CHAPTER 3
EVOLUTION AND RECENT TRENDS IN BANKING TECHNOLOGY

3.1. EVOLUTION OF BANKING TECHNOLOGY IN INDIA

The usage of information technology (IT), broadly referring to computers and peripheral equipment, has seen tremendous growth in service industries in the recent past. The most obvious example is perhaps the banking industry, where through the introduction of IT related products in internet banking, electronic payments, security investments, information exchanges (Berger, 2003), banks now can provide more diverse services to customers with less manpower.

3.1.1. Phases of Banking Technology in India

Technological innovation in general and information technology (IT) applications in particular, have had a major effect in banking and finance. Outstanding IT-based innovations are considered and grouped into four distinct periods: early adoption, specific application, emergence and diffusion and their periods based on Indian scenarios are

- Early adoption (1960-1980),
- Specific application (1980-1990),
- Emergence (1990-2000) and
- Diffusion (2000-till date).

<table>
<thead>
<tr>
<th>TABLE 3.1</th>
<th>Dimensions of IT Innovation in Indian Retail Banking 1960-2009</th>
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<tbody>
<tr>
<td>Impact on the Provision of Retail Finance</td>
<td>Use of Technology in the Organization</td>
</tr>
<tr>
<td>Operational Function Innovation</td>
<td>Increased coordination between head office and branches</td>
</tr>
</tbody>
</table>

Sources: Morris (1986) and Quintás (1991); Note: Designed by the researchers.
3.1.2. Technology Based Banking Services and their characteristics in India

Table 3.2 gives the characteristics of banking services.

**TABLE 3.2**

**Characteristics of banking services**

<table>
<thead>
<tr>
<th>Banking services</th>
<th>Key characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online services</td>
<td>Provide online real-time transaction processing between bank branches;</td>
</tr>
<tr>
<td></td>
<td>Customers are not restricted to transactions at account-opening branches;</td>
</tr>
<tr>
<td>Automated teller machine</td>
<td>Replace the functions of tellers in cash receiving and dispensing;</td>
</tr>
<tr>
<td>(ATM)</td>
<td>balance enquiries, etc.</td>
</tr>
<tr>
<td>Point of sale system (POS)</td>
<td>Provide convenient services by directly debiting customers’ accounts at the point of sale; avoid the need to carry cash</td>
</tr>
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<td></td>
<td>The complexities of using the machine (terminal) are transferred to the service providers</td>
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<tr>
<td>Phone banking</td>
<td>Provide easy and convenient access to account balance and other information i.e., interest rates, foreign exchange rates</td>
</tr>
<tr>
<td></td>
<td>Provide the transfer of funds within and between account holders or payment of public utilities by telephone</td>
</tr>
<tr>
<td></td>
<td>Credit card retailers can check the status of the card by telephone</td>
</tr>
<tr>
<td>Internet banking</td>
<td>Provide customers with access to making an inquiry about their accounts as well allowing customers to perform internet-based transactions (such as fund transfer, e-cash card payment) from the customers’ workplace or home</td>
</tr>
</tbody>
</table>

*Source: buzzacchi et.al (1993)*

3.1.3. Various Committees on Banking Technology in India

The foundation for large-scale induction of IT in the banking sector was provided by the recommendations of the committees headed by Dr. C. Rangarajan, in 1984 and 1989. Subsequently, in 1994, the Reserve Bank constituted a committee on 'Technology Upgradation in the Banking Sector'. The committee made a number of recommendations covering payment systems including setting up of an autonomous centre for development and research in banking technology. The IDRBT was created as a sequel. The Institute has established and operates the Indian Financial Network (INFINET), performs research in banking technology and provides consultancy services apart from providing educational and training facilities for the banking sector.
### TABLE 3.3
Committees on Computerisation

