STUDY OF USABILITY ASPECTS WITH REFERENCE TO CBS IN COOPERATIVE BANKS IN PUNE DISTRICT

A THESIS

SUBMITTED TO THE
TILAK MAHARASHTRA VIDYAPEETH PUNE

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN COMPUTER SCIENCE

UNDER THE BOARD OF MODERN SCIENCES & PROFESSIONAL SKILLS

BY

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SEPTEMBER-2023

CERTIFICATE

It is certified that work entitled **"Study of Usability Aspects with Reference to CBS in Cooperative Banks in Pune District"** is an original research work done by **Mrs. Arati Sameer Nimgaonkar** under my supervision for the degree of Doctor of Philosophy (Ph.D.) in Computer Science to be awarded by Tilak Maharashtra Vidyapeeth (TMV), Pune. To best of my knowledge this thesis

- embodies the work of the candidate herself.
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- fulfils the requirement of the ordinance related to Ph. D. degree of the TMV.
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Place: Pune

Dr. Rajendra Kumbhar
Research Guide

DECLARATION

I, Mrs. Arati Sameer Nimgaonkar, Ph. D. Scholar of Tilak Maharashtra Vidyapeeth in Computer Science solemnly affirms that, thesis entitled "**Study of Usability Aspects with Reference to CBS in Cooperative Banks in Pune District"** carried out under the supervision of Dr. Rajendra Kumbhar is my own work. I have not copied it from any source. I have gone through extensive reviews of literature of the related published / unpublished research works and the use of such references has been acknowledged in my thesis. The title and the content of the research is original. I understand that, in case of any complaint, especially plagiarism, regarding my Ph.D. research from any party, I have to go through the enquiry procedure as decided by the Vidyapeeth at any point of time. I understand that, if my Ph.D. thesis (or part of it) is found to be duplicated at any point of time, my research degree will be withdrawn and, in such circumstances, I will be solely responsible and liable for any consequences that arise thereby. I will not hold the TMV, Pune responsible and liable in any case.

Place: Pune

Mrs. Arati Sameer Nimgaonkar
Research Scholar

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Arati Sameer Nimgaonkar

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List of Abbreviations

Abbreviation	Explanation
AMC	Annual Maintenance Contract
ATM	Automatic Transfer Mode
BO	Branch Office
CBS	Core Banking System
CISO	Chief Information Security Officer
C-SOC	Cyber Security Operation Centre
Delivery Channel	Common term used to refer banking services like ATM, Internet Banking, Mobile Banking
HO	Head Office
ICT	Information and Communication Technology
IDS	Intrusion Detection System
IMPS	Immediate Payment Service
IT	Information Technology
IT	Information Technology
LAN	Local Area Network
Ltd	Limited
MIS	Management Information System
MIS	Management Information System
MoU	Memorandum of Understanding
NABARD	National Bank For Agriculture and Rural Development
NEFT	National Electronics Funds Transfer
Net Banking	Internet Banking
OS	Operating System
PC	Personal Computer

POS	Point of Sale
RBI	Reserve Bank of India
RTGS	Real Time Gross Settlement
SLA	Sevice Level Agreement
SMS	Short Message Service
SPSS	Statistical Package for Social Sciences
SSL	Secure Socket Layer
TAFCUB	Task Force for Co-operative Urban Banks
TAM	Technology Acceptance Model
UI	User Interface
UPI	Unified Payment Interface
VLAN	Virtual Locan Area Network
WAN	Wide Area Network
WiFi	Wireless Fidelity

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Study of Usability Aspects with Reference to CBS in Cooperative Banks in Pune District

Digitization has changed and will continue to change our cyber life. Information Systems have become an integral part of everyday life in the home, businesses, government, and organizations. In this digital era, the Indian banking industry has changed a lot to cope up with the digital world. Technological advancements have improved the pace of the banking industry.

One of the largest contributors to technology banking is Core Banking Solution or CBS. CBS records the transactions that store customer information for the calculation of interest means a software application to complete the process of delivering the items in a single database. CBS is connected to the customers via delivery channels such as NEFT, RTGS, ATM, Mobile banking, and Internet banking. In this computing journey, the Reserve Bank of India (RBI) has played an important role in providing necessary and important guidelines, and recommendations for the implementation of these technologies. But still, users of the CBS i.e., bank employees and customers are facing hurdles while using the system.

Neither all employees nor customers of the banks are technical people. They have learned the operations of CBS and using it. They have changed their way of doing traditional banking to technical banking but are facing problems during this transition. While performing these transactions, functionalities provided to the normal user should be usable. That is nothing but bank software should have a simple, user-friendly interface, easy to learn and memorize operations, acceptable error tolerance level with robust security that allows users to access information in a faster and easy way. Along with accomplishing banking functionality easily and accurately, establishing usable security environment plays an important role while carrying out all these tasks.

The main aim of the research study is to determine the variety of direct and indirect usability factors influenced the implementation of Core Banking Solutions in cooperative banks. Statistics reveal banks and vendors did not address usability concerns when creating or deploying CBS. Despite the fact that cooperative banks have adopted and implemented CBS, the study depicts that it is not being used to its full potential due to a lack of IT proficiency and a failure to appreciate the technical knowledge of the CBS implementation.

Chapter -1 Introduction and Research Design

Section -I – INTRODUCTION

1.1 Banking System Overview

The banking industry manages a country's finances, including cash and credit. Banks are the institutional bodies that accept deposits and issue credit to entities, and they play an important part in a country's economic standing. Banks are strictly regulated in most nations due to their importance in the economy. In India, the Reserve Bank of India (RBI) is the primary banking organization in charge of the country's monetary policy.

1.2 Evolution of Banking Technology in India (reform-period/, 2015)

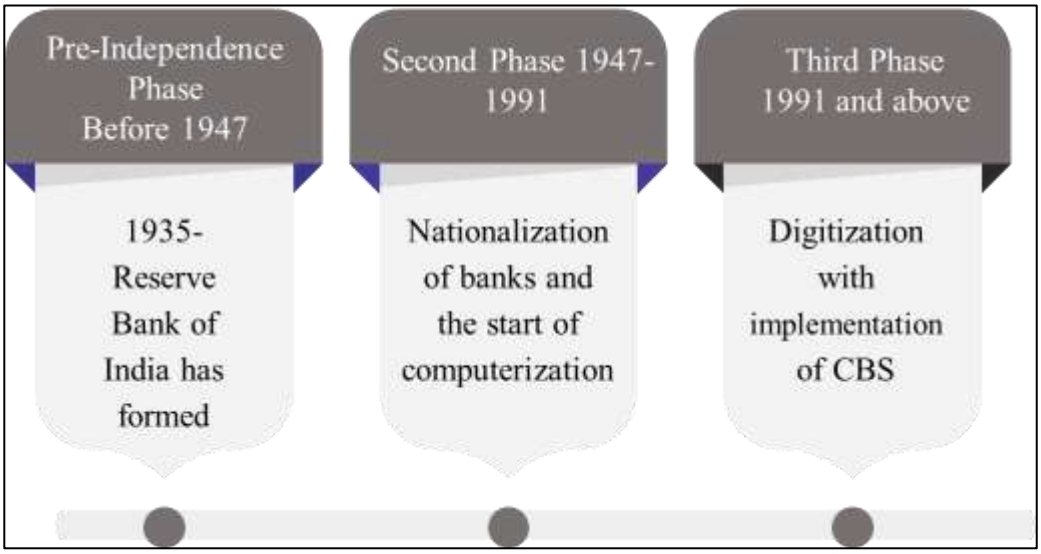
In India, modern banking began in the latter decade of the 18th century. The evolution of the Indian financial system can be divided into three major stages:

1. **The Pre-Independence Period (Before 1947)-** This time is notable by the presence of multiple banks. The Reserve Bank of India was formed in 1935. During this time, the bulk of banks were small and frequently dissolved.
2. **Second phase from 1947-1991** – The key distinguishing element of this period is the nationalization of banks and the beginning of bank computerization. In the late 1980s, the Indian banking sector recognized the need for computerization to improve customer service, bookkeeping, and MIS reporting. The Reserve Bank of India established a committee on bank computerization in 1984, chaired by Dr. C. Rangarajan. Furthermore, in 1988, another committee was formed under the chairmanship of Dr. C. Rangarajan to lay out a five-year plan for bank automation, paving the way for the implementation of a multiuser **Total Branch Automation (TBA)** package running on the Local Area Network (LAN). As a result, banks began to offer specialized services.

3. **Third phase 1991 and above** – With the liberalization of the economy in 1991-92, the development of computerization has accelerated. This time saw a significant increase in the process of bank development through digitalization. This was made possible for them primarily because they chose to adopt a WAN-based centralized banking solution, i.e., Core Banking Solution (CBS), rather than a LAN-based branch banking solution.

Previously, many banks were hesitant to embrace this banking trend due to its huge network of branches on the one hand and high IT costs on the other. However, in the late 1990s, there was a substantial fall in IT costs due to globalization and liberalization of the Indian market with the passage of TRAI, which led to a shift in bank attitude to try Core Banking Solution banking. This is a revolution that revolutionized the face of banking in India, allowing the concept of 'Anytime, Anywhere' banking to be realized. The concept is on its way to being the sole way to handle banking in the future, moving beyond just IT infrastructure automation.

Figure 1.1 Evolution of Banking Technology



(Compiled by Researcher)

Banks have benefited in several ways by accepting newer technologies. Implementation of these new technologies has reduced the cost and generated revenue through different channels. In this, RBI has played an important role in guiding and giving recommendations for achieving various objectives.

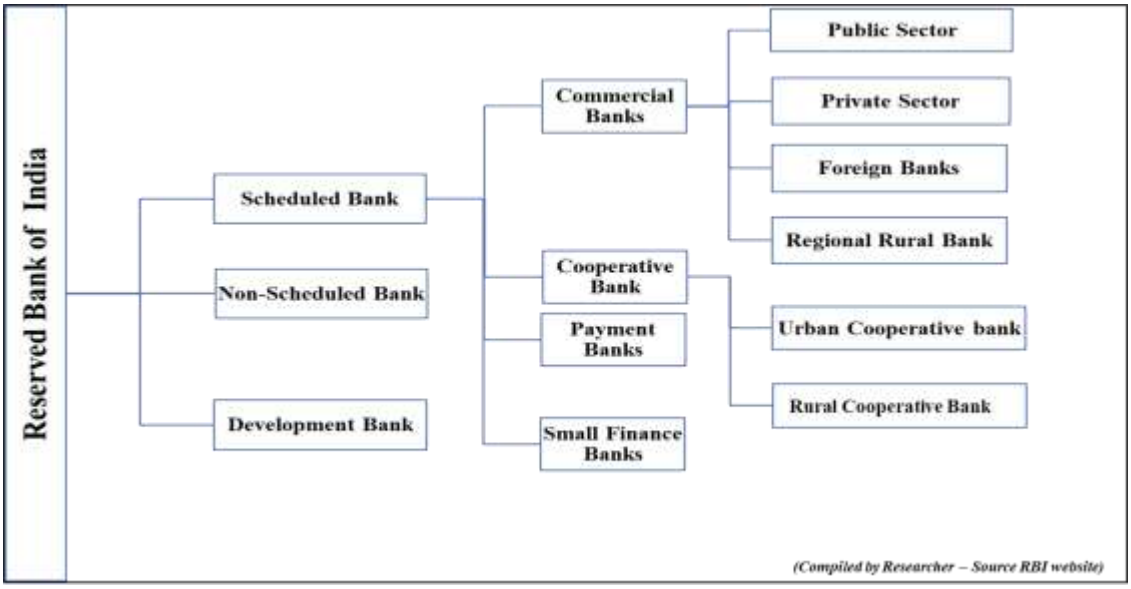
1.3 Classification of Banks

One of the important pillars of any country's economy is its Banking system. It is responsible for holding the financial system of the country's economy. The main function of any banking system is the mobilization of deposits and distribution of credits to various sectors of the economy.

The Reserve Bank of India is the ruler bank of the country which plays an important role in regulating the banking system, ensuring financial stability, and formulating monetary

policies of India. Indian banks are broadly divided into three categories. (Annual Report of RBI "Trend and Progress of Banking in India 2016-17", n.d.)

Figure 1.2 Classification of Banks



a. **Scheduled Banks**– These banks are listed in Section 42 of Schedule Two of the Reserve Bank of India Act 1934. To be eligible, banks must meet the system, such as more than 500,000 capital payments and more than 25% capital payments. Its branches in rural India etc. At the same time, these banks have other features. Banks have to send their details to the RBI every week. Selected banks are divided into four types - commercial banks, cooperative banks, payment banks and small banks.

- **Commercial banks** - Commercial banks commit income. Their main role is to accept deposits and loans for the public, business and government. Companies - can be divided into
  i. Public Sector Bank –SBI is the largest public sector bank in India. Public financial institutions provide basic services to rural and semi-urban areas of the country. These are state banks. The state owns some of the shares of banks.
  ii. Private Sector Bank – Here, major stake or equity is held by private shareholders. These banks offer personalized banking services to the customers. These are more customer oriented. All RBI rules are applicable to these banks.
  iii. Foreign Banks - These banks are headquartered abroad but operate as private entities in India. These banks must comply with the laws of their own country and the countries in which they operate.

iv. Regional Rural Banks –Provides loans to weaker segments of society such as small farmers, ranchers and small businesses. These banks operate mostly regionally, with some branches in cities.

- **Cooperative Banks –**All banks under the Cooperative Society Law of 1912 are called Cooperative Banks. They are an essential part of an important part of the Indian banking system. They have their own governing bodies. For that elections are conducted The main purpose is to operate the bank on a non-profit basis. These banks help small borrowers and businesses in the community that work in local groups.

    i. **Urban Cooperative bank** – These are located in Urban areas of the country. These banks work for small borrowers and businesses centered around communities, localities workplace groups.
    ii. **Rural Cooperative Bank**- These are located into Rural areas of the country and responsible for ensuring credit flow to the agriculture sector.

