CHAPTER 5
OBSERVATIONS, CONCLUSIONS AND SUGGESTIONS

5.1 Observations
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5.1 OBSERVATIONS:

Introduction:

This is fifth chapter of the thesis. This chapter presents the important observations of the study based on the statistical analysis of the data interpretation. Observations are given as general observations and specific observations.

General observations:

- It is observed that the majority of the service users are unsatisfied regarding support provided by the banks for solving their queries.
- It is found that all banks have excellent portability in ATM cards service with multiple banks.
- It is observed that the supports provided by all the banks through telephone are not satisfactory.
- It is seen that banks response for solution to the queries via internet are not satisfactory.
- It is observed that banks are not interested much for solving problems of customers. Whereas, the private sector banks are more supportive than nationalized banks.
- It is observed that the availability of information on internet is helpful for improving the E-banking services. From both sectors, banks have to publish information in a such way; that it will be easy to understand. The information should be reliable and useful.
- It is found that the majority of service users are highly satisfied with the security maintained for their accounts.
- It is observed that the growth and usage of ATM services are more in Sangli district. The majority of people having ATM cards (debit) and they use it frequently. The most use of cards is for withdrawal of cash. Banks provide ATM cards free of cost to their customers.
- It is found that the service users are satisfied with the facility of re-entering password while operating ATMs.
- It is observed that personal identification number (PIN) code is good security for operating ATM. Also it is found that sometimes service users are unable to remember and type correct PIN code.
➢ It is observed that many service users from urban area have started using mobile banking for paying utility bills like- water bill, electricity bill, charging mobiles etc.

➢ It is observed that many people have started using internet and mobile banking services for paying bills, premiums, tax etc.

➢ It is observed that EFT/NEFT is good service for transferring funds provided by all national and private sector banks. Due to its global scope and availability in each bank it is more popular service.

➢ It is observed that, people are more familiar with ATM operation as compared to internet and mobile banking services. Also ATMs are available at district place, taluka place, corporation areas, government offices, bazaar, market place, and other public places in Sangli district.

➢ It is found that interest rate for credit amount is higher in private sector banks as compared to the nationalized banks. Further time given for repayment of credited amount is more in private sector banks than the nationalized banks and sufficient amount is credited in both banks.

➢ It is found that opinion for helpline provided by the private sector banks are more reliable, useful and effective than that of the nationalized banks.

➢ It is observed that the majority of pensioners visit bank branches for getting account information.

➢ It is observed that the main intentions of pensioners to visit banks are- to deposit cash, passbook printing, withdraw and confirmation of cash.

Specific Observations:

✓ It is found that the private sector banks customer relations are better for giving good treatment to account holder than the nationalized banks.

✓ It is observed that all E-banking services like ATM, Internet, Mobile banking are not available in all places in Sangli district. At the district, taluka or tahasil places such services are available and sometimes due to some technical problems services are not operating due to insufficient cash in ATMs or due to network fail. Very few places have internet and mobile services. Major cities like Sangli, Miraj, Palus, Tasgaon, Vita, Islampur have more utilization and more e-service availability and usage as compared to other places like Ashta, Shirala, Kavte Mahankal, Jat and Atpadi.

✓ It is found that the internet banking (IB) usage is very less as compared to ATM services. The majority of account holders are unaware about internet banking.
services. The usage of IB is more in private sector banks as compared to nationalized banks.

✓ It is found that mobile banking services are used less in semi-urban and rural areas. The majority of service users are in Sangli, Miraj, Tasgaon, followed by Islampur, Kavte mahankal. But in remaining semi-urban and rural areas mobile banking is not much popular and used.

✓ It is observed that responses for on-line help provided by bank on internet are less effective. It is found that the majority of service users are unable to understand and use help provided by internet.

✓ It is found that many service users having a problem of handling and maintaining ATM cards of different banks.

✓ It is observed that the utilization of funds transfer service is growing fast over traditional methods.

✓ It is observed that the banks are providing good services for issuing and maintaining debit cards. Every bank has some limitations for withdrawing cash from ATM. It is due to the security purpose. Further no or very less charges are applied for providing new card or for regenerating new card.

✓ It is observed that customer relationship, product information services provided by private sector banks are better than the nationalized banks.

✓ It is found that the majority of pensioners are using ATM services than other E-banking services.

✓ It is observed that the majority of the pensioners prefer bank counter for withdrawal/transfer of cash than E-banking services.

✓ It is found that the majority of service user’s wants cash depositing system in ATM centers.

✓ The majority of service users opined for having authenticity at the time of swapping card at point of sale (POS) place.

✓ It is found that service user demands for the biometric security, because of easiness, simplicity and natural security.

✓ It is observed that the majority of service users prefer thumb, palm and iris as biometric security.
5.2 CONCLUSIONS:

I Reliability

It is concluded that the service users from the private sector banks are more satisfied than that of the nationalized banks for providing E-banking services as per broacher/specification. The service users are not much reliable with the service of good support to query. Further it is concluded that both the banks keep accurate account records. Service users are highly and equally satisfied with the services in the nationalized and the private sector banks. Portability in ATM card service, is excellent service provided by both the banks and respondents from both the banks are highly satisfied this service.

Further it is observed that service users are not satisfied with the service of generating alert by bank after updating account balance. Service users satisfactions in private sector banks are more than the nationalized banks. In general, service users from both the nationalized and private sector banks are unsatisfied for the service of providing support by banks for solving their queries. Comparatively, it shows that the respondents from the private sector banks are more satisfied than the nationalized banks. (Ref. Table 4.9)

II Responsiveness

Service users are not satisfied from both the banks for good and timely response for enquires. Further it is seen that the satisfactions from the nationalized and the private sector banks are same. Further it is concluded that service users from both the banks are unsatisfied for providing good continuity in services. It is observed that the service users expect more support via telephone for solving their problems and queries. But as per opinion, existing services provided by both national and private sector banks are not reliable and sufficient.