<table>
<thead>
<tr>
<th>Name of the Committee With year</th>
<th>Head of the Committee</th>
<th>Recommendations :</th>
</tr>
</thead>
</table>
| Working Group to consider feasibility of introducing MICR/OCR Technology for Cheque Processing (1982) | Dr. Y.B. Damle, Adviser, Management Services Department, Reserve Bank of India. | • Introduction of ‘item processing’ (sorting and listing of cheques with the help of computers) in three phases.  
• In the first phase at the four metropolitan cities viz. Mumbai, New Delhi, Chennai and Calcutta, with the help of MICR technology.  
• In the second phase all state capitals and important commercial centres.  
• In the final phase national clearing to be introduced by dividing the country into four Regional Grids with headquarters at Mumbai, New Delhi, Chennai and Calcutta. Each Regional Centre was to perform two functions: (i) to act as a clearing house for intra-grid instruments, and (ii) participate in national clearing on behalf of the grid for extra-grid outstation cheques. |
| Committee on Mechanisation in the Banking Industry (1984) | Dr. C. Rangarajan, Deputy Governor, Reserve Bank of India | Banks should set up service branches at centres where they have more than 10 branches. The service branch so set up would exclusively be devoted to clearing operations of the bank at that particular centre.  
• Banks to be in readiness for the introduction of MICR Clearing at the four metropolitan cities by assessing their requirements for encoders, adopting standardised cheque forms and reorganising work procedures where necessary, and training staff down to the branch level. |
| Committees on Communication Network for Banks and SWIFT implementation (1987) | Shri T.N.A. Iyer, Executive Director, Reserve Bank of India. | • Setting up of X.25 based packet switching network called ‘BANKNET’ to be jointly owned by the Reserve Bank and the public sector banks.  
• Inter-bank fund transfers on banks' own account and on customers' account;  
• Inter-branch funds transfers on banks' own account and on customers' account;  
• Currency chest transactions;  
• Government transactions;  
• Improvements in payment systems by facilitating automated clearing services  
• India should join the SWIFT (Society for Worldwide Interbank Financial Telecommunication) Network for the transmission and reception of international financial messages. |
| Committee on Computerisation in Banks (1988) | **Dr. C. Rangarajan**, Deputy Governor, Reserve Bank of India | Computerisation of the settlement operations in the clearing houses managed by Reserve Bank of India at Bhubaneshwar, Guwahati, Jaipur, Patna and Thiruvananthapuram.  
- Operationalisation of MICR technology and the National Clearing of inter-city cheques at the four metropolitan cities.  
- Introduction of one-way collection of cheques drawn on the 4 metros received from Ahmedabad, Bangalore, Nagpur and Hyderabad.  
- Framing of Uniform Regulations and Rules of Clearing Houses.  
- Branch level computerisation and the establishment of connectivity between branches.  
- Improvements in customer service - introduction of on-line banking.  
- Standardisation and rigorous security features to ensure an efficient and risk free transfer of funds electronically.  
- Setting up a network of Automated Teller Machines (ATMs)  
- Introduction of a single ‘All Bank’ credit card |
| Committee on Technology Issues relating to Payments System, Cheque Clearing and Securities Settlement in the Banking Industry (1994) | **Shri W.S.Saraf**, Executive Director, Reserve Bank of India | • Establishment of an Electronic Funds Transfer (EFT) system, with the BANKNET communications network as its carrier. Enactment of suitable legislation on the lines of the Electronic Funds Transfer Act 1978, USA and Data Protection Act 1984, UK.  
- MICR clearing be introduced at all centres with more than 100 bank branches.  
- Introduction of a Delivery versus Payment (DvP) system for SGL transactions, with settlement on gross basis both for securities transactions in PDO and funds transactions in current  
- Introduction of Electronic Clearing Service Credit for low value repetitive transactions such as interest, dividend, salary, pension payments and an Electronic Debit Clearing for payments to utility companies.  
- Switch over to on-line inter-bank clearing on a gross basis.  
- Large scale induction of computers and communication technology in service branches  
- Optimal usage of SWIFT. |
| Committee on Technology Issues relating to Payments System, Cheque Clearing and Securities Settlement in the Banking Industry (1994) | **Smt.K.S.Shere**, Principal Legal Adviser, Reserve Bank of India | EFT system could be introduced immediately by framing regulations under Section 58 of the RBI Act. A Model Customer Contract agreement to govern the banker-customer relationship with regard to EFT should be adopted by all banks participating in the system. |
3.1.4. Major Landmarks Banking Technology and Transformation in India