- **Small Finance Banks –** These banks provide financial supports to the society sections that are not served by other banks. For e.g., small scale industries, small or marginal farmers etc**.** Small Finance Banks are authorised under Section 22 of the Banking Regulation Act of 1949

- **Payments Bank -** Such banks very low deposits such as 1 Lakh per customer. These banks can also offer E-banking service.

b. **Non-Scheduled Banks-** These banks are not included in Section 2 of the Reserve Bank of India Act 1934. Their capital is less than Rs 5 million. These banking groups are legal, but the government is not helping the process. They do not comply with RBI rules and regulations. These banks do not offer wire transfer and check services. According to RBI, there are 1,511 regular banks in India. Subhadra Local Area Bank Ltd. In Kolhapur, Baroda City Cooperative Bank, Bangalore City Cooperative Bank etc. are examples.

c. **Development Banks –** These banks are moreover called Monetary Establishing. These banks have been built up for the improvement of distinctive divisions and never bargain with open segments. Specialized businesses such as lodging, universal exchange, and

agribusiness continuously bargain with Improvement Banks. NABARD, MUDRA, and IFCI are a few of the cases of Advancement bank.

1.4 Cooperative Banks in India

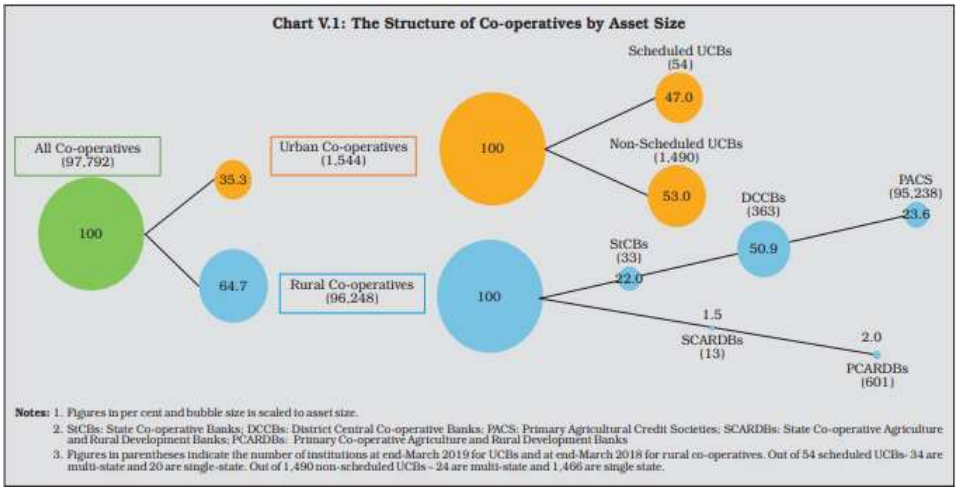
Cooperative development is the best economic development in the world. It helps to provide good jobs, alleviate poverty and promote social cohesion in the country. As a unique organization in India, cooperation is an important part of regional and rural organizations. Cooperatives are organizations created by people who need money. It is a self-empowerment and financial protection tool for disadvantaged groups such as agricultural workers, producers, small farmers and smart people.

Cooperative banks in India have a history of over 100 years. These banks emerged with the Agricultural Credit Union Act of 1904. Cooperative banks are an important part of the US banking system. These banks mainly serve rural people, especially agriculture. Cooperative banks encourage deposits and provide more loans to agriculture and rural areas. The loan for farmers is the foundation of the company.
Cooperative banks are mainly responsible for ruining the borrowers' job of providing loans to farmers. It is also an important tool for many development projects, particularly poor-based programs. Cooperative banks also work on non-farm projects, but their role is minor.

Cooperative credit unions in India started when the Cooperative Credit Union Act was passed in 1904. Cooperative banking in India is regulated by the Cooperative Bank Act of 1949 and the Cooperative Bank (Cooperative) Act of 1955.

The below figure depicts the structure of the Cooperative Bank of India. This figure is drawn based on the annual report released by the Reserve Bank of India in March 2019.

Figure 1.3 Cooperative banks



(Source: Annual Report of RBI 2019-20)

The Cooperative Banks in India are divided into two types which can further be subdivided. (Ms. Ashwini Chavhan, 2019)

a. Urban Cooperative Bank
    i. Non-Scheduled Urban Cooperative Bank
    ii. Scheduled Urban Cooperative Bank
b. Rural Cooperative Banks
    i. State Cooperative Banks
    ii. District Central Cooperative Banks
    iii. Primary Agricultural Credit Societies

The Reserve Bank of India (RBI) mandated a deadline for Co-operative Banks and advised them to implement the Core banking solutions (CBS) by December 31, 2013i n India. (RBI/2012-13/437 UBD.BPD.(PCB). Cir No.42/09.18.300/2012-13)

1.5 Step Toward Computerization in Indian Banking

Core Banking Solution (CBS) in India

The computerization of the Indian banking sector began in the late 80s. Over time, computerization was used to improve customer service, accounting, and MIS reporting. For this purpose, the Committee was appointed by the Reserve Bank of India in 1984 by Dr. C. Rangarajan.

First, banks started using personal computers (PCs). Banks connected with computers and banks started to use local area networks (LAN). Back then, LANs were used for Netware or Unix operating systems. Banking activities are divided into branches according to the commercial activity of the branch. This is the true beginning of the march towards computerization.

Banks have started to implement Core Banking Solutions, which is the biggest change in Indian banking, extending the banking system to the banking system. "Core" stands for "centralized online real-time exchange". It then starts accessing the application from the bank database.

The next big step banks can take with CBS is "banking everywhere". This banking feature is really convenient for customers. Infosys, TCS, Finacle, BaNCS are some of the companies that make up important companies.

CBS Records Transactions that store customer information for interest calculations are sent to software applications that complete the shipping process in a database. You can centrally control all account information. In this way, customers can use Internet Banking, Mobile Banking, Telephone Banking, ATM etc. can be connected to the bank according to their needs. (Roman Zollet, 2010)

From 1991 to 1992, the electronic commerce process accelerated, automation technology began to be used, and real-time banking business began. This is due to the international competition between private and foreign companies. Many commercial banks are turning to digital customer service to stay competitive and relevant. Now banks are realizing the benefits of CBS and are starting to use this new technology. Some of the main benefits CBS can be seen are the reduction of human error and banking anytime, anywhere.
Commercial banks in India are starting to use MICR-based checks, electronic payments, interbank and ATM (Automatic Teller Machine) lines.

At the end of 2000, the internet and mobile era began. Indian banks have also changed and started to move towards online banking or online banking. Banks started using online modes such as IMPS, RTGS and NEFT. This changed the banking services available to customers. These services take less time and are easier. After new challenges, banks are now ready to

take on the new challenges of mobile banking. At the same time, new technologies such as biometrics are well-received and used by banks.

In this computing journey, the Reserve Bank of India (RBI) has played an important role in providing necessary and important guidelines, guidelines, and recommendations for the implementation of CBS from time to time. This helps the bank achieve its goals. The Reserve Bank of India has tried to encourage banks' payments and settlements.