Further the service users are not much satisfied for immediate response provided for queries via internet. It also pointed out that, among all responses 24.72 per cent service users; responded it ‘very poor’ for that service. Further the private sector banks’ service user’s responses for immediate support on internet are good. The service users are satisfied for providing information about new scheme by both the nationalized and the private sector banks. Further private sector banks satisfaction contribution is more than the nationalized banks.

Overall satisfaction for better treatment to service users by the banks is unsatisfactory. But it is seen that in the private sector banks service users are more satisfied for the better treatment given to account holder as compared to the nationalized banks. (Ref. Table 4.10)
III Assurance

It is concluded that the overall service users are not satisfied with banks in supporting for solving their problems satisfactorily. Further private sector banks provide good support than the nationalized banks. Further it is concluded that overall service users are unsatisfied for availability of all bank information on internet.

It seems that the service users felt that, existing bank information available on internet is complex. The majority of service users from the private sector banks are satisfied than the nationalized banks for availing internet services. The service users opined that they are unsatisfied about availability of all E-banking services like internet, mobile and ATMs service.

Satisfaction level of private sector banks is more than that of the nationalized banks. Both banks provide good security to accounts. Opinion of service users from both the banks are satisfactory with the service of banks not performing any operation on account without permission of account holder. (Ref. Table 4.11)

IV Empathy

It is concluded that both the banks are providing satisfactory information for operating ATM card. It is seen that for this service, private sector banks are helpful to the customers. Service users from both the nationalized and the private sector banks are dissatisfied about guidelines provided by the banks for operating internet, mobile and online help on internet.

It is further seen that service users from both the nationalized and the private sector banks are satisfied for the service of having re-entering password for operating ATM and internet banking services. (Ref. Table 4.12)

V Operability in E-banking services

It is concluded that the service users from both the banks are not satisfied for the process of registration of E-banking services. It shows that service users feel complexity for registration of E-banking services like – Internet, Mobile. But the service users are more positive with the private sector banks regarding E-banking registration process. Further service users are highly satisfied with operating ATM, internet, mobile banking services from both the nationalized and the private sector banks.

It reflects that, overall service users from the nationalized and private sector banks are unsatisfied with location and availability of – ATMs. It is concluded that the service users are happy and satisfied about the service; as they don’t find any problems in balance mismatch
while operating E-banking services. Thus both nationalized and the private sector banks are providing excellent service for keeping account balance accurately. (Ref. Table 13)

VI  Security

It is concluded that the service users are highly satisfied with the security provided by both the nationalized and the private sector banks. Service users agreed for suitable PIN code for security purpose while using E-banking services. Further it is seen that, bank keeps account information secure, good protection against the unauthorized access. It provides excellent physical and logical securities to ATM centers and other E-banking services like internet, mobile banking etc. (Ref. Table 4.14)

D. Different methods of performing transactions

It is concluded that the majority of service users prefer service counter than internet and mobile banking service. Further, people started using internet and mobile banking services for transferring funds. For bill payment majority of people use service counter. On the other hand, people prefer internet for bill payment and premium payment than the debit and credit cards. Also the contribution of tax payment via internet is growing dramatically. (Ref. Table 4.15)

E  Level of Satisfaction

EFT/NEFT

It is concluded that the majority of service users from the nationalized and the private sector banks are fully satisfied with the service of simplicity in operating EFT/NEFT. Further through EFT/NEFT sufficient amount is transferred within minimum fees. Also immediate confirmation of transaction is done and this service is available in each bank. Thus, service users opined that EFT/NEFT is excellent service. (Ref. Table 4.16)

Mobile banking

We conclude that the majority of the respondents are highly satisfied with this service of providing response to requested queries as well as funds transferring through mobile banking service. Further it is observed that the respondents from the private sector banks are more satisfied than the nationalized banks for the service with very less service charges. Both the banks provide good service for generating alerts through simple mail message (SMS) on mobile by successful transaction with good continuity and punctuality in providing services. Also the service users are highly satisfied with the service of quick and timely response from the nationalized and private sector banks. (Ref. Table 4.17)
ATM banking

In general it is concluded that while using ATMs, the majority of the respondents are satisfied with the supported facility of multiple languages. Further it is observed that the service users found some problems while operating ATMs like insufficient balance, network problem. Also, the majority of service users are satisfied with the availability of ATMs at convenient location.

Among the service users of both the banks, the private sector banks service users are more satisfied than the nationalized banks for the convenient location of ATMs. Further it is concluded that the majority of service users are agreed for- banks return debited cash due to failure transaction. Balance slips are provided in ATM centre after every successful transaction. (Ref. Table 4.18)

Debit card

We conclude that the majority of service users from both the banks opine that banks don’t charge more for debit card transaction. The service users from both the banks are unsatisfied for having limitation for withdrawing amount and for providing new card after few years or some transactions. Further it is observed that, the private sector banks service users are more satisfied than nationalized banks about card facility services. (Ref. Table 4.19)

Credit card

It is concluded that, the service users are satisfied with credit services. Also it reflects that the service users are unsatisfied for affordable interest rate for credit amount charged by banks. Further it is observed that the private sector banks respondents are more satisfied than the nationalized banks. The majority of service users from both the banks are unsatisfied with insufficient timeperiod given for the repayment of credit amount. (Ref. Table 4.20)