- The introduction of MICR based cheque processing – a first for the region, during the years 1986-88;

- Computerisation of branches of banks – an activity which commenced from the late eighties with the introduction of ledger posting machines (LPMs), advanced ledger posting machines (ALPMs), followed by stand alone computer systems which metamorphosised into network based systems and the latest development pertaining to the installation of Core Banking solutions;

- Facilitating computerisation of Government business – from the late nineties which has now resulted in all branches handling Government business perform their functions using technology;

- The setting up of the Institute for Development and Research in Banking Technology (IDRBT), Hyderabad in the mid nineties, as a research and technology centre for the Banking sector;

- The commissioning in 1999, of the Indian Financial Network as a Closed User Group based network for the exclusive use of the Banking sector with state-of-the-art safety and security. The network supports applications having features such as Public Key Infrastructure (PKI) which international networks such as S.W.I.F.T. are now planning to implement;
• Commencement of Certification Authority (CA) functions of the IDRBT for ensuring that electronic banking transactions get the requisite legal protection under the Information Technology Act, 2000;

• Ensuring Information Systems Audit (IS Audit) in the banks for which detailed guidelines relating to IS Audit were formulated and circulated;

• Enabling IT based delivery channels which enhance customer service at banks, in areas such as cash delivery through shared Automated Teller Machines (ATMs), card based transaction settlements etc.;

• Providing Guidelines for Internet Banking, which facilitated the banks to ensure that common minimum requirements relating to Internet Banking offerings were provided for;

• Providing detailed specifications to banks on the configuration of systems relating to critical inter-bank payment system applications such as Real Time Gross Settlement (RTGS) System, Negotiated Dealing System (NDS), Centralised Funds Management System (CFMS) etc.;

• Implementation of the National Financial Switch (NFS) to ensure inter-connectivity of shared ATMs and to provide for funds settlement across various banks.

• Establishment of e-payment gateways for the benefit of customers (such as the gateways for funds transfers and other account related transactions) and for facilitating e-commerce.

• Sharing of information through the secured internet website for the Centralised Data Based Management System-Internet (CDBMSI) project.

• Providing a platform for transmission of electronic messages across banks using common standards, for facilitating ‘Straight Through Processing’ (STP) in the form of the Structured Financial Messaging System (SFMS), which will be similar to the SWIFT messaging pattern;

• Setting up connectivity of all clearing houses of the country so as to enable the introduction of the National Settlement System (NSS)
• Introducing a secured web site for internet based data transfer to Central and State Government. Government Departments may populate the data from the secured web site to their own systems based on their requirements.

3.2. RECENT TRENDS IN BANKING TECHNOLOGY

Banking technology as a confluence of several disparate disciplines such as finance (including risk management), information technology, computer science, communication technology, and marketing science. The tremendous influence of information and communication technologies on banking and its products, the quintessential role played by computer science helped in fulfilling banks’ marketing objective of servicing customers better at less cost and thereby reaping more profits. Advanced statistics and computer science are used to measure, mitigate, and manage various risks associated with banks’ business with its customers and other banks. The growing influence of customer relationship management and data mining in tackling various marketing-related problems and fraud detection problems in the banking industry is well documented. Fig 3.1 explains the components of banking technology.

Figure 3.1: Components of Banking technology
Technology is no longer being used simply as a means for automating processes. Instead it is being used as a revolutionary means of delivering services to customers. The adoption of technology has led to the following benefits: greater productivity, profitability, and efficiency; faster service and customer satisfaction; convenience and flexibility; 24x7 operations; and space and cost savings (Sivakumaran, 2005).

3.2.1. Technology Application in Banks

Indian banking industry adopted various technology applications in banking. They are classified into:

1) Data Warehousing
2) Data Mining
3) Electronic Data Interchange
4) Corporate Web Sites
5) Management Information System

3.2.1.1. Data warehouse

Data warehouse is a repository of an organization's electronically stored data. Data warehouses are designed to facilitate reporting and analysis. A data warehouse houses a standardized, consistent, clean and integrated form of data sourced from various operational systems in use in the organization, structured in a way to specifically address the reporting and analytic requirements.

