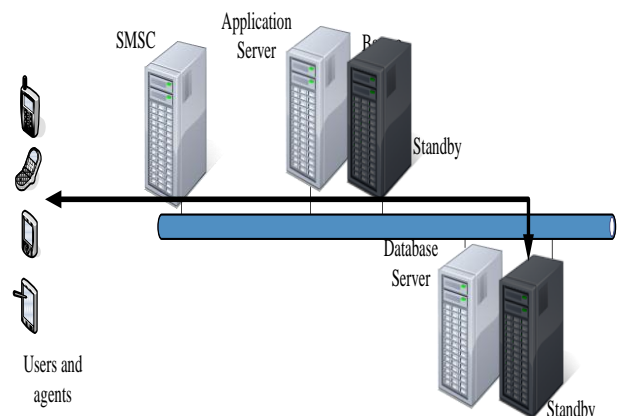


**Figure 9: The architecture of the proposed system**

The SIM card is a SMART card which stores data for a subscriber of a GSM network. Being a SMART card it provides security and as a result can be used for services that require high security such as financial services. From what it is seen above, it is noted that if SIM Application Toolkit (SAT) is used in the delivery of services accessible via mobile device (mobile services) the best end-to-end security is achieved. SIM Application Toolkit [17] provides mechanisms that allow applications that are on the SIM, to interact with a mobile phone and the external environment.

SAT-based services can be developed easily by using SIM API. It consists in API for proactive functions and API for transport functions. Procedural programming languages like C, Java and Visual Basic have full access to SIM API. The program that is built in a procedural language is being compiled and converted into byte code which is a code

independent from the machine. Byte code stored in a file called applet toolkit is sent to SIM. It is downloaded using as a carrier SMS which is transmitted to SIM card through SMSC or using BIP via GPRS.

If it is used BIP as a carrier the SIM card and the mobile device should support this protocol. Mobile handsets that support BIP are built recently and there are not many currently on the market. The SIM card also has the compatibility with this protocol as an additional option. The application that it is build will provide the opportunity for access to financial services for all users, for poor and low income users also, and this category of users can not use the new phones which cost a lot for them. As a result it will be used as a carrier the SMS which is transmitted to SIM card through SMSC.

Figure 9 depicts the architecture of the proposed innovative information system.

The standard 3GPP TS 03.48 "Security mechanisms for the SIM application toolkit" [18] defines the structure of secure packets for SMSs sent from a SIM to a different SIM and for broadcast SMSs. It also defines a set of commands used for remote SIM file management and a set of commands for remote management of SIM card applets compatible with standard 3GPP TS 03.19 [19].

A SIM card compatible with standard 3GPP TS 03.19 [19] has implemented a Java Card TM virtual machine. The virtual machine is also a bytecode interpreter and executes the toolkit applets. There are several virtual machines which facilitate the creation of mobile applications that run on SIM (programmers can use more popular programming language than SIM Toolkit) and download of the applications on SIM or updates after SIM is received by the user.
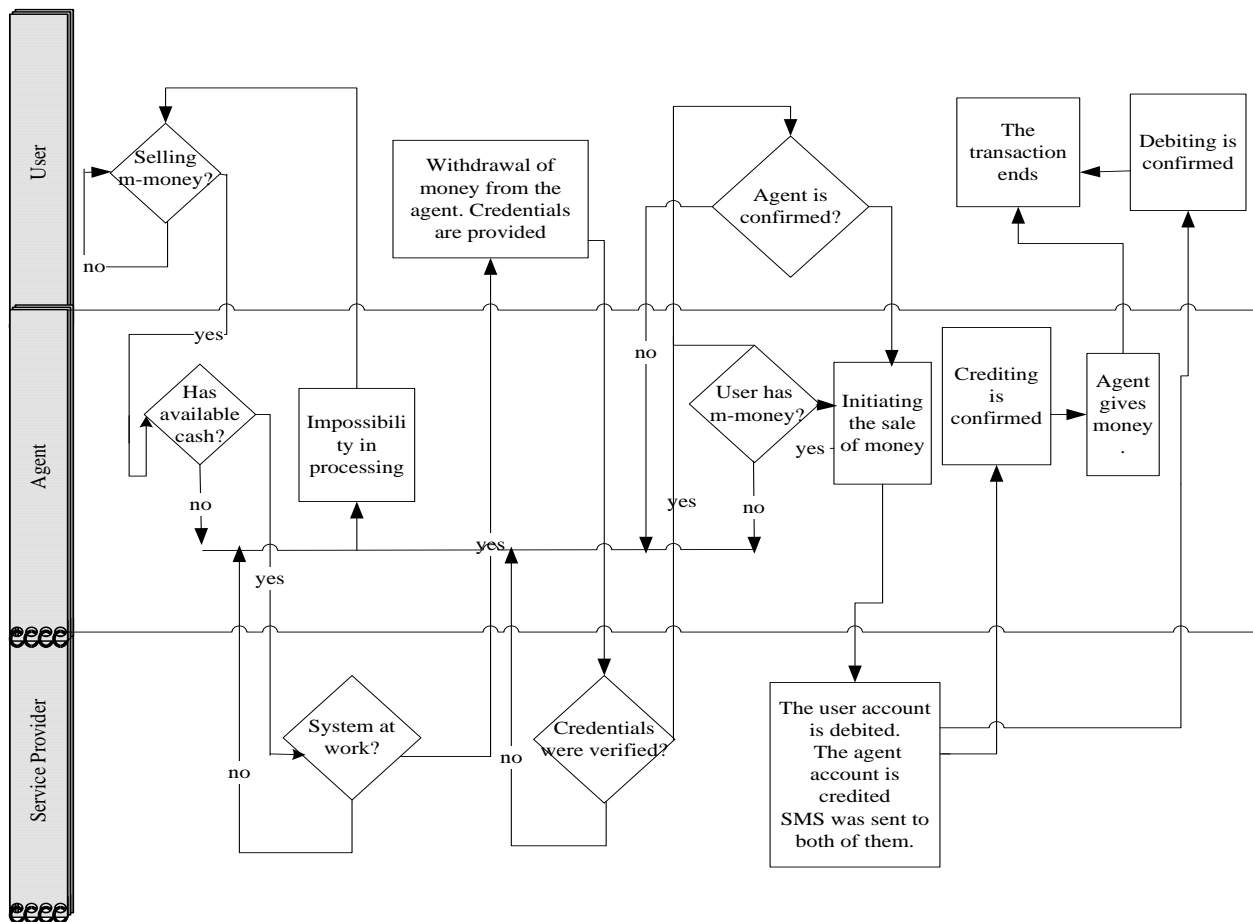


