E-Banking: Survey

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Abstract - Electronic banking (e-banking), is the new technology in banking environment, that allows the bank customers to do banking activities at any time and from any place. Several electronic channels to transfer money were implemented during the last four decades. Internet is the most recent one. The purpose of this survey is to give an overview and description for the e-banking technology. It contains brief description about the electronic channels, capabilities, opportunities, architecture, security, and future trends of this technology.

Keywords: e-banking, Internet banking, online banking, e-banking channels, e-banking security, e-banking capabilities.

I. INTRODUCTION

Electronic banking (e-banking), also known as Cyberbanking, Internet banking, Virtual banking, Online banking, Home banking, Personal banking, and other names; means that various banking activities can be performed at any time from home, business, or the road instead of at a physical bank location.

Innovations in computing and telecommunications have improved all the functions in retail banking. Computers have empowered the production and telecommunications have created new distribution channels that have global reach. Of these new channels, Internet is the least costly and with widest reach.

The advent of e-Business (e-commerce), technological innovations and globalization are increasingly driving businesses to change their traditional modes of operation. Globally, the financial sector is changing under the impact of competitive, regulatory and technological forces. Today, e-Banking is being considered as a strategic tool by the global banking sector, to remain competitive and retain customers.

Today, most of the large banks offer fully secure, fully functional online banking for free or for a small fee. Medium and small banks, and other financial companies offer some forms of online banking.

In this survey, we will give an overview and discuss some issues about the e-banking technology. In section 2, we show the factors that driving the banking sector to consider e-banking as a strategic tool for their business. In section 3, we show the opportunities and challenges that the bank face from the Internet technology. In section 4, we give an overview about the different electronic distribution channels used in banking. In section 5, we list and explained some of the services and capabilities offered by e-banking. In section 6, we show the initial steps for registering and using the e-banking services. In section 7, an overview about the e-banking system architecture is given. In section 8, we discussed some points about the security of the e-banking services. In section 9, an overview about the future trends features in e-banking is given. Finally, a conclusion is given.

II.   DRIVING FORCES IN E-BANKING

The advent of e-Business (e-commerce), technological innovations and globalization are increasingly driving businesses to change their traditional types of operation. The business strategist Michael Porter identified five competitive forces which affects and measure the position of any organization in the market. These forces are: barriers to entry, power of suppliers, power of buyers (customers), substitutes of products and competitors [5].

Applying Porter's Five Forces Model (Porter,1985) to the banking industry, researchers found that: first, the critical factor – barriers to entry – no longer exists in banking. Competitors can come from any industry; for example, credit card issuers and Microsoft financial services are from non-banking companies. In addition many countries have de-regulated their banking sector, which eliminate the entry barriers to banks competitors. Second, Product differentiation is very difficult for banks, since most of the products in retail banking are constrained by legal or industry regulations. Third, bargaining power of customers is increasing, switching costs are becoming lower with Internet banking and customer loyalties are harder to retain. Fourth, Threat of substitutes to banking from non-banking organizations is increasing.

Porter's Model shows that banks are under threat, and trend toward electronic banking services is necessary for banks. Banking institutions are responding to their competitors by developing electronic money channels, leveraging e-commerce technology, and creating online services through the Internet.

Internet is increasingly considered as a strategic weapon by banks to lower cost and provide value added services for customers. Internet can play a major role as a source of competitive information (competitive intelligence); for example, through the Internet a bank can review competitors' Web sites, analyze related newsgroups, examine publicly available financial documents, and ask the customers—award prizes to those who best describe the bank competitors' strengths and weaknesses.
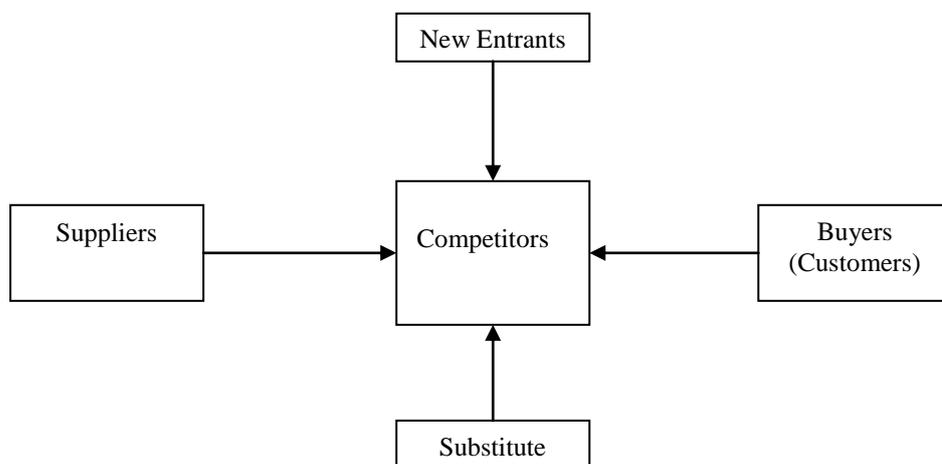