This definition of the data warehouse focuses on data storage. However, the means to retrieve and analyze data, to extract, transform and load data, and to manage the data dictionary are also considered essential components of a data warehousing system. Many references to data warehousing use this broader context. Thus, an expanded definition for data warehousing includes business intelligence tools, tools to extract, transform, and load data into the repository, and tools to manage and retrieve metadata.

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1 Sivakumaran, M.V. (2005). Banking technology course material for MTech (IT) with specialization in banking technology and information security, IDRBT.

**Data warehouse architecture**

Architecture, in the context of an organization's data warehousing efforts, is a conceptualization of how the data warehouse is built. There is no right or wrong architecture, rather multiple architectures exist to support various environments and situations. The worthiness of the architecture can be judged in how the conceptualization aids in the building, maintenance, and usage of the data warehouse. Fig 3.2 and Fig 3.3 explains data warehouse architecture and its process respectively. One possible simple conceptualization of data warehouse architecture consists of the following interconnected layers:

**Operational database layer**

The source data for the data warehouse - An organization's Enterprise Resource Planning systems fall into this layer.

**Data access layer**

The interface between the operational and informational access layer - Tools to extract, transform, load data into the warehouse fall into this layer.

**Metadata layer**

The data directory - This is usually more detailed than an operational system data directory. There are dictionaries for the entire warehouse and sometimes dictionaries for the data that can be accessed by a particular reporting and analysis tool.

**Informational access layer**

The data accessed for reporting and analyzing and the tools for reporting and analyzing data - Business intelligence tools fall into this layer. And the Inmon-Kimball differences about design methodology, discussed later in this article, have to do with this layer.
3.2.1.2. Data mining

Data mining is the process of extracting patterns from data. As more data are gathered, with the amount of data doubling every three years, data mining is becoming an increasingly important tool to transform these data into information. It is commonly used in a wide range of profiling practices, such as marketing, surveillance, fraud detection and scientific discovery.
While data mining can be used to uncover patterns in data samples, it is important to be aware that the use of non-representative samples of data may produce results that are not indicative of the domain. Similarly, data mining will not find patterns that may be present in the domain, if those patterns are not present in the sample being "mined". There is a tendency for insufficiently knowledgeable "consumers" of the results to attribute "magical abilities" to data mining, treating the technique as a sort of all-seeing crystal ball. Like any other tool, it only functions in conjunction with the appropriate raw material: in this case, indicative and representative data that the user must first collect. Further, the discovery of a particular pattern in a particular set of data does not necessarily mean that pattern is representative of the whole population from which that data was drawn. Hence, an important part of the process is the verification and validation of patterns on other samples of data.

The term data mining has also been used in a related but negative sense, to mean the deliberate searching for apparent but not necessarily representative patterns in large numbers of data. To avoid confusion with the other sense, the terms data dredging and data snooping are often used. Note, however, that dredging and snooping can be (and sometimes are) used as exploratory tools when developing and clarifying hypotheses.\(^3\)\(^4\)

**An Architecture for Data Mining**

To best apply these advanced techniques, they must be fully integrated with a data warehouse as well as flexible interactive business analysis tools. Many data mining tools currently operate outside of the warehouse, requiring extra steps for extracting, importing, and analyzing the data. Furthermore, when new insights

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require operational implementation, integration with the warehouse simplifies the application of results from data mining. The resulting analytic data warehouse can be applied to improve business processes throughout the organization, in areas such as promotional campaign management, fraud detection, new product rollout, and so on. Fig 3.4 illustrates an architecture for integrated data mining.

**Figure 3.4 - Integrated Data Mining Architecture**

The ideal starting point is a data warehouse containing a combination of internal data tracking all customer contact coupled with external market data about competitor activity. Background information on potential customers also provides an excellent basis for prospecting. This warehouse can be implemented in a variety of relational database systems: Sybase, Oracle, Redbrick, and so on, and should be optimized for flexible and fast data access.