1.6 Current Status of Indian Banking in Digital Space

Now India's journey from one country is coming to an end and India is becoming a developing country. In August 2010, the Reserve Bank of India (RBI) mandated the Core Banking Solution (CBS) for all banks intended to conduct business electronically, where customers store data in a central database accessible to all branches of the bank. All banks must complete the implementation of Core Banking Solutions (CBS) within three years.

The bank today aims to provide its customers with speed, accuracy and good business. The focus of all banks in India today is not only to provide digital services, but also to provide customers with a simple business experience.

According to the 2021-22 RBI report, there are 2,13,149 automatic cash machines (ATMs) and 25,29,141 point-of-sale devices (POS). NEFT (National Electronic Funds Transfer), ECS (Electronic Clearing Service), RTGS (Real Time Gross Clearing), Check Cutting System, Mobile Banking System, Debit Card, Credit Card, Prepaid Card etc. use of electronic payment systems. It was accepted in the bank of India and became part of the daily business. These are key elements of digital transformation in banking. Internet banking changed the face of the banking industry and brought with it the best changes in the banking industry. (Source RBI official website)

After the demonization, the Indian government supported the digital economy. Launched by the National Payments Corporation of India (NPCI), United Payments Interface (UPI) and Bharat Money Interface (BHIM) are key steps in innovation in payments space.

1.7 Research Problem

Before computerization, banks had various problems. Banks should keep a comprehensive list. In many industries, banks have to contend with mathematical and human error. These actions lead to difficulties. Customers need to go to the bank to make a transaction. Since there is no ATM, people have to carry cash. It is also not possible to deposit money anywhere. Therefore, it is difficult for Indian banks to compete with western banks without a computer.

In the mid and late 1990s, there was a revolution in communication technologies such as the internet and cell phones. As a result of the IT revolution, the Indian banking sector has been a huge success. Almost all private and foreign banks are 100% computerized. This provides a faster turnaround and greater focus on work. Many banks are now switching to Core banking solutions. Core Banking Solutions stands for Centralized Online Real Time Exchange (CORE) based banking solutions. This helps banks maintain electronic bookkeeping in the data center. The Bank's customers and customers of other banks with which it does business can access these electronic records. The Reserve Bank of India (RBI) has made CBS mandatory for all banks including Rural Banks (RRBs) and municipal banks.

So, while exploring this entire situation, banks in India are using computerized systems from last two decades for performing different banking functions. But now they are heading toward more online transactions. Internet banking is one of the web-based information systems designed to provide convenience for the customer in the transaction. While performing these transactions, an interface that is provided to the normal user should be usable. That is nothing but a bank website that should have a simple, user-friendly interface with robust security that allows the user to access information in a faster and easy way.

Internet users can fail at several hurdles, e.g., issues related to trouble-free and self-explanatory interaction. Not only users but also organizations are affected adversely by these difficulties. No other medium than the Internet – the fastest-growing form of communication media in history (Berners-Lee, T. and Fischetti, M. 1999) – has ever confronted its new users with such vast and diverse difficulties of use. Even nowadays as the Internet is used as a common instrument, its utilization often evokes problems.

The banking industry has been chosen because Banking applications are considered one of the most successful and most established applications ever and the fact that Internet Banking contains many interesting characteristics from the usability point of view (multi-stage processes, diverse and complex basis, independent transactions, etc.). (Pakkarainen, 2004)

Statement of the Research Problem

The above discussion needs to be analyzed and resolved, so the study will be undertaken, titled as **'Study of Usability Aspects with Reference to CBS in Cooperative Banks in Pune District.'**

1.8 Objectives of The Study

The proposed study has been confined to the following objectives.

1. To study the technological milestones in the banking sector of India.
2. To study the Core Banking System (CBS) with respect to the usability aspect implemented in the
   cooperative banks.
3. To analyze the perceptions about the usability of CBS from staff members working in the different
   positions in the banks.
4. To examine the efforts taken by the banks for adopting CBS effectively by users.
5. To study the relationship between security and usability implemented for perceiving that security with respect to E-banking.

1.9 Hypothesis

The study has been undertaken to test the following hypothesis.

1. The Usability perception of the Core Banking System (CBS) varies depending on the position of the staff working in the banking organization.
2. The Usability of the Core Banking System (CBS) depends on the training provided to the bank employees.
3. Involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.
4. The cooperative bank customers are not satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking).

1.10 Significance of The Study

The ultimate CBS is to empower a diverse population of users by providing a series of convenient and anywhere online banking. Yet the challenge and responsibility of online CBS is to ensure these services remain open and accessible to accommodate a diverse user population, in addition to being both secure and private. The main outcome of this research helps to encourage improvements in making online banking interfaces more usable for users.

1. This research is useful for banks for knowing the problems which users have to face while interacting with the bank system.
2. This is also helpful for Cooperative bank authorities to analyze their Core banking system interface design and make design decisions accordingly.
3. The Research gives a new dimension to the usability of the online banking system from the security point of view.
4. It is supportive to the bank management to perform, and transform provided usability mechanism to minimize the gap between security and usability providing a less vulnerable system.
5. More customers having less technical knowledge will get attracted to electronic banking since banks are providing an interactive, easy, and secure interface that demands much less technical knowledge from them to use the system.