Fig. 1 Porter's five forces model

III. OPPORTUNITIES AND CHALLENGES FROM E-BANKING

Internet offers many opportunities to financial services providers, and many challenges for them to face:

A. Opportunities

Internet banking with friendly user interface, trusted system, and large number of online services will attract customers to banking, and as a result increase the bank revenue. Banks can generate revenue through increased account access fees, and cross-sell products such as credit cards and loans. The Internet enables banks to offer low-cost, high value-added financial services, become technology providers by selling banking products, providing technology information about these products, Providing back bone systems to support multiple payment system alternatives, and remain competitive with their competitors.

B. Challenges

Banks and customers had serious concerns about the security of the Internet, which was the biggest challenge for e-banking. Advances in Internet security and the advent of relevant protocols such as SET, SSL, OFX, … etc. increase consumer confidence, and put banks in perspective again as financial intermediaries. Regulatory barriers in many countries are on the decrease. governments are under pressure to reduce the barriers to competitive activity in the financial sector.

one major threat to banks is the "Internet-only" virtual banks. With low cost, one can set up a fully-functional, Internet-only bank and provide payment services on the Internet. For examples: Security First Net Bank (SFNB) which was formed in 1996 in the US, offer several online services. SFNB created a software company to market the online banking software to many banks. Other examples of virtual banks in US are (netbank.com) and First Internet bank (fibank.com). Studies found that customers still wanted the comfort of a physical presence.

IV. ELECTRONIC DELIVERY CHANNELS

In 70's, banks started to centralized data processing centers, using the computer and telecommunication technologies. In 80's, banks started technology investments for branches; first step is the offline branches, and second step is the online branches connected centrally. In the mid-1980's, banks developed new products for their customers:

Credit, Debit, and other plastic cards. And brought new channels to give service to their customers like: ATM, POS, and IVR In 90's, alternative delivery channels were used: Telephone banking, Internet banking, Mobile banking, and Television banking [4].

Electronic delivery channels (costing between 10 and 25 cents per transaction compared with $1.50 to $2.50 for transactions through bank staff) provide cost reduction. Two revolutions were found by these channels. First revolution began in 1969 when a cash machine was placed at a bank in New York. Then followed by the ATMs, plastic cards, PINs and a totally revised customer value system. It took about 20 years to fully take hold. Second revolution is driven by the Internet and is now in the early stages.The most difference between the two periods is the financial customer: In '70s and '80s, financial customers were being led by the financial industry, while today, financial customers are waiting for the industry to catch up to their expectation levels [4].

Several electronic channels were developed during the last decades [4], we will describe some of these channels here:

A. ATM

 Automated Teller Machines (ATM) or 24-hour Tellers are electronic terminals that let you bank almost any time, you generally insert an ATM card and enter your PIN. Some financial institutions and ATM owners charge a fee, particularly to consumers who don't have accounts with them. Acceptance of ATMs was not easy even in the bank industry, today, an average of 30% of consumers still do not hold an ATM card.

B. Telephony

In the middle of 80's, to reduce cost and get profits banks implement call centers. Call centers automate the most basic exchanges, like requesting an account balance or making a deposit. Transaction cost by a live agent is about 1/6th of that of the branch agent. Call centers help to secure customers' loyalty, ensuring that their individual needs are met by an automated system or a live agent over the phone as quickly as possible. Call centers were expanded by new technology, to create the most reliable systems. A number of strategic issues were used. For examples:

- Site selection : a number of centers using intelligent networking.
- The office : suitable design of the call center offices to achieve higher performance.
- Interactive Voice Response (IVR) : automatic answering and routing calls, provides a self service functionality. IVR can be utilized to manage upto 80% of investment calls, 60% of securities calls, and 25% of retail banking calls.
- Computer Telephony Interface(CTI) : initiates database queries or transactions by calling functions on the back-end systems. Help agents to identify customer and perform their tasks.
- Contact center: route and answer e-mail messages along with phone calls. Genesys Internet Suite is a software that automatically responds to customer e-mail or suggests responses. Also Provides on-line chat sessions with customers.
- Continuous Development : highly technical products are developed to increase agent performance. Some popular examples are : SmartRoute, that identifies callers from phone numbers; Sixth Sense, that receives data from the IVR system and display customers' histories and other relevant information; and voice over IP, which makes use of the Internet for speech communications to drop the cost.
- Other services : call center infrastructure can be utilized to serve other banks or even companies from other industries.

C. POS

Point-of-Sale (POS) transfers, let you pay for purchases with a credit card, debit card, and ATM card. POS can be used to process paper Checks as an Electronic Check. Electronic Check Conversion converts a paper check into an electronic payment at the point of sale, using the POS terminal. The Check should be voided or marked by the merchant so that it can't be used again.

D. PDA (Personal Digital Assistant)

E-banking enables you to perform; account enquiry, funds transfer, bill payment, rates enquiry, and change PIN transactions through a Windows CE 3.0 based PDA, 24 hours a day. After registering for this service, the bank gives you a diskette and an "Installation Guide" for downloading the PDA Security Components into your PDA to ensure full transaction security.

E. Internet

Internet banking means that various banking activities conducted from home, business, or the road using an Internet connection. Also known as: Cyberbanking, Online banking, Home banking, Virtual banking, …etc.

Internet banking started in 1995 in US and Europe. Over 1,200 European financial institutions offer Internet banking in 2000, more than twice as many as 1999. In 2000, financial institutions drived 13% of their revenues from business done on the Internet, and that share was expected to jump to 28% in 2001. Today, all banks in USA and most of the banks in Europe and around the word offer Internet banking.

Some of the leaders in Internet banks are: Wells Fargo in US and SEB in Europe. Well Fargo, a US bank, claims 450,000 online customers as of Spring2000, up 50% from 1999. SEB the Scandinavia's largest asset management bank, hopes to have five million customers banking via the Internet by 2004. These two banks offer a full range of services like: banking, brokerage, mutual funds, loans, mortgages, bill pay and presentment, and others.

For the customers, Internet banking is Convenient, Inexpensive, Convenient bill paying medium, 7/24 availability, paperless, and can bank from anywhere in the world. In the other side, it has some disadvantages like:
- Requirement for computer and Internet software (browser).
- Need for a network connection.
- Security concerns.

These disadvantages are eroding away as more and more people are starting to use Internet and security protocols are improving.
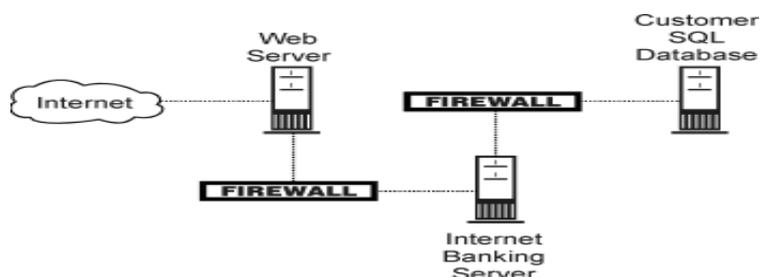

Fig. 2 Sample Internet Banking Architecture [4]

F. Mobile phones

Banking activities conducted via a mobile telecommunication network, or a wireless environment. It can be connected to the bank system via; Internet, Private communication lines, Smart cards, or other infrastructure. The Wireless internet access service provides cost reduction for the bank and a value added service for the customer. Wireless data services are technically not able to achieve end-to-end security; it is breached at least at one point, at the mobile operator premises.

Some studies have found that the number of mobile data users will total nearly 1.2 billion worldwide in 2005, which means increasing mobile banking users rapidly. Western Europe will lead the way in this rapidly developing market with over 400 million people during 5 years time.

Some large banks in the word provide Mobile banking, for example : Swedish Postal Bank, Citibank, Japanese banks, Hoover's wireless (hoover.com), ASB Bank (New Zealand), Charles Schwab, E*TRADE, SEB in Sweden, and Arab Bank.

