

A Study on Evolution of Digital Economy using Conceptual Models

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Abstract. Global economy is shifting from production-driven to consumer-driven economy with constant evolution in the buying behavior pattern. This necessitates an efficient tracking mechanism of cash circulation in the economy. Tracking of physical money becomes difficult once it moves out of a bank account. In this paper, the possibility of making customer payments, money transfers and all other financial transactions through digital smart cards ingrained with RFID and integrated SIM technology in the economy are analyzed and an attempt is made to bring out a set of conceptual models involving digital smart cards to usher in a more efficient, systematic and robust digital economic system. The proposed conceptual models have universal applicability across the global economic scenario, provided the country has the required technical infrastructure. However, in this paper, Indian economy has been taken as a paradigm to simulate these models.

Keywords: UID, UEBA, AADHAR, SIM, RFID

1. Economic Growth in India

India is increasingly attracting the world's interest with its impressive economic growth brought about by the liberalization process of the past two decades and vibrant market economy. The economy has achieved a growth of 8.5 per cent in 2010/11 and anticipated a 9 per cent growth in 2011/12. However it registered a growth of 6.9 per cent in 2011/12, lower than the previous year. But, in the current world situation, the growth rate proves the potential of India's economic future.^[1]

2. Objectives

The main objective of this paper is to design conceptual models facilitating the financial inclusion plan for all sections of the society.

- a. Digital Card Architectural Design
- b. Card Transaction Model
- c. Retail Payment Model
- d. Card Recharge Model

3. Digital Card Technology in the Economy

With economic growth in India, standard of living and the spending pattern of the people are improving. Key factors for this growth are the IT revolution since 1990 and the telecom revolution since 2000, enabling growth of many ancillary industries. However, this growth does not cover all, as one third of the Indian population is Below the Poverty Line. Moreover, there is wide gap in the purchasing power of the people above poverty line and below poverty line due to inequitable money distribution. Therefore, tracking physical money becomes cumbersome once it moves out of the bank account, leading to generation of unaccounted money, which escapes the tax net, affecting thereby country's economic planning and growth. These points demand the need for digital card technology in the economy.

Physical cash – circulation and production cost statistics

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- i) Number of coins minted in India Government Mint, Kolkata increased from 701.13 million in 2000-01 to 1443.80 million in 2009-10 and those minted in India Government Mint, Mumbai increased from 656.75 million in 2000-01 to 1574.75 million in 2009-10.^[2]
- ii) Notes issued increased from INR 2129.36 billion in 2000-01 to INR 7882.99 billion in 2009-10, whereas, notes in circulation increased from INR 2128.51 billion to INR 7882.79 billion during same period. The total money supply increased from INR 3794.50 billion in 2000-01 to INR 14858.91 billion in 2009-10.^[2]
- iii) The currency with public increased from INR 2095.50 billion in 2000-01 to INR 7680.48 billion in 2009-10, whereas, the deposit money of the public increased from INR 1698.99 billion to INR 7179.43 billion during the same period.^[2]
- iv) Circulation of coins increased from 73.78 billion pieces in 2000-01 to 100.01 billion pieces in 2009-10, whereas, their value increased from INR 52.42 billion to INR 99.57 billion during same period. [2]
- v) It is stated that the annual manufacturing cost of printing and minting currency and coins increased from INR 1525 crore in 2009-10 to INR 1628 Crores 2010-11.^[3]

Above points clearly indicate that manufacturing cost is directly proportional to the circulation of money. The government has to print currency and mint coins in relation to the demand, involving huge manufacturing cost (cost of paper, cost of ink, cost of metals etc). These direct and indirect costs are met by the tax money from the public. Moreover, the currency chest has to spend huge amounts in safeguarding the printed currency till it is put into circulation and the government also incurs additional cost in the proper disposal of the soiled currency. These costs can be minimised / eliminated if the financial transactions are made digital. The very concept of digital economic system will reduce tax burden of the common man. This process will eventually reduce inflation thereby paving the way for a sustainable economic development.

4. Conceptual Models

In this paper a 4-tier conceptual model is proposed to optimize and streamline the economy.