Internet Banking

It is concluded that almost all the respondents are satisfied with the high speed of opening and operating of bank web sites from both the nationalized and the private sector banks. Further good security is maintained in internet banking service. Also banks web sites support multiple browsers. There is simplicity in operating bank web sites and 24 hours and 7 days availability. Further the majority of the service users are satisfied for having understandable internet banking demonstration supporting for multiple operations on bank web sites. (Ref. Table 4.21)
Real Time Gross Settlement (RTGS)

It is concluded that the majority of service users have not used RTGS services, but very few service users use the service. Further it is seen that the service users from the private bank sector are more than the nationalized banks. (Ref. Table 4.22)

It is concluded that the majority of service users from the nationalized and the private sector banks strongly agreed for the service of sufficient amount transfer (i.e. 91.38 per cent and 82.50 per cent). (Ref. Table 4.23)

It is observed that very less service charges are applied by the banks for per transaction of RTGS service. The service users from the nationalized banks are more satisfied than the private sector banks. (Ref. Table 4.24)

It is concluded that all RTGS service users from the nationalized and private sector banks are highly satisfied with the time required for fulfilling and completing transaction. (Ref. Table 4.25)

Helpline provided by banks

We conclude that the majority of the service users are unsatisfied with the service of reliable and right kind of information timely provided by banks. Further, it is observed that the service users from the private sector banks are more satisfied than the nationalized banks. Further, as per service user’s opinion, information available on internet is not much supportive for solving problems. Also the service users are unable to fully understand frequently asked questions (FAQ) on internet.

It is concluded that the service users are not satisfied with the service for providing information through e-mails. But the private sector banks service users are more satisfied than nationalized banks for providing help and latest information through e-mail. The majority of service users express that the information is not updated time-to-time on bank web sites. Further it is seen that the private sector banks service users more satisfied than the nationalized banks service users. (Ref. Table 4.26)

Transparency

We conclude that E-banking system provides transparency in transaction. Further, the researcher is trying to identify upto which extent transparency is maintained. It is observed that E-banking doesn’t lead 100 per cent transparency in transactions. Transparency lies in between 90 to 98 per cent for the various types of the transactions. Majority of the service users are satisfied with transparency in E-banking services (Ref. 4.28)
Pensioners Information

It is observed that the majority of pensioners prefer to visit bank branch for cash withdrawal, printing passbook and fund transfer. Very less amongst them are using ATM, internet and mobile banking services. (Ref. Table 4.29 to Table 4.32)

General opinion service users

Majority of the service users demand for cash depositing system in each and every ATM center. They also demand for entering password at the time of swapping card at point of sale (POS) place. Further almost all service users prefer for biometric security in ATMs and prefers -thumb, iris, palm and voice as biometric input. Also they wish to provide alert system before any transaction on their account. (Ref. 4.33 to 4.37)

5.3 SUGGESTIONS:

Suggestions for both nationalized and private sector banks:

- The banks should provide automatic SMS alert facility to every account holder after updating balance.
- The banks should focus on customer relationship by providing support to queries and helping for operating e-services.
- The banks should take continuous region wise follow-ups and provide immediate response via e-mail or SMS for internet support.
- For customizing e-services use of e-channels like- SMS, e-mail is more effective.
- The bank web site design should be attractive, easy to understand and related, relevant information should be easily accessible and useful. If banks provide information in local languages then it will be easier to use it. This helps to utilize more E-banking services.
- E-banking services are not available in all places in Sangli district. Thus both the nationalized and the private sector banks should provide such facility in semi-urban and rural areas. Many of talukas like Shirala, Jat, Kavte Mahankal, Khanapur Kadegaon have only limited ATMs, internet and mobile services.
- Present usage of ATM services is good in Sangli district. Further by installing on-site and off-site ATMs at rural area at convenient location helps to enhance this service to rural people.
• Both the nationalized and the private sector banks should create awareness among the customers about internet and mobile banking and motivate them by conducting free seminars and demos in banks.

• The banks should assure customers about good e-services and explain their benefits.

• It is necessary to create awareness among customers to increase the usage of mobile banking. Also the banks should provide demos, guidelines and help for operating mobile banking services.

• The banks should design web sites in local languages. This is more useful to local service users to understand and better utilization of e-services.

• It is recommended that if availability of ATMs increases in rural area then there will be more ATM business. Thus, banks should implement on-site or off-site ATMs where populations is more than 2000 in rural area.

• The banks should increase cash withdrawal capacity from ATMs on the basis of quarterly balance which will be helpful for customers for urgent needs.

• The majority of people is unfamiliar about the credit card services. Thus, banks have to provide detailed information and provide this service to every account holder as per demand.

• For improving E-banking services; the banks should provide services like- alert facility- if balance goes down below minimum balance level and collect customer feedback for the services, alerts for new products and changed interest rates and alerts for different offers/gifts/discounts for online purchase, clear and detailed information of schemes on internet.

• To increase the utilization of E-banking services by the pensioners especially internet and mobile banking, it is recommended that banks should provide demos for operating internet and mobile banking.

• It is recommended that the banks should add facility of depositing cash in ATM centre. Recently, there is vast demand for that service and it will reduce work pressure on bank employees; for depositing cash and also save customers from waiting in queues for depositing cash.

• At the time of payment via POS machine, the banks have to make compulsory authentication of service users through password or any other authentication mode like biometric authentication while swapping card.
• The banks should implement biometric technology in ATMs, mobile and internet banking for avoiding frauds, malpractices and misuses of accounts. The service users should give priority to the thumb, palm and iris for biometric authentications (biometric method).

• The banks should make use of extensive customer information to gather customer insights.

• The banks should make some services compulsory based on E-banking services for motivating service users in utilizing E-banking services.