An OLAP (On-Line Analytical Processing) server enables a more sophisticated end-user business model to be applied when navigating the data warehouse. The multidimensional structures allow the user to analyze the data as they want to view their business – summarizing by product line, region, and other key perspectives of their business. The Data Mining Server must be integrated with the data warehouse and the OLAP server to embed ROI-focused business analysis directly into this infrastructure. An advanced, process-centric metadata template defines the data mining objectives for specific business issues like campaign
management, prospecting, and promotion optimization. Integration with the data warehouse enables operational decisions to be directly implemented and tracked.

![Figure 3.5 - Steps in Data Mining Architecture](image)

As the warehouse grows with new decisions and results, the organization can continually mine the best practices and apply them to future decisions. This design represents a fundamental shift from conventional decision support systems. Rather than simply delivering data to the end user through query and reporting software, the Advanced Analysis Server applies users’ business models directly to the warehouse and returns a proactive analysis of the most relevant information. These results enhance the metadata in the OLAP Server by providing a dynamic metadata layer that represents a distilled view of the data. Reporting, visualization, and other analysis tools can then be applied to plan future actions and confirm the impact of those plans. Fig 3.5 explains the steps in data mining architecture.

### 3.2.1.3 Electronic Data Interchange (EDI)

Electronic Data Interchange (EDI) refers to the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents from one computer system to another, i.e. from one trading partner to another trading partner. It is more than mere E-mail; for instance, organizations...
might replace bills of lading and even Cheque with appropriate EDI messages. It also refers specifically to a family of standards, including the X12 series. However, EDI also exhibits its pre-Internet roots, and the standards tend to focus on ASCII (American Standard Code for Information Interchange)-formatted single messages rather than the whole sequence of conditions and exchanges that make up an inter-organization business process. Fig 3.6 explains the EDI architecture.

**Figure 3.6 and 3.7 EDI Architecture**

3.2.1.4 Corporate Website

A corporate website or corporate site is an informational website operated by a business or other private enterprise such as a charity or non-profit foundation.

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Corporate sites differ from electronic commerce, portal, or sites in that they provide information to the public about the company rather than transacting business or providing other services. The phrase is a term of art referring to the purpose of the site rather than its design or specific features, or the nature, market sector, or business structure of the site operator. Nearly every company that interacts with the public has a corporate site or else integrates the same features into its other websites. Large companies typically maintain a single umbrella corporate site for all of their various brands and subsidiaries.

**Corporate Website Common Features**

Corporate websites usually include the following:

- A homepage
- A navigation bar or other means for accessing various site sections
- A unified look and feel incorporating the company logos, style sheets, and graphic images.
- A summary of company operations, history, and mission statement
- A list of the company's products and services
- A "people" section with biographical information on founders, board members, and/or key executives. Sometimes provides an overview of the company's overall workforce.
- A "news" section containing press releases, press kits, and/or links to news articles about the company
- An "investor" section describing key owners / investors of the company
- A list of key clients, suppliers, achievements, projects, partners, or others
- Pages of special interest to specific groups. These may include:
- An employment section where the company lists open positions and/or tells job seekers how to apply
- Investor pages with the annual report, business plan, current stock price, financial statements, overview of the company structure, SEC filing or other regulatory filings
- Pages for employees, suppliers, customers, strategic partners, affiliates, etc.
- Contact information. Sometimes includes a feedback form by which visitors may submit messages
- A terms of use document and statement of intellectual property ownership and policies as they apply to site content
- A privacy policy
- A splash page as an entry point that directs users to the site's home page
- Embedded search engines allowing users to search pages from within the website, or external searches of the Web
- A site map
- A blog with news and commentary about the company, its products and services
- "Community" pages describing the company's environmental / sustainability, charity, corporate citizenship, and other policies as they affect the public
- A "store locator" or similar feature used to find nearby retail locations of the company or where the company's products or services can be found
- A "downloads" or "media" section for users to obtain web tools, free or trial software, software patches, company demos, promotional material, and the like
- A calendar or events section
- A "links" page with hyperlinks to consumer-oriented or other websites, or information about specific brands or subsidiaries of the company
- Links

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3.2.1.5. Management Information System (MIS)