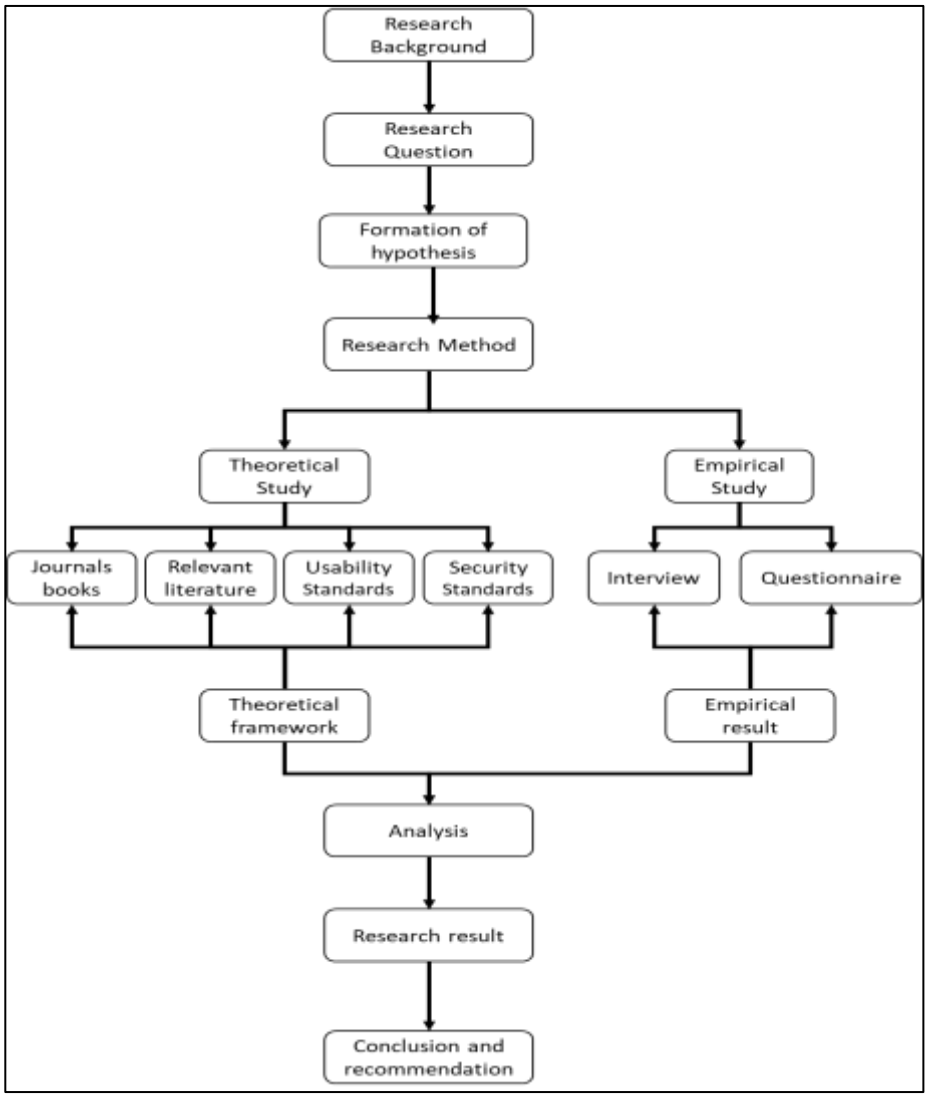
Section -II - RESEARCH METHODOLOGY

This study is mixed method research since the researcher has collected both qualitative and quantitative data. Also, the study is inferential descriptive (diagnostic) in nature based on the systematic collection, analysis, and interpretation of the data related to the CBS system.

1.11 Research Design

The study has been focused on the Usability aspect of CBS by the selected Cooperative Banks in the Pune district. The Respondents of this study have limited to the Pune district and as well as selected Cooperative Banks. Write from the implementation of the CBS the banking sector, has observed considerable changes. This section describes the plan of the study, structure, and strategy. The current research employs both quantitative and qualitative research methods.

Figure 1.4 Research Design



(Compiled by Researcher)

1.12 Scope of Study

The present research is confined to selecting the Cooperative banks from the Pune district only. Research has been conducted in selected Cooperative banks that have Head Offices in the Pune district.

Geographical Location of Pune

Pune district is located between 17 degrees 54' and 10 degrees 24' north latitude and 73 degrees19' and 75 degrees 10' east longitude. The district has a geographical area of 15,642 sq. km. Pune district is surrounded by Ahmednagar district on the north-east, Solapur district on the south-east, Satara district on the south, Raigad district on the west, and Thane district on the north-west. It is the second largest district in the state and covers 5.10 % of the total geographical area of the state. (https://pune.gov.in/about-pune/, n.d.)

Conceptual scope: The conceptual scope is restricted to the usability problems which are faced by the stakeholders (Users) of Core Banking Solution (CBS), software. Also, problems related to the usability of the security implemented by the CBS software are addressed.

Analytical scope: Analytical scope is confined to various statistical tools viz. percentage, averages, co-relations, Mean, Standard Deviation, Spearman's rank correlation, One sample KS test etc. For this analysis, the researcher has used MS. Excel and SPSS 22

1.13 Data Collection

For this study, data regarding existing CBS implementation in cooperative banks, usability issues of CBS in cooperative banks, the concept of e-security, and security issues related to the usability of CBS in cooperative banks are required. The researcher has used a cross-sectional approach for collecting the data. Cross-sectional research is selected since it accurately captures the observations and opinions of the respondents.

Structured questionnaires are used as the instrument to gather the data. Four separate questionnaires are designed to gather data from different sets of respondents. Apart from

the demographic details, the questionnaire contains various questions referring to the usability of the CBS software based on the role of the respondent.

The data has been collected through qualitative and quantitative data sources.

- Primary Data Sources – The researcher has specifically gathered primary data from,
  1. **Management level people** who take the decisions related to which CBS to be purchased based on budgetary provision, training for staff and customers, Infrastructural decisions, etc. For this role of respondent's questionnaire contains questions based on
     - CBS Implementation
     - Finalizing and exploring the CBS at the time of Purchase
     - Preparedness for implementation of the CBS
     - Usability and Security Aspects Considered while purchasing the CBS

  2. **Branch staff** officers, clerks, heads of different sections, etc. These are the actual people who use different CBS modules, maybe Head-office Module or Branch Module Day to day for banking transactions, report generations, etc. For this role of respondent's questionnaire contains questions based on,
     - CBS Implementation
     - Usability and Security Aspects
     - Suggestions on and Training of CBS
     - Availability of Infrastructure
     - Rating on Usability
     - Problems Faces during using CBS

  3. **Technocrats**, technical staff, or IT Department people who take care of CBS implementation, Infrastructure requirement and maintenance, handling CBS-related or hardware, and software queries of staff, and customers. For this role of respondent's questionnaire contains questions based on,
     - CBS Implementation
     - Usability and Security Aspects
     - IT Infrastructure
     - Involvement During CBS implementation
     - Technical and Security Training

- Rating on Usability
- Network Aspect Handled
- Security Aspect Handled
- Authentication & Security for Customers
- Problems faced during using CBS

4. **Customers** are people who have bank accounts in the bank and use different delivery channels like ATM, Internet banking, and Mobile Banking provided by the bank. For this role of respondent's questionnaire contains questions based on Rating on Implemented Usability and Security

- Secondary Data Sources –The necessary secondary data will be collected from sources like bank documents, RBI reports, various publications, journals, articles, and reports.

1.14 Sample Design

For this research, the researcher has collected the data from cooperative banks having their Head Offices in Pune district. Cooperative banks are the units in the population and the size of the population is finite. According to the Cooperative Commissionerate DDR office's records, there are 48 cooperative banks in the Pune district.

The researcher employed Probability sampling, to a sample from intended population. The sampling unit considered in this research study has been divided into four categories, Managerial people, Front office staff (Clerical staff), Technical Staff and Customers using CBS of Cooperative banks.

The researcher has calculated sample size using following formula for population of 48,

Finite population:

$$CI' = \hat{p} \pm z \times \sqrt{\frac{\hat{p}(1-\hat{p})}{n'} \times \frac{N-n'}{N-1}}$$

Substituting the values in the formula,

Z = 1.96 (Z-score for a 95% confidence level)

p = 0.9 (population proportion)

E = 0.1 (10% margin of error)

N = 48 (population size)

Sample Size = *CI'* =24

After calculation, 24 measurements/surveys are needed to have a confidence level of 95% with ±5% margin of error in the sample value for population size of 48 banks.

The researcher has selected 25 cooperative banks having their head offices in Pune district (i.e., more than 50% of cooperative banks) by random sampling method. The researcher has visited these cooperative banks personally and collected data from 25 cooperative banks from managerial level people, front office staff and technical staff. Table1.5 elaborate the details of the sample banks.