**Figure 10: The withdrawal business process**

Java CardTM SIM standardization is closer than other virtual machines. Java CardTM SIM is created by placing a virtual machine Java CardTM in the SIM card and adding a runtime library with access to SAT API. Java CardTM SIM executes programs that are built on Java Card version of Java. As a result it will be used Java Card programming language to create these services. The functional requirements were created and business process modelling is made. Figure 10 depicts the withdrawal business process.

The following javacard code makes possible adding a value on the user account.

```
private void VeprimiShto () {
        ProactiveHandler proHdlr = ProactiveHandler.getTheHandler ();
        proHdlr.initDisplayText ((byte) 0x00, DCS_8_BIT_DATA, Shto, (short) 0, (short) (Shto.length));
        proHdlr.send ();
proHdlr.initGetInput ((byte)0x00, DCS_8_BIT_DATA, Vlera, (short) 0, (short)(Vlera.length), (short)1, (short)5);
        proHdlr.send ();
        ProactiveResponseHandler rspHdlr=ProactiveResponseHandler.getTheHandler();
        rspHdlr.copyTextString(buffer,(short)0);
        shuma = Util.getShort (buffer,(short)0);
        if (shuma <=0 || (short) (balance+shuma) <= 0)
                ISOException.throwIt (ISO7816.SW_WRONG_DATA);
                else {
                balance += shuma;
                return;
        }
```

## 4. CONCLUSION AND FUTURE WORK

Provision of financial services for all will help reduce the poverty and the poverty exists. There is low accessibility to financial services in the country. Highly priced, financial services are barely affordable by the population that lives in urban areas, while access to financial access points barely exists in rural areas. The rural population spends more time and money on financial services than does the urban population. An appropriate solution would be of great benefit for all. An agent it is needed in the solution and it will be an important actor of it. They help withdraw and deposit money. The most appropriate solution is the solution where a mobile network is part of it and a mobile phone would be needed for the customer and agent. A mobile network would be unavoidable and of great benefit. The services needed by customers in a system that needs a mobile network and provide financial inclusion could be delivered by using as a communication channel: IVR, USSD, SMS or SIM Application Toolkit. The security is really important in the use of financial services. The most appropriate solution is the one that provide the best security. SIM Application Toolkit provides end to end security and as a result is the most appropriate solution in terms of user interface and wireless communications channel. SIM Application Toolkit provides mechanisms that allow applications that are on the SIM, to interact with a mobile phone and the external environment. SAT-based services can be developed easily by using SIM API. There are several virtual machines which facilitate the creation of mobile applications that run on SIM (programmers can use more popular programming language than SIM Toolkit) and download of the applications on SIM or updates after SIM is received by the user. Java CardTM SIM standardization is closer than other virtual machines. Java CardTM SIM executes programs that are built on Java Card version of Java. As a result the services needed by customers are created by using Java Card programming language.

The study of the most appropriate innovative information system for financial inclusion will serve as a source of information for the policymakers to draw strategies for the implementation of these innovative information systems and as a result to make possible the financial inclusion and the promotion of financial access in rural areas. The study could be a source of information also for the possible providers of the financial services with non-traditional methods to choose the most appropriate solution in terms of user interface and wireless communications channel. By implementing the most appropriate non-traditional solution for financial inclusion in Albania will benefit the most the people leaving in rural areas of Albania because they could not reach financial access points with the traditional solutions, they are poorer and with lower income than people leaving in urban areas.

Further work could be made to create in our system bill pay service and personalized interfaces for more advanced devices.

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