G. TV banking

TV is the latest technology used in e-banking and e-commerce area for digital content delivery. Broadcasting the TV content in digital form provides at least 6 times capacity savings on the allocated frequency bands of the delivery medium whether it is air, cable or satellite. A global digital delivery medium to every TV set will be established within a decade. Forrester Research predicts that Interactive TV (iTV) will overtake Internet as Europe's primary e-commerce platform, and the subscriber base will be 80 million by 2005.

The characteristics of the iTV service consist: superior resolution, smaller bandwidth, compatibility with the computer and Internet, and can reach varying distances.

UK is a leader in using this technology, and Digital TV commerce is catching on in other European countries like: Holland, France and Spain.

Case study: United Kingdom:

In the last decade UK developed a test laboratory for all the interactive TV ideas in the world. In UK, iTV is delivered using all the three known broadcast mediums: Satellite, Cable, and Terrestrial (air). Several financial institutions in UK provide financial services over the digital TV. For example Abbey National (Britain's 6th largest

bank) have started to serve over all the digitalTV platforms in July 2000 and it announced that it expects 4 million homes to have TV banking available by the end of 2000 and 9 million by 2003.

V. CAPABILITIES OF E- BANKING

Visiting the sites of banks who offer the Internet banking, you will see a huge number of services and capabilities that are offered for the customers by these banks. Some of these capabilities are: Get current account balances any time, obtain charge and credit card statements, Pay bills, download account transactions, transfer money between accounts, check balance accounts, send e-mail to the bank, handle finances when traveling, and others services like free phone banking and waive checking fees [1], [2].

Other advanced services offered by e-banking [1], [2] are:

1) *Personal Finance services like:* bill paying and e-checks, tracking bank accounts, Portfolio management, Investment tracking, Quotes and prices (past and current), Budget organization, Record keeping, Tax computations, Retirement goals, planning and budgeting. Some software programs used for personal finance are: Quicken, Prosper, and CAP-TOOL.
2) *Billing Online:* Several billing activities are done through the e-banking, the following are some examples:
   - Automatic transfer of mortgages, the payer authorizes its bank to pay the mortgage, including tax payments
   - Automatic transfer of funds to pay monthly utility bills (automatic payment schedules).
   - Billing can be made into any bank account
   - Monthly rent and other bills paid directly into the payee's bank accounts
   - A merchant-to-customer direct billing: Customers can view and pay their bill on merchant Web site.
   - Using an intermediary: A third party consolidates all bills related to each customer in one site in a standard format.

   Billing activities can be classified into B2C, B2B, or C2C. B2B services can save businesses about 50% of billing costs. B2C save time to customer and processing cost for payees. For customer, there is no need for writing checks and can Pay bills from the road. Quicken's is a popular software used for billing online.

3) *Using bank intranets:* Banks provide large business customers with personalized service by allowing them access to the bank's intranet to access accounts, historical transactions, intranet-based decision-support applications
4) *Imaging systems:* Allow customers to view images of all: Incoming checks, Invoices, and other related online correspondence. Example: Bank of America.
5) *International e-banking:*   Some international retail purchasing can be done by credit card, other transactions may require international banking support. The following banks provide international retail purchasing through their e-banking systems:
   - Hong Kong Bank's provides e-banking in Asia
   - Mark Twain Bank in the U.S. uses e-cash to support trading in 20 foreign currencies
   - Bank of America and other banks offer: Cash management, Foreign exchange and trade services , and other services on an international level.

VI.   MANAGE YOUR ACCOUNTS ONLINE

To get an account and access the e-banking services, you have to follow the following steps [3]:
   a) First you sign up for online banking with your bank, and choose which accounts you wish to access online.
   b) Then you will be given a user ID and temporary password via regular mail, e-mail or both, with instructions on how to use them to access the secure online banking.
   c) Many banks require you to change your password during your initial visit for added security.
   d) your user ID and password are the only way to access your accounts online, so keep them in a safe place.
   e) Once inside your private site, you will have access to all of the accounts that you have registered for online banking. You can easily view your current balances, recent deposits and payments, complete account history, and many other activities on your account.
   f) Most sites have a financial summary page that lists all registered accounts.

One of the services provided to you when you register an Internet banking account is the Alerts service. Through this service you can instructs your bank to notify you via e-mail, wireless device and also on your private banking site

when a particular event occurs. Alerts can help you better manage your accounts by raising a flag when: An account balance rises above or drops below a certain amount, a check clears, an account becomes overdrawn, a transfer fails, or a new statement is available.