A management information system (MIS) is a subset of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solve business problems such as costing a product, service or a business-wide strategy. Management information systems are distinct from regular information systems in that they are used to analyze other information systems applied in operational activities in the organization.[1] Academically, the term is commonly used to refer to the group of information management methods tied to the automation or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive information systems. It has been described as, "MIS 'lives' in the space that intersects technology and business. MIS combines tech with business to get people the information they need to do their jobs better/faster/smarter. Information is the lifeblood of all organizations - now more than ever. MIS professionals work as systems analysts, project managers, systems administrators, etc., communicating directly with staff and management across the organization."[7] Fig 3.7 and 3.8 explain the architecture of MIS and modules of MIS respectively.

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3.2.2. Current Information Technology Tools

Apart from already mentioned technology, banks adopting various Information Technology Tools. They are:

1) Electronic Clearing And Settlement System
2) Plastic Money
3) Electronic Banking
3.2.2.1. Electronic Clearing And Settlement System

Some of the electronic electronic and settlement system are OCR clearing, MICR clearing, Debit Clearing, RTGS, SFMS, and SWIFT.

Optical Character Recognition (OCR)

Optical Character Recognition is the machine recognition of printed characters. OCR systems can recognize many different OCR fonts, as well as typewriter and computer-printed characters. Advanced OCR systems can recognize hand printing. When a text document is scanned into the computer, it is turned into a bitmap, which is a picture of the text. OCR software analyzes the light and dark areas of the bitmap in order to identify each alphabetic letter and numeric digit. When it recognizes a character, it converts it into ASCII text (see ASCII file). Hand printing is much more difficult to analyze than machine-printed characters. Old, worn and smudged documents are also difficult. Scanning documents and processing them with OCR is sometimes as much an art as it is a science. Fig 3.9 explains the operation of OCR clearing system.

Figure 3.10 OCR Creates ASCII Text
When text documents are scanned, they are "photographed" and stored as pictures in the computer. OCR software analyzes the symbols in the image and converts each letter and digit into an ASCII character.

**Magnetic Ink Character Recognition**

Magnetic Ink Character Recognition is the machine recognition of numeric data printed with magnetically charged ink. It is used on bank checks and deposit slips. MICR readers detect the characters and convert them into digital data. Although optical methods (OCR) became as sophisticated as the early MICR technology, magnetic ink is still used. It serves as a deterrent to fraud, because a photocopied check will not be printed with magnetic ink.

**MICR Technology**

MICR characters are printed using an ink laden with iron oxide particles. Iron oxide has magnetic properties and can retain magnetic fields when it is applied on it. The working of a MICR reader is essentially based on the concept of moving characters printed with this magnetic ink over two magnetic heads, one that charges the characters and the second one that immediately follows the first and reads the magnetic charge. The pattern of the electrical field is what determines the character being read. The characteristic shape of the electrical signature pattern to each character which can be easily recognized by the machine with minimum ambiguity and maximum tolerance. Another related topic of interest is the very common bar code we so often see on items on the shelves of a supermarket. Bar coding utilizes a technique is similar to Morse code – a series of narrow and wide bars make up for one character. The reader contains a photo diode and a light/laser source. The photo diode measures the intensity of light as the light source is moved across the bar code. The waveform of reflected light thus produced is decoded to read the contents.\(^8\)

3.2.2.2. Plastic Money

a) Credit Card  
b) Debit Card  
c) Smart Card

Debit card

A debit card (also known as a bank card or check card) is a plastic card that provides an alternative payment method to cash when making purchases. Functionally, it can be called an electronic check, as the funds are withdrawn directly from either the bank account, or from the remaining balance on the card. In some cases, the cards are designed exclusively for use on the Internet, and so there is no physical card.

The use of debit cards has become widespread in many countries and has overtaken the check, and in some instances cash transactions by volume. Like credit cards, debit cards are used widely for telephone and Internet purchases, and unlike credit cards the funds are transferred from the bearer's bank account instead of having the bearer to pay back on a later date. Debit cards can also allow for instant withdrawal of cash, acting as the ATM card for withdrawing cash and as a cheque guarantee card. Merchants can also offer "cashback"/"cashout" facilities to customers, where a customer can withdraw cash along with their purchase.