Table 1.5 Sample Banks

Sr. No.	Bank Name	Establishment	Branches
1	Indrayani Cooperative Bank Ltd	2001	7
2	Jai Bhavani Cooperative Bank Ltd	1972	2
3	Jai Hind Urban Cooperative Bank Ltd	1999	1
4	Janata Sahakari Bank Ltd	1949	71
5	Janseva Sahakari Bank Ltd	1972	30
6	Jijamata Mahila Sahakari Bank Ltd	1974	15
7	Mahesh Sahakari Bank Ltd	1972	16
8	Pavana Sahakari Bank Ltd	1973	22
9	Pune Cantonment Sahakari Bank Ltd	1973	11
10	Pune District Central Cooperative Bank Ltd	1917	283

11	Pune Merchant's Co-operative Bank Ltd	1924	10
12	Pune People's Cooperative Bank Ltd	1952	22
13	Rajashree Shahu Sahakari Bank Ltd	1985	17
14	Ramrajya Sahakari Bank Ltd	1997	9
15	Sadhana Sahakari Bank Ltd	1979	29
16	Sampada Sahakari Bank Ltd	2005	9
17	Sant Sopankaka Sahakari Bank Ltd	1997	19
18	Shri Gajanan Lokseva Cooperative Bank Ltd	1999	2
19	Shri Ganesh Sahakari Bank Ltd	1997	1
20	Shri Laxmi Co-op Bank Ltd	1971	4
21	Shri Laxmi Krupa Sahakari Bank Ltd	1998	2
22	Suvarnayug Sahakari Bank Ltd	1973	22
23	Udyam Vikas Sahakari Bank Ltd	1974	9
24	Vidya Sahakari Bank Ltd	1974	13
25	Vishweshwar Sahakari Bank Ltd.	1972	29

(Source: Compiled by Researcher based on Primary and Secondary Data)

The researcher has collected the data from top level Managers, Technocrats and Front office bank staff members of the above sample banks mentioned above.

Customers of the banks are connected to CBS via delivery channel i.e ATM, Mobile banking, and internet banking. For calculating the sample size of customers, the researcher has considered the customers of the banks which provides ATM, Mobile banking, and internet banking.

Out of 25 sample banks (mentioned above), 14 banks are providing ATM, Mobile banking, and internet banking facilities to their customers. Samples of the customers are collected from these banks. As per the secondary data, the population of the customers from these banks is 4,12,761.

The researcher has used same the sampling formula for calculating customer size which suggests that 139 measurements/surveys are needed to have a confidence level of 95% with ±5% margin of error in the calculated sample for population size of 4,12,761.

For this research study, the researcher collected data from 225 customers using google form.

The researcher performed a pilot survey among a select set of cooperative banks. The questionnaire was finalized after pilot study. A Cronbach alpha test is used to test the reliability and validity to assess the consistency of the questionnaire. Reliability statistics suggested that the reliability of questionnaire is of 0.812 which can be considered extremely good for the research.

1.15 Limitations of the Study

1. The study focuses on cooperative banks having their headquarters in the Pune District.
2. The impact of CBS implementation on the profitability of the banks has not been covered in the study.
3. The study focuses on the usability aspect of CBS and its implemented security. It does not cover technological implementation of the same.

1.16 Chapter Scheme

A brief outline of the chapters is as below-

Chapter 1: Introduction and Research Design

The chapter provides an overview of the Indian Banking System giving more focus on cooperative banks. The chapter discusses the scope and relevance of the study, objectives, hypotheses, and methodology employed.

Chapter 2: Literature Review

The chapter covers brief summaries of referred books, thesis, and research articles pertaining to the banking industry, the present status of CBS implementation in banks from a usability perspective, problems in CBS implementation in banks from the usability perspective, the impact of CBS implementation on performance of banks from the usability perspective, security frameworks used by the banks from the usability perspective.

Chapter 3: Conceptual Framework

This chapter talks about the conceptual framework of the study. Different terminologies, and technologies related to CBS with respect to usability and security have been discussed in the chapter. Emphasis is given to the various models of usability and security of CBS. Also, the conceptual framework lays out the summary of sample cooperative banks in the Pune district.

Chapter 4: Data Analysis and Interpretation

In this chapter, an attempt is made to analyze the present status of CBS implemented in the cooperative banks of the Pune district from different usability perspectives and security perspectives. implementation in banks from the usability perspective, the existing usable security framework.

Chapter 5: Observations, Conclusion, and Suggestions

The chapter summarizes the findings, conclusions drawn, and suitable suggestions made for effective usability and security in online banking to improve the efficiencies of various online functional areas of banks and will increase the confidence of online users for secure banking.

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Chapter -2-Review of Literature

2.1 Introduction

A review of the Literature is important for gathering and presenting evidence to support the claim that has created some new knowledge, especially that, the topic is worthwhile, research does not the work of others, and some new knowledge is created that was not known before. (Oates, 2006)

The researcher has reviewed various literature available in the form of books, Ph.D. thesis, research papers, journals, articles to carry out study under consideration. To enhance the relevance of the research work, the researcher attempted to focus on industry-specific empirical results along with the rich literature from the banking industry. For this the researcher has reviewed the literature related to

- The Indian Banking Industry with more focus on Cooperative Banks
- Implementation of the Core Banking Solution (CBS) by the banks.
- Various Usability aspects implemented while designing software, and websites such as
    - Technology or software acceptance parameters
    - Human-Computer Interaction (HCI)
    - Security measures with respect to usability

While reviewing the literature, the researcher realized that the research area of study can broadly be divided into two major areas:

1. The implementation status of Core Banking System (CBS) and its repercussions on its users (employees and customers)
2. Various aspects of usability of CBS that can enhance and improve the overall experience of the system from its user's (employees and customers) point of view.

2.2 Review of Books

The book "Researching Information Systems and Computing" written by **Briony Oates (2006),** is a complete guide to the researchers doing their research in the field of Information Systems. This book is very suitable for novice researchers. The book starts it's discussing the nature of research and the research process, continuing to the further stages of the research such as literature review, research strategies such as surveys, design, experiment creation, case studies, and data generation methods - interviews, questionnaires. It addresses both qualitative and quantitative data analysis.

Some guidance is also given on how to present the result of research, whether via an article or thesis, conference paper, or software demonstration by the author. The book also emphasizes the ethics of research. (Oates, 2006)

Jakob Neilson (1993) in his book *'Usability Engineering'* highlighted that usability is multi-dimensional.
The book explained the concept of usability in detail. In his book, he has elaborated 5 dimensions on which usability can be measured. Such as learnability, efficiency, memorability, error tolerance, and satisfaction. He also mentioned the importance of these dimensions may vary from product to product. (Neilsen, 1993)

Shahena Z. (2018), designed a book to enhance knowledge about CORE Banking Services, titled "Core Banking System". The book has been written with an academic approach for students. The book is written in very simple language which provides an understanding of the components and architecture of the CBS and the impact of related risks and controls. The book also elaborates on the functioning of core modules of banking and business process flow.