Suggestions for Nationalized Banks:
• The employees of banks that they should establish better relations with the customers. This can be done by understanding and helping to solve problems of customers.

• The banks should improve customer relationship via personal contact, e-mail, SMS, telephone, mobiles which leads to better customer satisfaction and also helps for more utilization of E-banking services.

• By opening ATMs in rural area helps to improve better and quick e-services with good business opportunities.

• The banks should focus on providing more internet and mobile banking services.

• The banks should support updated, relevant and clear information on internet in regional languages. Also different online forms should be available on internet for quick service.

• The banks should appoint efficient and expert IT staff for enhancing and supporting IT services.

• The bank should provide immediate information for service charges, service tax, interest, penalty if any etc. for keeping transparency in E-banking services.

• The banks should identify customer segments and customize products/services.

Suggestions for Private Sector Banks:
• The banks should open more branches with ATMs in rural area (except ICICI bank).

• For opening new account, bank should reduce minimum balance amount condition so that average income people will open account in bank and avail different E-banking services.

• For improving E-banking services banks should take feedback monthly or quarterly of service users.
- If bank provides internet services in local languages then there is more use of internet banking by the local service users; which will lead to better utilization of internet banking.

**Technical Suggestions:**

**Banks:**

- Banks should use the proxy server type of firewall so that there will not be any direct connection between the internet and the bank’s system.
- Information System Auditor should audit the information systems periodically.
- Banks should introduce logical access controls to data, systems, application software, utilities, telecommunication lines, libraries, system software etc. Logical access control techniques may include user-ids, passwords, smart cards or other biometric technologies.
- For sensitive systems, a stateful inspection firewall is recommended which thoroughly inspects all packets of information, and past and present transactions will be compared. These generally include a real time security alert.
- Physical security should cover all the information systems and sites; where they are housed, both against internal and external threats.
- Banks should have proper infrastructure and schedules for backing up data. The backed-up data should be periodically tested to ensure recovery without loss of transactions in a time frame as given out in the bank’s security policy.
- In case of internet disconnectivity problem, wireless modem (e.g. MTS, Reliance, BSNL) should be used for avoiding inconvenience and continuity of banking services.
- Banks should update/renew or maintain computers periodically for faster, safer and for immediate service to end users.
- Banks should update antivirus software timely to detect viruses for protecting and securing confidential information of service users and their own.
- Bank should provide power back-up facility (online) to avoid inconvenience of daily work.
- If bank support ATMs for depositing cash and printing passbook in bank, then it will be very excellent service to service users.
- Bank should implement biometric security (i.e. thumb, palm, iris etc) for identification of service users to avoid misuse and fraud in banking transaction.
• Only authenticate and licensed software’s should be installed into the PCs of banks.

E-banking service users

• Bank service users should never share personal information like PIN numbers, passwords etc. with anyone, including employees of the bank.
• PIN or password should not be stored, the PIN or passwords should be changed frequently and memorized before destroying.
• Bank service users are advised not to provide sensitive account-related information over unsecured e-mails or over the phone.
• Always use E-banking at house or only at secure place and not at public places.
• While operating internet banking, confirm accurate bank web site name, https://, and ensure whether banking session is secure for banking operations.
• Due to network problems online banking websites go down. When this happens, there's no backup branch that you can go to- and the phone lines will be clogged. To protect yourself, always keep a local bank or credit union account open with some emergency cash.
• The risk of technological changes has to be carefully watched. This is essential to update technologies and remain cost effective and customer friendly.

5.4 CONCLUDING REMARKS:

Banking business is based on customer satisfaction. Delighted customers and their satisfaction help to achieve more business target with the better benefits to banks. New technologies are emerging in business every day. By adopting these technologies and providing these services at the bottom level of service users help to reduce cost, time, efforts and leads to better customer satisfaction. E-banking is one of the powerful technologies for providing excellent e-services to service users. Thus proper utilization of these e-services in rural, semi-urban and urban areas by considering needs and requirements of potential service users helps for growing skill, knowledge and economy of the country.

Further we observed that, both the nationalized and the private sector banks provide nearly equal E-banking services in Sangli district. The nationalized bank branches are distributed more in rural area as compared to the private sector banks. Thus if the nationalized banks provide more E-banking facility like- installation of ATMs, the availability of internet facility, with the mobile services in rural area then there will be high potential market for their existing branches. Thus by providing reliable, qualitative,
transparent, secure, timely and satisfactory E-banking services banks can achieve more benefits and their vision.

Analysis of result reveals that ATM services are more popular than other services in Sangli district. Reasons for using ATMs are for withdrawal amount and balance enquiry. It also reveals that, the service users from the urban area use more E-banking services as compared to the semi-urban and rural areas. The majority of E-banking service users are in age group of 35-45 years and below age 35 years, as compared to age group of above 55 years age. Post graduates use more E-banking services followed by graduates and very less by the under graduates and matriculates.

SCOPE FOR FURTHER RESEARCH:

Present study deals with the evaluation of E-banking service users in the nationalized and the private sector banks in Sangli district. During the present study we conclude that there is growing demand for E-banking services. People use and perceive technology in different ways and a study explores the perception towards ATM, Internet and Mobile services. The study deals with Sangli district, if applied globally, it will be more useful to banking field to understand perception towards different E-banking services in different areas like- villages, taluka places, district and state level also in different sectors like- banks, industry, business, and service sector which will be easy to understand and overcome problems in that services for optimizing utilization of E-banking services worldwide.