Difference Between Credit Card and Debit Card

For consumers, the difference between a "debit card" and a "credit card" is that the debit card deducts the balance from a deposit account, like a checking account, whereas the credit card allows the consumer to spend money on credit to the issuing bank. In other words, a debit card uses the money you have and a credit card uses the money you don't have. "Debit cards" which are linked directly to a checking account are sometimes dual-purpose, so that they can be used as a credit card, and can be charged by merchants using the traditional credit networks. A merchant will ask for "credit or debit?" if the card is a combined credit+debit card. If the payee chooses "credit", the credit balance will be debited the amount of the purchase; if the payee chooses "debit", the bank account balance will be debited the amount of the purchase. The "debit" networks usually require that a personal
identification number be supplied. The "credit" networks typically require that purchases be made in person and often allow cards to be charged with only a signature, and/or picture ID. However, most merchant agreements in the United States forbid picture ID as a requirement to use a Credit Card.

**Types of debit card**


There are currently three ways that debit card transactions are processed: online debit (also known as PIN debit), offline debit (also known as signature debit) and Electronic Purse Card.

**3.2.2.3. Electronic Banking**

Electronic banking includes ATM, Internet banking, Phone banking, SMS banking, EFT, and IVRS.

**SMS banking**

Short Message Service (SMS) is a communication service standardized in the GSM mobile communication system, using standardized communications protocols allowing the interchange of short text messages between mobile telephone devices. SMS text messaging is the most widely used data application on the planet, with 2.4 billion active users, or 74% of all mobile phone subscribers sending and receiving text messages on their phones. SMS banking is a technology-enabled service offering from banks to its customers, permitting them to operate selected banking services over their mobile phones using SMS messaging. SMS banking solutions are operated using both push and pull messages. Fig 3.10 explains the architecture of SMS Banking.

Depending on the selected extent of SMS banking transactions offered by the bank, a customer can be authorized to carry out either non-financial transactions, or both and financial and non-financial transactions. SMS banking solutions offer customers a range of functionality, classified by push and pull services as outlined below.
Typical push services would include:

- Periodic account balance reporting (say at the end of month);
- Reporting of salary and other credits to the bank account;
- Successful or un-successful execution of a standing order;
- Successful payment of a cheque issued on the account;
- Insufficient funds;
- Large value withdrawals on an account;
- Large value withdrawals on the ATM or EFTPOS on a debit card;
- Large value payment on a credit card or out of country activity on a credit card.
- One-time password and authentication

Typical pull services would include:

- Account balance enquiry;
- Mini statement request;
- Electronic bill payment;
- Transfers between customer's own accounts, like moving money from a savings account to a current account to fund a cheque;
- Stop payment instruction on a cheque;
- Requesting for an ATM card or credit card to be suspended;
- De-activating a credit or debit card when it is lost or the PIN is known to be compromised;
- Foreign currency exchange rates enquiry;
- Fixed deposit interest rates enquiry.
Mobile banking

Mobile banking (also known as M-Banking, mbanking, SMS Banking etc.) is a term used for performing balance checks, account transactions, payments etc. via a mobile device such as a mobile phone. Mobile banking today (2007) is most often performed via SMS or the Mobile Internet but can also use special programs called clients downloaded to the mobile devices. Fig 3.11 explains the architecture of mobile banking.

Mobile banking can offer services such as the following:

**Account Information**

- Mini-statements and checking of account history
- Alerts on account activity or passing of set thresholds
- Monitoring of term deposits
- Access to loan statements
- Access to card statements
- Mutual funds / equity statements
- Insurance policy management
- Pension plan management
- Status on cheque, stop payment on cheque
• Ordering check books
• Balance checking in the account
• Recent transactions
• Due date of payment (functionality for stop, change and deleting of payments)
• PIN provision, Change of PIN and reminder over the Internet
• Blocking of (lost, stolen) cards

Payments, Deposits, Withdrawals, and Transfers
• Domestic and international fund transfers
• Micro-payment handling
• Mobile recharging
• Commercial payment processing
• Bill payment processing
• Peer to Peer payments
• Withdrawal at banking agent
• Deposit at banking agent