The book also talks about the regulatory and compliance requirements applicable to CBS such as RBI regulations, Banking Regulation Act, etc. This section of the book helps in understanding various regulations imposed by RBI on different categories of Banks. This book has also given an overview of the Internet banking process and e-Commerce transaction processing. (Z., 2018)

M. Revathy Sriram (2013), has written a book "Core Banking Solution - Evolution of Security and Controls". This book provides a brief and clear understanding of the concepts of core banking solutions (CBS). Experts of the IT department of the banks surely benefit from reading this book, since it talks about the control and security of the bank.

The author said that - CBS is customer and employee-friendly. Banks can increase their customers by choosing software wisely. Delivery channels such as Internet banking, cash management systems, and automated teller machines are well explained in the book by the author. (Sriram, 2013)

Author **Albert Badre (2002)** in his book, "Shaping web usability: interaction design in Context" has stated that *optimizing the user experience should be the ultimate aim of the Web usability designer*. This book focuses on two themes, first designing for the context and designing for the user experience. The author has clearly mentioned in this book that there is a difference between the GUI and web design environment and Usability designers should pay attention to that. The author has very well explained the concept and history of Human-Computer Interaction which an important factor is to be considered while designing any user interface.

This book is a comprehensive coverage of various aspects related to web usability. Albert Badre has precisely explained how to design your website that is easy to learn and use. The author goes beyond just the 'Usability' by introducing a complete, framework for Web-specialized design, considering every aspect of the Web environment. According to the author, - Designing usable Websites requires more attention to context than designing usable GUIs. (Badre, 2002)

Lorrie Faith Cranor and Simson Grafinkel (2008) highlighted in their book titled, "Security and Usability: Designing Secure System that People Can Use" that Security experts have overlooked usability issues because they often failed to recognize the importance of human factors. In this book, the authors have elaborated on the concept of Human-Computer Interaction with keeping security at the center. The authors have addressed the issue of the tradeoff between usability and computer security. Both authors have also given their stress on how to design a secure system that is usable for untrained computer users. This book is intended for both, academic and professional learning. This

book starts the discussion, with new ideas, and further advances in this important field. (Lorrie Faith Cranor, 2008)

Domenic Potter (2014), in his book – '*Essentials of Design'* has elaborated on Human-Computer Interaction in the 14th chapter. The chapter talks about HCI and working with users. It provides HCI concepts that can help in designing human–computer interfaces, feedback, e-commerce Web sites, and Web queries. The author has focused on the concepts of HCI, the application of which ensures the functionality and usability of computer systems that are designed.

The author has suggested that the use of the Technology Acceptance Model (TAM), will help designers to judge whether users of the technology accept it or not. Since the model is useful not only to predict the likelihood of acceptance and use but also for acceptance after implementation. (Potter, 2014)

2.3 Review of Ph.D. Thesis

Davis, F.D. (1986) in his doctoral dissertation proposed '*A technology acceptance model for empirically testing new end-user information system: Theory and result'*. Technology Acceptance Model (TAM) highlights the two factors of the technology, perceived usefulness and perceived ease of usefulness. According to this model perceived usefulness and perceived ease of use determine the user's attitude toward the adoption of new technology. (Davis, 1986)

Lasantha Thennakoon (2019), in her Ph.D. thesis, '*How the core banking systems impact on employee behavior of a small banking institution'* investigated how the CORE Banking System (CBS) impact
employee behavior from a small banking institution standpoint. The research findings show that within the bank, and among different job functions and core banking modules, the employee reaction to a new CBS is not similar. Employees using specialized CBS modules reacted negatively whereas employees using standalone CBS modules reacted positively.

In the research findings, the researcher listed some of the below success factors that influence the reaction of employees,

- Employee training
- Post-implementation support
- Integration of all modules
- Process Alignment

Based on these findings, the researcher concluded that only capital investment on CBS does not result in the positive behaviors of employees unless it is supported by the above-mentioned success factors. (Thennakoon, 2019)

Adane Kebkab (2012), in his thesis 'Improving Usability of Banking Websites – By Implementing User-Centered Design' designed a model for developing a usable website for the banking industry by taking into consideration the users as the center of the design process by using a user-centered design. Also, while carrying out this study, he has come across one of a very interesting ideas that can be further investigated for conducting a deep

study on the impact of the security feature of the banking application in the design process of a usable banking website. (Kebkab, 2012)

The thesis entitled, '*Success of Implementation of Core Banking Solutions – A Study of Factors Involve*" carried out by **Ayana Johny (2016)**, focuses on IT implementation as an organizational modification process. The researcher has evolved a holistic model for successful enterprise information technology implementation because of the study. The study gives answers to two main questions – First, what are the factors that contribute to effective IT adoption and implementation, and second how do the identified factors affect CBS implementation? According to the author, thirty-four elements that contribute to IT implementation success have been identified. And two important factors that contribute to the successful implementation are Usability and Security of the system. (Johny, 2016)

R. T. Khenat (2014), in his Ph.D. research entitled, "*A Study Of Information Security Systems For Core Banking In Urban Co-Operative Banks of Pune & Mumbai*," has focused on the data center used by the UCB. The researcher has studied the case of UCB and given some recommendations for the management of the data center. UCBs need to adopt and implement information security controls as per their business requirements.

The researcher said that the data center is one of the most reliable, effective, and efficient methods for high availability and integrity of data. Further researchers suggest the traditional data center design can be a time-consuming and challenging process for small-size UCBs. The small server room can be a better choice for small UCBs than traditional data centers. Also, data centers can be replaced by cloud services. (Khenat, 2014)

Sven Kiljan (2017), carried out the research entitled *–'Exploring, Expanding and Evaluating Usable Security in Online Banking'*, as part of the Dutch Research Program on Safety and Security of Online Banking. In this notable research, the researcher has studied the security mechanism which is been used and implemented in the banks. He made some suggestions and proposed a new usable security method for the users of online banking.

The author has proposed a framework that implements virtual banks to measure user behaviors while performing financial and security-related- specifically authentication tasks.

The security task considered here is the authentication method. After analyzing the data, the result shows that user behavior similarities and differences between the two distinct groups were measurable.

Online banking is about both usability and security. Ease of use is about allowing users to use the system, while security is about preventing adversaries from doing the same thing illegally. These two characteristics always clash with each other. Strict security may make it almost impossible for an attacker to carry out a successful attack, but users may not want to use the system anymore because of the inconvenience of the highly secure system. (Kiljan, 2017)

2.4 Reviews of Research Papers, Articles, Journals, and Reports

2.4.1 Related to the Implementation and Impact of CBS technology.

According to the Reserve Bank of India (RBI), all banks in India must to implement CBS. Almost all public and private sector banks have adopted this change. But cooperative banks in our country are still struggling in this. RBI has also made it compulsory to adopt CBS gradually by large Urban cooperative banks by Dec31,2013, tier-I banks by June 30, 2014, and unit banks by Dec 31, 2014. **(RBI/2012-13/437 UBD.BPD.(PCB). Cir No.42/09.18.300/2012-13)**