5.5 Proposed conceptual model: Security in E-banking Via Card less Biometric ATMs

Introduction:

Banks in India have started introducing biometric automatic teller machines (ATMs) as it seems to be an effective way of preventing card usage and is also a channel to expand a bank’s reach to the rural and illiterate masses. Union Bank of India installed a first such ‘Kisan ATM’ at Siyagangai branch in Tamil Nadu. Dena Bank has launched the Bio-metric ATMs in Gujarat. Corporation Bank has also introduced ‘talking’ biometric ATMs. These ATMs talk to the farmer in their local languages.

Researcher has designed new innovative model for biometric ATMs which replaces card system by biometric technology for operating ATMs. Proposed model provides high security in authentication which also protects service user from unauthorized access. In this proposed model user required to authenticate himself with biometric identification.
(fingerprint and iris), Personal Identification Number (PIN) and selection of bank from displayed list. This proposed model is designed for the rural farmers, semi-literate people. This model reduces complexity with authentication as “authentication is always with you” with high security. It also saves time, cost, and efforts compared with card based ATMs and also saves environmental pollution problem of excess number of plastic cards.

**Alternative uses of ATMs:**

Although ATMs were originally developed as just cash dispensers, they have evolved to include many other bank-related functions. In some countries, especially those which benefit from a fully integrated cross-bank ATM network, ATMs include many functions which are not directly related to the management of one's own bank account, such as:

Deposit currency recognition, acceptance, and recycling, paying routine bills etc. Following are some alternative uses of ATMs:

- Printing bank statements.
- Updating passbooks.
- Adding pre-paid cell phone/ mobile phone credit.
- Purchasing.
- Postage stamps.
- Lottery tickets.
- Train tickets.
- Movie tickets.
- Transferring money between linked accounts (such as transferring between checking and savings accounts)
- Games and promotional features.
- Donating to charities.
- Cheque Processing Module.
- Gold, Silver, Diamond.

**Current examples of ATM usage:**

1. In London [in 2011] some smart businessmen launched the country’s first gold ATM. Stick in your debit card or some cash, and the machine will swap your plastic or paper money for a small bar of the real stuff.

2. In Mumbai, branded jewelry manufacturer Gitanjali group launches ATM that dispenses diamonds in addition to gold and silver. [*]
Increasingly banks are seeking to use the ATM as a sales device to deliver pre approved loans and targeted advertising using products such as ITM (the Intelligent Teller Machine). ATMs can also act as an advertising channel for companies to advertise their own products or third-party products and services.

**Working model of Proposed Biometric ATM:**

![Block diagram of Proposed Biometric ATM](http://e.wikipedia.org/wiki/File:Atm_blockdiagram.png)

**Basic hardware requirement:**

An ATM is typically made up of the following devices:

- Central Processing Unit (to control the user interface and transaction devices).
- Biometric devices.
- PIN pad (similar in layout to a Touch tone or Calculator keypad), often manufactured as part of a secure enclosure.
- Secure crypto processor generally within a secure enclosure.
- Display (used by the customer for performing the transaction).
- Function key buttons (usually close to the display) or a touch screen (to select the various aspects of the transaction).
- Record Printer (to provide the customers with a record of their transaction).
- Vault (to store the parts of the machinery requiring restricted access).
- Housing (for aesthetics and to attach signage).
Mechanisms found inside the vault may include.

- Dispensing mechanism (to provide cash or other items of value).
- Deposit mechanism including a Check Processing Module and Bulk Note Acceptor (to allow the customer to make deposits).
- Security sensors (Magnetic, Thermal, Seismic, gas).
- Locks: (to ensure controlled access to the contents of the vault).
- Journaling systems; many are electronic (a sealed flash memory device based on in-house standards) or a solid-state device (an actual printer) which accrues all records of activity including access timestamps, number of notes dispensed, etc. - This is considered sensitive data and is secured in similar fashion to the cash as it is a similar liability.
- ATM vaults are supplied by manufacturers in several grades. Factors influencing vault grade selection include cost, weight, regulatory requirements, ATM type, operator risk avoidance practices and internal volume requirements.
- ATM manufacturers recommend that an ATM vault be attached to the floor to prevent theft though there is a record of a theft conducted by tunneling into an ATM floor.

Basic software requirement:

With the migration to commodity Personal Computer hardware, standard commercial "off-the-shelf" operating systems, and programming environments can be used inside of ATMs. Today the vast majority of ATMs worldwide use-

Operating Systems: Microsoft windows OS, Windows XP professional, Windows XP embedded or Linux. A small number of deployments may still be running older versions of Windows OS such as Windows NT, Windows CE or Windows 2000.

Application layer transaction protocols: Diebold 91x (911or 912) and NCR NDC or NDC+. Newer versions (e.g. NCR's AANDC v3.x.y, where x.y are subversions). Most major ATM manufacturers provide software packages that implement these protocols. Newer protocols such as Interactive Financial Exchange (IFX).

Application Protocol Interface (API): With the move to a more standardized software base, financial institutions have been increasingly interested in the ability to pick and choose the application programs that drive their equipment. XFS, now known as CEN XFS, provides a common Application Platform Interface (API) for accessing and manipulating the various devices of an ATM. The result of these differences in interpretation means that ATM
applications typically use a middleware to even out the differences between various platforms.

With the onset of Windows operating systems and XFS on ATM's, the software applications have the ability to become more intelligent. This has created a new breed of ATM applications commonly referred to as programmable applications. These types of applications allows for an entirely new host of applications in which the ATM terminal can do more than only communicate with the ATM switch. It is now empowered to connect to other content servers and video banking systems.

Special Software: Software for recognition of country code, bank code, biometric signal and PIN code for identification of customers. Also able to support for regular ATM operations. With the move of ATMs to industry-standard computing environments, concern has risen about the integrity of the ATM's software stack.