VII. BANKING SYSTEM ARCHITECTURE

Computer capacity in banks is shared by the alternative channels of the bank. Common architecture of the e-banking system contains three parts: the centralized back-end, the middleware, and the front-end (user interface) [1], [2], [4]. Successful system infrastructure must provide the following:

- Highly robust and scalable architecture.
- The ability to absorb additional growth
- Response time of less than one second, and customer availability of 99.9 percent.

In addition, directors must focus on virtual systems more than branch systems, and build a single real-time customer-related view of data across the entire bank.

Front-end (User Interface): It is what customers use to authenticate themselves and initiate their orders for financial products. Objective of the banks is to use the same presentation at all their front-ends but with minor adaptations. Example: HTML front-end interface is a popular one. The Interface contains some software products like personal financial management (PFM), from Major vendors like Quicken and MS Money.

Middleware: It is software, which acts as an application intermediator, enables communication between several different applications, between an application and a database, or between several databases. It uses messages to communicate between applications. Messaging standards can successfully integrate applications that are developed by separate vendors. Commonly used middleware product in the banking industry is the IBM MQSeries middleware.

Back-end: It is the centralized Computing capacity in the bank, which is shared by the alternative channels of the bank. Transactions are collected in various forms, and middleware translate the request into a form that the transaction engine would understand, and then executed by the back-end level. Back-end requires; a potentail computing power which is increasing rapidly, additional security measures and advanced programming techniques. The back-end power is mainly consumed by updating tables of the databases.
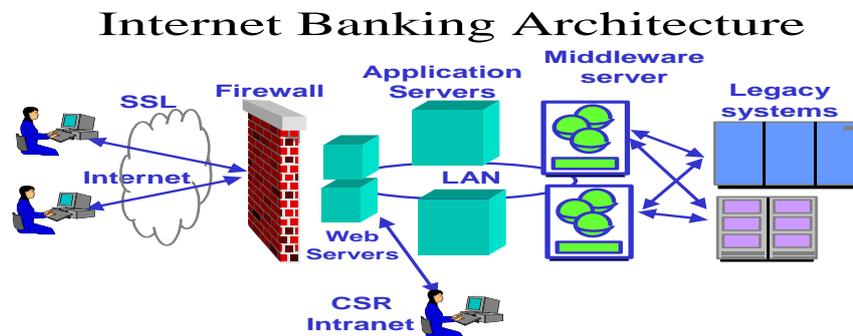

Fig. 3 E-banking architecture [2].

VIII. SECURITY

Security is the most important issue for the financial institutions and the customers. security started to mean much more than just strong building constructions and safe-deposit boxes. With electronic delivery channel the kinds of attacks are mostly technical [4]. When considering the security of the channels two components must be identified :

1) The Network : The attacks on the network is generally in the form of tapping-in and stealing data. The precaution is to use strong enough encryption of the data as it is being transferred over the network.

2) The Facility : The attacks on the banking facility could be either to disable its functions (Denial of Service – DoS attacks) or to login as an intruder for committing transactions or for spreading viruses to corrupt. The precaution is to use firewalls at the point where the facility is connected to the network.

A. Encryption

Encryption is the process of converting information into a more secure format for transmission, and decrypted back at the receiving end of the transmission. There are 2 levels of encryption generally available in web browsers: 40-bit encryption, and 128-bit encryption. 128-bit encryption is exponentially more powerful than 40-bit encryption. Internet browsers use 128-bit encryption. Handheld devices or smartcards usually use 40-bit encryption. Some Security protocols used are: Secure Socket layer (SSL), Standard Security electronic transaction (SET). To check if a site is secured or not you can notice the following point on the sit:

- After inputting user-id and password, the lettering in the URL address must change from "http" to "https.
- At the bottom of the screen, a padlock icon must appear.
- Gold seal appears somewhere on the site that reads, "VeriSign Secure Site; Click to Verify.", means the site is certified as a secure domain.

B. Firewalls

Firewalls are used to filter traffic passing into or out of the internal networks of the bank. To counteract invasion threats, like Denial of Service (DoS) attacks, finance institutions most commonly use: Firewalls, Anti-virus software (also called malicious code detectors), and Vulnerability scanners.

C. Authentication

User-authentication technologies, allow both the sender and recipient of online transactions to verify themselves and each other, by attaching a "digital certificate" or some other form of digital signature. User authentication, known as public key infrastructure (PKI) is usually used. It consists two security keys; the public key (digital certificate) and the private key (RSA key).