4.1. Digital Card Architectural Design

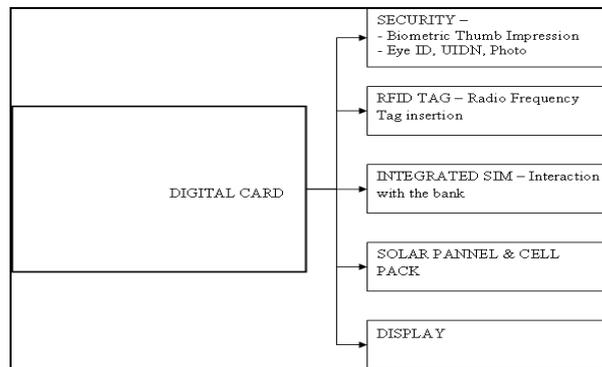


Fig 3.1: Newly proposed “Digital Card Model”

The proposed concept envisages the introduction of “DIGITAL CARD ARCHITECTURE” which complements the AADHAAR card introduced by Unique Identification Authority of Government of India. AADHAAR card is a UIDAI's mandate to issue every resident a unique identification number linked to the resident's demographic and biometric information, which they can use to identify them anywhere in India, and to access a host of benefits and services. The proposed concept of digital card is an idea for upgrading the AADHAAR card, the features of which can be ingrained in the current AADHAAR card.

4.1.1 Contents of the Card

As mentioned in figure 1, the card contains the following technical facilities.

- i) SECURITY – The security of the card concentrates on the following areas
 - a. Biometric Thumb Impression – For basic security, the thumb impression of the card user is loaded into the card to facilitate transaction authorization whenever the card is used.
 - b. Eye ID – Eye patterns of the user is loaded in the card as a complementary security system, which enables the authorization process.
 - c. UIDN & PHOTO – UIDN is that unique identification number provided with this card to every user. Also, the card is ingrained with user’s photograph. These features form the basic structure of the card. This enables the initial identification of a person followed by the authorization of every transaction.

- ii) RFID TAG – The card is installed with the contemporary Radio-frequency identification (RFID) tag. This technology enables speedy financial transaction in retail environs (process explained in the following sections).
- iii) INTEGRATED SIM – A Subscriber identity module (SIM) is installed in the card to enable the electronic fund transfer facility for the user, by which the digital currency is loaded in card with the help of RFID.
- iv) SOLAR CARD & BATTERY PACK – The card is backed by solar power technology, which will activate the SIM and RFID.
- v) DISPLAY & KEYS – The card is provided with a small display and feather touch keys, which enable the user to view each transaction.

4.1.2 Issuance of the Card

As contemplated earlier, this card is an up gradation of AADHAAR card issued by the Government of India, as planned by UDIAI, except for the point that the card holder is expected to open a bank account before activation and after his / her card is registered.

4.2. Currency Transaction Model

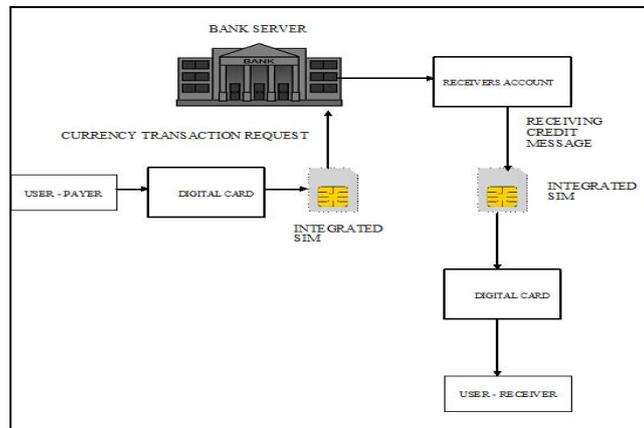


Fig 3.2: Newly proposed “Currency Transaction Model”

In this section, currency transaction model is enumerated, otherwise called as electronic fund transfer. The biggest advantage of this model is that the transaction is done with the digital card that is held by the users.

The proposed model of AADHAAR speaks that “A stable and secure channel for the delivery of micropayments will be central to successful, widespread financial access. A UID-Enabled Bank Account (UEBA) linked to a UID number can provide this channel. A customer can access their UEBA through a BC operating a handheld micro ATM (Automatic Teller Machine) device.