Working of biometric authentication:

A biometric device works on the basis of some human characteristics, such as fingerprint, patter of line in the iris of eye. These devices include handprint detectors, voice recognizers and identification pattern in the retina. Authentication with such devices uses unforgivable physical characteristics to authenticate users. The user database contains a sample of user’s biometric characteristics. During authentication, the user is required to provide another sample of the users biometric characteristics. This is matched with the one in the database, and if the two samples are the same, then the user is considered to be a valid user. Following figure shows the working of biometric authentication process.

![Fig 5.2 Working of biometric authentication:](http://en.wikipedia.org/wiki/File:Biometric_system_diagram.png)

Technical Specification:

During every authentication process there is slight variation in matching biometric characteristic. This is because the physical characteristics of the user may change for a number of reasons. For instance, suppose the fingerprint of the user is captured and used for
authentication every time. The sample taken every authentication may not be the same, because of finger can be dirty, can have cuts, other marks or the fingers position on the reader can be different and so on. Therefore, an exact match of the sample need not be required. An approximate match can be acceptable. Therefore using registration process, multiple samples of the user biometric data are created. They are combined and their average stored in the user database, so that the different possibilities of the users samples during the actual authentication can roughly map to this average sample. Using this basic philosophy, any biometric authentication system defines different configurable parameters these are as:

**False accept rate or false match rate (FAR or FMR):** the probability that the system incorrectly matches the input pattern to a non-matching template in the database. It measures the percent of invalid inputs which are incorrectly accepted.

**False reject rate or false non-match rate (FRR or FNMR):** the probability that the system fails to detect a match between the input pattern and a matching template in the database. It measures the percent of valid inputs which are incorrectly rejected.

**Received operating characteristic or relative operating characteristic (ROC):** The ROC plot is a visual characterization of the trade-off between the FAR and the FRR. In general, the matching algorithm performs a decision based on a threshold which determines how close to a template the input needs to be for it to be considered a match. If the threshold is reduced, there will be less false non-matches but more false accepts. Correspondingly, a higher threshold will reduce the FAR but increase the FRR. A common variation is the Detection error trade-off (DET), which is obtained using normal deviate scales on both axes.

**Equal error rate or crossover error rate (EER or CER):** The rates at which both accept and reject errors are equal. The value of the EER can be easily obtained from the ROC curve. The EER is a quick way to compare the accuracy of devices with different ROC curves. In general, the device with the lowest EER is most accurate.

**Failure to enroll rate (FTE or FER):** The rate at which attempts to create a template from an input is unsuccessful. This is most commonly caused by low quality inputs.

**Failure to capture rate (FTC):** Within automatic systems, the probability that the system fails to detect a biometric input when presented correctly.

**Template capacity:** The maximum number of sets of data which can be stored in the system.

For the banking and finance sector there is high security requirement for financial transaction to the various electronic devices. Recently various electronic devices are used for financial transactions like- Computer, Mobile, ATMs, Point of Sale (POS) Machines, Laptop’s etc.
Perhaps the best security solution is created by combining the password/PIN with biometrics technology. It covers all the key aspects related to authentication:

Key aspects related to authentication:

Who are you? = Personal Identification Number (PIN)
What you know? = Biometric authentication (Fingerprint and Iris)
What you have? = Bank Name

Virtual Identification Code (V-ID):

Virtual identification code (V-ID) is generated in the ATM centre at the time of authentication of account holder. V-ID code is combination of: country name, bank name, biometric impression and PIN.

For operating card less biometric method all ATMs in all country have this unique structure and method for authorization.

Step-1
Step-2
Step-3

Step-4 (keypad for PIN)  Step-4 (touch screen pad for PIN)

Fig 5.3 Steps in operating card less biometric ATMs:

Step-1 Country name:
When customer enters into ATM centre, he has to select country name. Default country code is assigned to respective country, but even if customer is in abroad, then also he/she selects their own country which is displayed on screen of ATM.

Step-2 Bank Name:
After selecting country name customer has to select bank name in which their account opened. This bank names are displayed on screen, customer has to just select appropriate bank name. This helps to connect customer information with their home banks database. As all banks are connected through core banking, It becomes easy to access respective account information.

**Step-3 Biometric impression:**
In the present conceptual model researcher has decided to enter two biometric impression for the security purpose called dual biometric authentication (DBA). Present system is designed for considering two biometric impressions that is middle finger and iris. Reason behind is that these impressions are easy to operate and having lower equal error rate (EER). Once customer provides these biometric impressions then last step is to enter PIN code.

**Step-4 Personal Identification Number (P IN):**
Initially PIN is provided by bank to customer. But afterwards customer can change their PIN for security purpose. The last step for authentication is to enter PIN code.

**Thus V-ID code consist of -**

Country name + Bank name + Biometric impression + PIN

Combination of these codes helpful for accessing accurate account information from any country, bank in respective country in the world. Once account information found then user is able to perform any operation on his/her account in ATM center.

Conceptual Model for ATM Banking with knowledge based and biometric security:

Fig.5.4 Proposed conceptual model for ATM/POS model
Working:

A typical biometrics authentication process involves: Initially the bank stores user’s biometric impression- fingerprint (Middle finger) and iris impression. At the time of operating biometric ATMs users have to provide their biometric impression with country code, bank name and personal identification number (PIN) then system will generate code called virtual account identification (V-ID). This code is converted into encrypted form (e.g. using SSL) and send through network towards service users bank branch. On the server side (in banks database), the user’s country code, bank name, biometric impression and PIN code is decrypted and compared with the stored values in the database.

If the two samples match to the expected degree on the particular values, the user is considered as authenticate user and proceed further for transactions i.e. withdraw cash, balance enquiry etc., otherwise user is considered as invalid user and then terminates session.