The process is such that the signer uses his private key to lock the data and the verifiers use the signer's public key to unlock the data. This way not only the signer guarantees that the viewers are only those to whom he has distributed his public key, but also the viewers are sure that the signer is the holder of the private key.

Usually three things are used to establish authentication: Something the user knows, Something the user has, or Something the user is. The last is the biometrics science: such as Fingerprint imaging, iris-scanning and signature-reading.
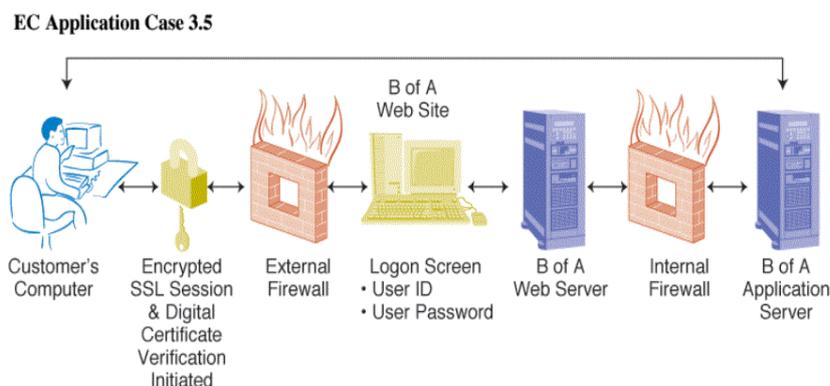

Fig. 4   Security components in a banking system [2].

Example: Security at the Bank of America:

Bank of America (B o A) provides extensive security to its customers. Here are some of the safeguards provided by the bank:

- Encryption and digital certification verification—assures users that they are connected to the B of A
- Information flows through a direct Web server, then goes through an internal firewall to the application server
- Information is shared among the company's family of partners only for legitimate business purposes
- The company uses "cookies" to learn about its customers; customers can control both the collection and use of the information
- The bank provides suggestions on how users can increase security ("Use a browser with 128-bit encryption")

IX.   FUTURE TRENDS

E-banking services in the future seems to have new features [4], some of these are:

➢ No Geographic Barriers: Customers will choose banking services on the basis of price considerations, not just from banks located near the customer's home or work place.
➢ Banking Products and New Competitors: Non-bank competitors are increasing, and offering several products like: credit cards, mortgages, auto loans and some investment and savings products. So customers could bank on a product-by-product basis.
➢ New Competitive Strategies: Some banks may use small but high-tech branch structure, at supermarket chains. Example: Banking kiosks.
➢ Speech recognition: is a technology now available or under development, that the call centers can make use of it.
➢ Virtual banks: the future will rely more on people and technology, and less on physical location. People will phone or e-mail an expert rather than talk face-to-face with a local teller.
➢ Data mining: Banks are beginning to collect customers information into data warehouses, so they can target certain customer segments for new product offerings.
➢ Intelligent agents (IA): are software applications that can: speed searching, customer searches becomes more effective and efficient over time (learning activity), and assist in data-mining activities.
➢ Biometrics: new technology for banking security. within a few years it will take place in the banking services. Biometrics for considerations are:
> - PC/Internet banking: Fingerprint, face, and voice.
> - ATM: Fingerprint, face, voice, retina, and iris.
> - Telephone banking: Voice.
> - Branch: Fingerprint, face, voice, retina, iris, hand, finger geometry.
➢ Mobile wireless access devices: development of the Internet and proliferation of cell phones, PDAs, pagers and other unwired access devices are driving the financial industry to support wireless device access, to serve their customers.
➢ Marketing online   banking software: bank can create a marketing software department (company), to market online banking software to other banks. Example: In March 1998, Security First Network Bank (SFNB) sold its online banking operations to Royal Bank of Canada.

X.   CONCLUSION

Banks are being forced to change rapidly as a result of forces such as threat of competition, customer demand, and technological innovations. E-banking becomes a necessity strategic tool for banks to remain competitive in the market, and provide integrated value added services for the customer.

In the foregoing pages we have discussed some aspects of e-banking. We can say, it is hard to imagine a bank without the e-banking technology. However, technological advancement are and will continue impact the banking environment, to make existing channels more efficient and support creating new channels like M-banking and T-banking.

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