Investments
• Portfolio management services
• Real-time stock quotes
• Personalized alerts and notifications on security prices

Support
• Status of requests for credit, including mortgage approval, and insurance coverage
• Check (cheque) book and card requests
• Exchange of data messages and email, including complaint submission and tracking
• ATM Location

Content Services
• General information such as weather updates, news
• Loyalty-related offers
• Location-based services
Based on a survey conducted by Forrester, mobile banking will be attractive mainly to the younger, more "tech-savvy" customer segment. A third of mobile phone users say that they may consider performing some kind of financial transaction through their mobile phone. But most of the users are interested in performing basic transactions such as querying for account balance and making bill payment.

Figure 3.11  Mobile banking Architecture

Telephone banking and /or IVRS

Telephone banking is a service provided by a financial institution which allows its customers to perform transactions over the telephone.

Most telephone banking use an automated phone answering system with phone keypad response or voice recognition capability. To guarantee security, the customer must first authenticate through a numeric or verbal password or through security questions asked by a live representative. With the obvious exception of cash withdrawals and deposits, it offers virtually all the features of an automated
teller machine: account balance information and list of latest transactions, electronic bill payments, funds transfers between a customer's accounts, etc. Usually, customers can also speak to a live representative located in a call centre or a branch, although this feature is not guaranteed to be offered 24/7. In addition to the self-service transactions listed earlier, telephone banking representatives are usually trained to do what was traditionally available only at the branch: loan applications, investment purchases and redemptions, chequebook orders, debit card replacements, change of address, etc. Banks which operate mostly or exclusively by telephone are known as phone banks

**Electronic funds transfer (EFT)**

Electronic funds transfer or EFT refers to the computer-based systems used to perform financial transactions electronically. The term is used for a number of different concepts:

- Cardholder-initiated transactions, where a cardholder makes use of a payment card
- Direct deposit payroll payments for a business to its employees, possibly via a payroll services company
- Direct debit payments from customer to business, where the transaction is initiated by the business with customer permission
- Electronic bill payment in online banking, which may be delivered by EFT or paper check
- Transactions involving stored value of electronic money, possibly in a private currency
- Wire transfer via an international banking network (generally carries a higher fee)
- Electronic Benefit Transfer

**Electronic Funds Transfer at Point of Sale (EFTPOS)**

EFTPOS (short for Electronic Funds Transfer at Point of Sale) is an Australian and New Zealand electronic processing system for credit cards, debit cards and charge cards. European banks and card companies also sometimes reference "EFTPOS" as the system used for processing card transactions through terminals on points of sale, though the system is not the trademarked Australian/New Zealand variant.
Credit cards EFT may be initiated by a cardholder when a payment card such as a credit card or debit card is used. This may take place at an automated teller machine (ATM) or point of sale (POS), or when the card is not present, which covers cards used for mail order, telephone order and internet purchases.

A number of transaction types may be performed, including the following:

- **Sale**: where the cardholder pays for goods or service
- **Refund**: where a merchant refunds an earlier payment made by a cardholder
- **Withdrawal**: the cardholder withdraws funds from their account, e.g. from an ATM. The term Cash Advance may also be used, typically when the funds are advanced by a merchant rather than at an ATM
- **Deposit**: where a cardholder deposits funds to their own account (typically at an ATM)
- **Cashback**: where a cardholder withdraws funds from their own account at the same time as making a purchase
- **Inter-account transfer**: transferring funds between linked accounts belonging to the same cardholder
- **Payment**: transferring funds to a third party account
- **Enquiry**: a transaction without financial impact, for instance balance enquiry, available funds enquiry, linked accounts enquiry, or request for a statement of recent transactions on the account
- **E top-up**: where a cardholder can use a device (typically POS or ATM) to add funds (top-up) their pre-pay mobile phone
- **Mini-statement**: where a cardholder uses a device (typically an ATM) to obtain details of recent transactions on their account
- **Administrative**: this covers a variety of non-financial transactions including PIN change
- **The transaction types offered depend on the terminal. An ATM would offer different transactions from a POS terminal, for instance.**