Preconditions for ATM center:
1. It should have and provide multiple countries names.
2. It should have and provide banks in each country.
3. It should facilitate with biometric devices e.g. fingerprint and iris recognition machine.
4. It should have PIN pad or touch screen pad for entering PIN code.

**Drawbacks of existing Card based ATMs:**

- Persons having Debit/Credit or different cards with PIN becomes owner of that account, without identification of actual account holder.
- Existing system is on card basis so it requires more time to process cards.
- If card is lost/stolen there is high possibility of misuse.
- If card is stolen/lost requires more time to regenerate new card and it is costly.
- After 2/3 years card is unable to operate, hence bank require to provide new card to account holder which is expensive costly and time consuming.
- Excess use of plastic cards is harmful for environment.
- If an account holder has multiple cards then it is difficult to carry and use those cards.

**Requirement and Working Conditions of cardless biometric ATMs:**

- ATM centre should have scanners for accessing biometric authentication and PIN pad to accept PIN.
- Authentication is required for every transaction.
- If users fail more than 4 times to identify himself then block that user for that day for security purpose.
- If such blocks are more than 4 (within 3 months) then block the user account and tell him to regenerate new authentication in respective home bank.

**Advantages of card less biometric ATMs:**

- It provides strong authentication.
- No requirement of any card for operating ATM.
- Hidden costs of ATM card management like card personalization, delivery, management, re-issuance, help-desk, will be avoided.
- Ideal for Indian rural masses.
- Account holder may nominate someone, then he/she is valid user for that account.
- It is more helpful to senior citizens because it is not necessary to carry and maintain card with him.
- Due to proper and correct authentication it helps bank to utilize their work for innovative tasks for better customer satisfaction.
Complaints regarding card such as: stolen cards, regenerating new cards, maintaining and recording of cards etc are eliminated. Thus, it is helpful to bank to reduce cost, time and efforts for card process.

Flexible account access allows service users to access their accounts at their convenience.

Due to biometric authentication no one is able to access others account.

In case user may change their PIN code for security purpose.

Biometric technology represents a step forward in reducing cases of identity fraud.

This is universal system. There are no any physical boundaries (Worlwide) restrictions for operating carless biometric ATMs.

Limitations of card less biometric ATMs:

- This method is costly requires more instrument to be installed in ATM centers.
- Due to biometric only owner (exception of nominee) can access account.
- Due to more authentications it is time consuming at initial stage and requires fast and efficient technology to manage such system.
- If service user is unable to input correct identification within 4 chances then his account will be blocked for that day and if such block is more than 4 in 3 months his account is blocked and he/she has to re-identify himself in respective home bank.
- At initial stage and in blocked account case banks has to do more efforts to regenerate biometric identity.

Suggestions while implementing card less biometric ATMs:

- Separate efficient, talent and trained technical staff should be available in bank for supporting that system and for achieving better service user satisfaction.
- Banks should have multimedia hall in bank for demonstrating new technologies to service users, video conferencing system for live communication.
- Bank should promote their service users for operating E-banking services.
- Bank may plan to collect nominal fees for providing training regarding usage of E-banking service to their account holder’s which helps bank to generate revenue and better customer relationship.
- Banks should always support to their service users regarding any problems while using E-banking services.
- The ATMs should be equipped with a high quality fingerprint sensor ideally suited for dry, moist and rough fingers, advanced image processing and pattern recognition algorithms for fingerprint verification and for iris scanners (FBI approved).
Problems of card less biometric ATMs:

Biometric are relatively new and some people find their use intrusive. Hand geometry, fingerprint and face recognition (which can be done from a camera across the room) are not quite enveloping, but people have real concerns about peering (hard to watch) into a laser beam or strictly a finger into a slot.

Biometric recognition devices are costly, although as the devices become more popular, their cost goes down. All biometric readers use sampling and establish a threshold for when a match is close enough to accept. The device has to sample the biometric, measure often hundreds of key point, and compare that set of measurements with a template. There is normal variability. Although equipments are improving, there are still false reading / recognition. The speed at which recognition must be done limits accuracy. We might ideally like to take several readings and merge the results or evaluate the closet fit. But authentication is done to allow a user to do something. Authentication is not the end goal but a gate keeping the user from the goal. If authentication takes too long, service users will get irritated and become unsatisfied with bank facilities.

Future ATMs:

Today’s ATMs operating on basis of card system and PIN, where as for better security biometric authentication is growing demand. According to security experts, fingerprints can easily be lifted and replicated. The most secure biometric technology uses a device designed to perform an iris scan based on more than 2,000 unique measurement points. According to developers, people and pets all over the world will be connected to a system that uses iris scan identification within the next decade. In future solar power and biometric with PIN based ATMs will be launched by banks especially in rural areas.

Conclusion:

Proposed model is designed for ATM users for various transactions like withdrawing cash, balance enquiry etc. Point of Sales (POS) machines will also use biometric authentication. This system requires biometric authentication (finger print, iris recognition) which is always with user, PIN and selection of bank branch, which then creates virtual account (V-ID) it helps for identification and authentication of service user. This is card less E-banking method for ATMs, which reduces efforts of handling, operating and various risks associated with cards. The same and simplified procedure will be helpful for Internet, Mobile
and POS transactions. Due to unique method of authentication it reduces cost, time, efforts of both bank and service users.

5.6 Payment Gateway Model- Mobile Cash Wallet

Mobile cash wallet is a concept of downloading required digital cash from banks accounts to his/her mobile memory card and then uses it for various transactions. Mobile cash wallet helps to hide all account details of account holder. Thus, for each transaction cash in mobile wallet are used. If more cash required then customer request to bank for transfer digital cash from his bank account to his mobile. Bank will check and identify customer request fulfill request and alert messages. Through automated clearing house (ACH), bank confirms and fulfills transaction and alert messages which are involved in transactions. Mobile cash wallet technique helps to provide security to account and immediate transaction confirmation.