A UEBA provides four basic banking features:

- i) It provides a convenient store of cash for savings, with a facility for making electronic deposits and withdrawals in micro-amounts
- ii) It is a convenient way to make payments
- iii) It works as a fast channel for sending and receiving remittances
- iv) It allows balance queries, and provides a history of transactions

Transactions on the UEBA function essentially as a prepaid system, similar to that used by mobile operators. This enables local Business Correspondents (BCs) such as self-help groups and kirana shops to offer basic banking services at low risk to the bank. The customers are already familiar with this model. The BC starts out by depositing a certain amount with the banking institution. This ‘prepaid balance’ paid up by the BC to the bank changes with every transaction the BC makes. It decreases when a customer makes a deposit transaction and increases when a customer withdraws money. This transfer from physical cash to its electronic equivalent has precedence across India in the purchase of mobile prepaid cards. Each time a prepaid subscriber purchases talk-time for his phone in the form of prepaid cards, he is exchanging physical cash for electronic cash in the form of talk-time. The primary advantage of this approach is that even as it runs electronic transactions at the account level, thus bringing down the costs of cash management for banks, it also supports physical cash transactions at the local level—which is an important component of rural banking [4].”

However the above AADHAAR model can be taken to the next level with the issuance of the digital card (Model 1) as proposed in this paper. AADHAAR ideates about developing a network of BCs throughout

India to enable payments and deposits specifically in villages. This very process of payments and deposits can be addressed by the following mechanism to create a sustainable digital economy.

- i) In an organized sector, the monthly salary is electronically transferred to the bank account of the employee at the end of the month. From his account, an employee in an organized sector has various means to operate his cash in the current financial system. However in an unorganized sector, to pay day to day wages or payments, physical cash is the only medium used. To eliminate the handling of physical cash, the digital card steps in as a medium of financial transactions.
- ii) When a payer wants to pay an amount to the payee (where computer or smart phone is not an option) he uses this digital card where the card
 - a. First asks for the UID account number to which the amount has to be transferred
 - b. Next it asks for the amount to be transferred and Once it is entered, it asks for the pass code
- iii) When the user authorizes the transaction after entering the pass code, the integrated SIM contacts the bank server which in turn connects with the UID account of the payer.
- iv) Now the authorization of the transaction allows the bank server to transfer the amount authorized to the payee's UID account. This in turn generates the transaction message which is sent to the payee's card.

With the above said process the operations of Business Correspondents are eliminated as it throws out a certain level of complexity in the proposed AADHAAR model.

4.3. Retail Payment Model

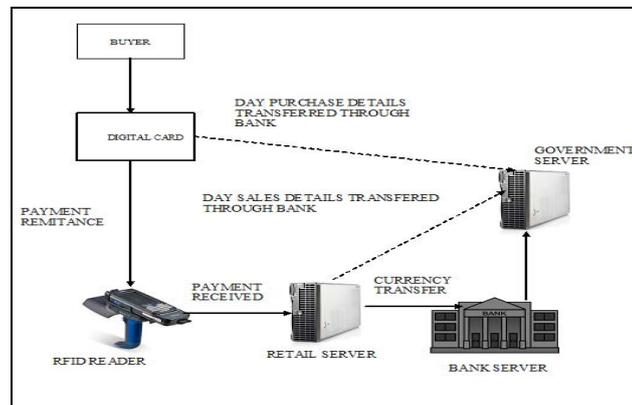


Fig 3.3: Newly proposed "Retail Payment Model"

Retailing is the system which delivers products and services to the ultimate consumer. As the name suggests, the retail payment model enumerates the process in which the payment of goods and services are carried out in a digital way. This model explains the digital way of transactions in a retail store.

- i) Once a buyer buys a product / service, the retailer enters the amount of purchase in the computer / a kirana store owner writes the bill.
- ii) The AADHAAR model envisages that the BCs hold a mini-ATM for payments / deposits, in villages / small towns, where computers and smart phones are rare.
- iii) In this retail payment model, it is proposed that the BC's hold an RFID reader instead of a mini ATM, which is connected to the bank server.
- iv) In a local kirana shop (sole proprietorship) the transfer of funds can take place through digital card transfer (as explained in Currency Transaction Model) instead of a RFID reader.
- v) As shown in the above diagram, once the purchase is made and the bill generated, the buyer shows his digital card (containing all information of the card holder and the digital money stored in the RFID tag installed therein) to the RFID reader and the RFID reader detects the RFID tag in the card, gets the information of the user and takes the billed amount from the digitally stored currency in the card.
- vi) After detecting the card, the RFID reader asks for the authorization of the card holder in the following ways to process the transaction:
 - c. It asks for the thumb impression and the eye ID of the user.
 - d. Since both the above informations are stored in the card, the reader verifies the real time thumb impression and eye ID given by the user with the stored information of the card.
 - e. On successful verification, the transaction is processed. If not, the transaction is rejected.

- vii) Now the retail server receives the digital money through the RFID reader and contacts the bank, which in turn contacts the government server to account the details of the transaction.