I Introduction

Electronic Payment is a financial exchange that takes place online between customers and merchants. The content of this exchange is usually in some form of digital financial instrument such as encrypted credit card numbers, electronic cheques or digital cash etc. which is then backed by a bank or an intermediary, or by a legal tender. The various factors that are beneficial to the financial institutions to make use of electronic payments are:

1. **Decreasing technology cost**: The technology used in the networks is decreasing day by day, which is evident from the fact that computers are now very cheap and internet is becoming free almost everywhere in the world.

2. **Reduced operational and processing cost**: Due to reduced technology the processing cost of various commerce activities becomes very less. A very simple reason to prove this is the fact that electronic transactions helps to reduce both paper and time.

II Electronic or Digital Cash

This combines computerized convenience with security and privacy that improve upon paper cash. Cash is still the dominant form of payment. The consumer still mistrusts the banks. The non-cash transactions are inefficiently cleared. In addition, due to negative real interests rates on bank deposits. Now we will enumerate some characteristics of cash:

a. Cash is a legal tender i.e. payee is obligatory to take it.

b. It is negotiable i.e. can be given or traded to someone else.
c. It is a bearer instrument i.e. possession is proof of ownership.

d. It can be held and used by anyone, even those without a bank certificate.

e. It places no risk on part of acceptor.

Debit/Credit or any plastic card stores electronic information which is capable to convert it into cash via ATM, funds transfer etc.

The following are the limitations of Debit and Credit Cards:

1. They are identification cards owned by the issuer and restricted to one user i.e. cannot be given away.

2. They are not legal tender.

3. Their usage requires an account relationship and authorization system.

### III Difference between mobile banking and mobile cash wallet

1. In mobile banking there is restriction for limited cash transfer per day. But in mobile cash wallet technique there will not be such restriction for downloading digital and transferring cash.

2. In mobile banking user directly access all account information. It is risky if somebody unauthentically access account. But in mobile cash wallet technique only required cash is downloaded from banks, so nobody else is able to access users all account information.

### IV Properties of Digital Cash

1. **Must have a monetary value:** It must be converted and backed by cash (currency), bank authorized credit or a bank or certified cashier’s check.

2. **Interopertablity:** Digital data must be interopertablity or exchangeable as payment for other digital cash, paper cash, goods or services, lines of credit, bank notes or obligations, electronic benefit transfers.

3. **Retrievable:** Data must be storable and retrievable.

4. **Storage:** Cash could be stored on a remote computer’s memory, in smart cards, or on other easily transported standard or special purpose devices. Remote storage or retrieval would allow users to exchange digital cash from home or office or while traveling.

5. **Technology:** Technology should not be much easy to copy or tamper with while it is being exchanged.
6. **Security:** Digital cash is based on cryptographic systems called "Digital Signatures" similar to the signatures used by banks on paper cheques to authenticate a customer. So high security should be provided via cryptography, username and password, biometric security.

V **Proposed Model for Mobile Cash Wallet**

![Fig. 5.5 Proposed model for mobile cash wallet](image)

VI **Working of Mobile cash wallet:**

1. Customers request to their bank for opening digital account following KYC rule with biometric authentication (B_ID).
2. Bank confirms customers and registers for digital account with mobile details, sufficient balance and generate account identification code (Ac_ID) for identification.
3. Customer request for transferring digital cash via mobile on their mobile through Ac_ID.
4. Bank generates transaction identification code at the time of transferring digital cash as:
   \[
   \text{Tran}_{-}\text{ID} = \text{Ac}_{-}\text{ID} + \text{B}_{-}\text{ID} + \text{type of account} + \text{bank branch code} + \text{amount}.
   \]
5. Customer purchases products from merchant and sends Ac_ID with Tran_ID and bill amount to merchants via mobile.
6. Merchant receive message and forward to their bank.
7. Merchants bank identifies and confirms customer’s mobile number, Ac_ID, Tran_ID, balance via Automatic Clearing House (ACH) then completes transactions, updates balance on both customer and merchants mobile and alerts both with transaction details.

VII Requirements

1. Unique Tran_Id, Cust_ID and B_ID for customer with transaction amount.
2. Software for requesting, transferring digital cash and performing online transactions.
4. Biometric security facility for mobile transaction authority.
5. Secure Socket Layer (SSL) security for online transaction.
6. Automatic alert message generation for sharing transaction details and balances for customers, banks and merchants.

VIII Advantages

1. Not require to carry any hard cash while shopping.
2. Not required ATM, computer, visit to bank branches for transaction.
3. Handling mobile transactions are very easy.
4. Only authenticate person can make transaction.
5. Even if customer lost/ damaged his/her mobile still nobody else can access account details.
6. Immediate transaction confirmation is done through SMS, so it saves time, cost and efforts of banks, customers and merchants.
7. High reliability in transaction leads to better satisfaction.
8. Bilateral transaction reduces pressure on banking network.
9. More applicable in rural area due to mobile awareness and procedure for transaction.

X Limitations

1. Mobile range and internet connectivity is essential for being transaction with mobile device.
2. Registration with biometric authentication in the bank from both parties for digital cash transaction.
3. If customers mobile’s does not having biometric facility or sufficient memory then this system will not work.
4. Customers/buyers must have to maintain sufficient balance for digital cash on his account.

5. Software should be able to exchange and convert digital cash into different currencies.

6. Bank should provide universal bank account so that customers can make online transactions globally.