4.4. Card Recharge Model

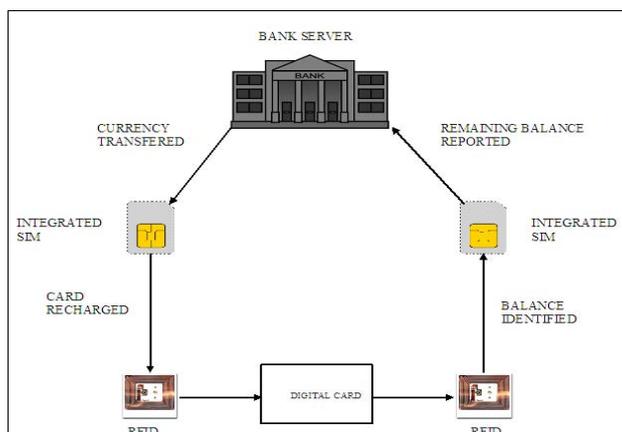


Fig 3.4: Newly proposed “Retail Payment Model”

In RFID technology, the RFID tag can store information in it. In the retail payment model, digital money will be stored in the RFID tag to make an instant transfer of money for the goods purchased - to the RFID reader and then to the retail server. To enable this speedy transfer the card has to be recharged as and when it attains the minimum balance as per the process below:

Once the money stored in the RFID tag reaches the minimum balance, it triggers a reminder to the bank server through the integrated SIM and the bank server, with the request received, authenticates the request by verifying the card’s information and recharges the RFID tag through the integrated SIM.

5. Dealing with Voluminous Transactions

In an economy, the government and the companies often deal with voluminous financial transactions and these should be routed through a streamlined accounting procedure. However, sometimes unethical and questionable transactions are resorted to. These unaccounted transactions lead to generation of black money like buying a house, investing in land or gold etc. Implementing the above proposed models will ensure an economy free of black money and the economy will operate in a transparent manner in a fully digital environment.

6. Benefits of using Digital Card Technology

Some of the notable benefits of digital card technology into the financial system are listed below:

6.1. Technological Advantages

- i) Multi-information storage card with biometrics, with high security and accurate data
- ii) The tag can stand a harsh environment
- iii) No line of sight requirement and Long read range & Portable database with multiple tag read / write

6.2. Paper Specific Advantages

- i) Creation of a more organized and systematic economy in the country through elimination of physical money and easy handling of digital money.
- ii) This model of unification stands as the base for future technology to be implemented and helps the economy to gradually move into digital platform.
- iii) The government gets an accurate data regarding “below the poverty line” people, which will enable them to formulate the five year plans for economic growth and in formulating economic policies by analyzing the buying and spending pattern of the economy which helps in regulating inflation.
- iv) As the concept of financial inclusion is one of the main objectives of AADHAAR, this model, further expands the purview of the concept in a simpler and accessible way.
- v) Helps in easy tracking of cash flow and in turn eliminating generation of black money. Elimination of black money helps the economy by equitable distribution of wealth. Also the elimination of black money helps the government to reduce the tax rates on account of equally distributed cash flow.

- vi) Savings of every person is considered to be the capital of a country. This model will give boost to savings and the pattern of savings & spending can be monitored through this model.
- vii) The model ensures a systematic collection of tax as the model by default eliminates the concept of unaccounted money or tax evasion.
- viii) Finally this model eliminates the cost involved and the process of printing the currency notes and coins.
- ix) This model helps environment protection as paper currency is replaced with digital currency.

7. Challenges of using Digital Card Technology

Following are the main challenges that the concept would face in implementation:

- i) **Technology and Infrastructure:** Developing the required infrastructure at the national level will be a challenging task for the government to implement this model. Besides implementing, the government should be one step ahead in designing, implementing new technologies and maintaining them.
- ii) **Security:** The next biggest challenge would be ensuring the security of such digital economic system, especially with mounting cyber crime / warfare. The government should foresee the possible cyber threats and should upgrade their security system through continuous / constant research which will give them an edge in safeguarding their digital assets and the economy from such digital attacks.

8. Conclusion

Financial services embedded with modern technology will bring in sea change in the economic canvas of the country. Induction of the above model in the country's economy would be a sure game changer; it will create a systematic and organised way of dealing with financial transactions & the country's ever growing needs and giving boost to government's financial inclusion plan. However, being a conceptual model, further in-depth research and proper implementation thereof are the *sine qua non* for the success of this model.

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