Research paper entitled 'ICT Innovation in Indian Banking Industry: Trends and Challenges', published by **Madhura Ayachit (2017)**, focuses on advances in computation. The world is developing at an astonishing speed. India looks too extreme in the rapid development of information and communication technology. Since then, the Indian banking sector has undergone huge changes to become better and better with updated management for that customer. The constant development of ICT in the finance space has made virtual banking a reality in India. The establishment of Innovation Lab, encourage banks to explore different means of financing, including Biometric authentication, artificial intelligence, robotics, data analysis, wearable technology

Computerized wallets can be effectively used for cashless exchange. As countries embrace ICT progress, banks must prepare the foundation they need. According to the author, as a prominent degree of rural-urban educated youth, Banks must make efforts to reach out to recognize and welcome virtual banking for the rural poor who are not educated. In modern banking, banks also need to plan to overcome the difficulties presented. (MadhuraAyachit, 2017)

Prof. Bijoy Bhattacharyya & Ms. Swati Pradhan (2017), has given a very useful insight into digitization that took place in the banking industry in their article – '*Digital Revolution in the Indian Banking Sector'* on ForbesIndia.com. The article has elaborated on the technological milestones in the Indian banking system very effectively. Also, the article talks about the current status of banks in the digital space. (Pradhan, 2017)

Ms. Ranjana Hatwar (2015), has published a research paper *'Application of Information Technology in Indian Banking Industry'* in which she has given an overview of IT and Indian banking. She has mentioned in her paper that the most visible impact of technology is reflected in the way the banks respond strategically for making its effective use for efficient service delivery. Banking industry is shifting from traditional banking to Relationship banking. (Hatwra, 2015)

Ms. Ashwini Chavhan, Dr. R. D. Kumbhar, Dr. S. D. Mundhe(2019), in their research paper entitled – '*CBS Adoption By Cooperative Banks: A Theoretical Review'* has given a very educational review of the adoption of CBS in a cooperative bank. The authors have mentioned different RBI mandates and guidelines which cooperative banks need to follow for the successful implementation of CBS.

The authors also listed some of the hurdles those cooperative banks face while implementing CBS, such as Higher IT costs, for technology selection many a times non-technical people are involved, non-availability of required qualified professionals, data centers, and technocrats are high cost, and bank staff are reluctant to adopt new technology.

Based on this study, the authors have suggested that bank should adopt the CBS as early as possible with the latest technological solutions that are user-friendly and budget-friendly non-technosavy employees of the banks. (Ms. Ashwini Chavhan, 2019)

Jhumkee Iyengar and Manisha Belvalkar (2010), in the paper entitled *'Case Study of Online Banking in India: User Behaviors and Design Guidelines'* concluded that system design with user's success as focus, content understandable by 'anybody', supported with demos and help to reduce intimidation, will justify investment in online banking through increased usage by satisfied customers. (Jhumkee Iyengar, 2010)

Prachi Mittal, Sneha Singh Jadaun, Manoj Kumar Dash (2013), in their notable research paper titled '*Computerization in Banks'*, discussed changes that took place over the years in banking technology. They have elaborated on different technologies and their implementation. Along with that, the authors have listed down some of the risk factors such as computer fraud and computer crimes. They have conducted a survey about the technology

threats such as phishing, spoofing, and spamming from shrewd customers using latest banking products. (Prachi Mittal, 2013)

J. Shifa Fathima(2015), in her paper titled 'Implementation Of Core Banking Systems (CBS) In The Banks In India – With Special Reference To Urban Co-Operative Banks (UCB)' has outlined the implementation of CBS in India. She has presented in depth study about CBS in Urban Cooperative Banks & extracted the advantages of CBS. The present setup of technology has been studied and then proposed new technology to cope up with change. (Fathima, 2015)

'Current Scenario of State Co-Operative Bank in India and Its' Working Performance - A Study', the research paper written by **Subashchandira Bose, and Dr. P. Nagarajan(2016),** highlights the overall performance and working of State cooperative banks. The study has elaborated on the role of state cooperative banks in the Indian banking sector. Data analysis is done through secondary data such as government reports, Journals, Books, etc (Subashchandira Bose, 2016)

CA Kuntal Shaha(2014), in his article '*Core Banking System*', has sketched the future scenario of the Core Banking System at the same time he has listed out challenges that will be faced by the banking industry. He mentioned that the biggest challenge that the banking industry will have to face is customer expectations. He has rightly assessed that customer is more informed and aware than before. Customers require more and more delivery channels and services. In his article, he has also given an overview of CBS software – Finacle, BaNCS, Flex Cube (Kuntal Shaha, 2014)

2.4.2 Related to Usable and Secure Technology

Malathy.K, Dr. Subhashini Srivatsa (2018), in their research paper titled, '*Impact Of Core Banking Solutions On Bank Employees-A Study In Dakshina Kannada District Of Karnataka*' studied the opinion of 100 bank employees of Dakshnina Kannada District about their experiences of the use of CBS. The paper focuses on the contributions and confusion caused by CBS. It also studied the major changes in the mode of banking operations, which caused satisfaction or dissatisfaction among bank employees.

The authors have tested three hypotheses, Impact of CBS on bank employees, CBS as a tool of smart banking, and the Impact of CBS on bank jobs. After analyzing the survey result, the author has concluded that the introduction of CBS has a good impact on bank employees of Dakshina Kannada District. Also due to the smartness of CBS, bank jobs are reduced since banks will give preferences to the candidate having high technical caliber besides having other academic qualifications.

The authors have given an important suggestion that more user-friendly CBS software is recommended especially in rural areas, in rural languages, and in remote branches of banks. Even if employees are using CBS for years, they still get confused while adapting themselves to the change so banks should train them from time to time to deal with these intricacies. (Malathy.K, 2018)

Burhan Suryo Ambodo, Rudy Suryanto, Hafiez Sofyani (2017), in their research paper entitled -'*Testing of Technology Acceptance Model on Core Banking System: A Perspective on Mandatory Use'* studies the acceptance of CBS in BPD DIY Wonosari Branch, Indonesia. Researchers have conducted the survey and gathered the data from bank tellers, customer service, and back-office. Data were measured on a 5-Likart scale.
The sample of the study involves all employees involved in front-office and back-office processing. The result showed that ease of use, satisfaction, and compatibility have a positive effect on attitude toward use . (Burhan Suryo Ambodo, 2017)

Neha Dixit and Dr. Saroj K. Datta (2010), in their research paper '*Acceptance of E-banking among Adult Customers: An Empirical Investigation in India*' investigated the acceptance of online banking among those customers who are the more than 35 age group. Specifically, the study was carried out to check the effect of security and privacy issues on the acceptance of online banking in India. In these, questions were asked with possible acceptance factors of whether they are ready to adopt online banking or not.

Data analysis confirms that security and privacy, trust, innovativeness, familiarity, and awareness have a positive influence on the acceptance of e-banking services in India. Also, data showed that participants are ready to try experiencing e-banking if banks give them the necessary guidelines and training. So, there is a need to provide a better and more customized service environment to the customers. The study also showcased that, adult

customers are reluctant to join new technologies or methods that contain risks. Also some customers are interested in online banking but they do not possess the computer literacy to conduct it. (Datta, 2010)

Roman Zollet, Andrea Back (2010), in their research paper '*Website Usability for Internet Banking',* concluded that higher recognizability of the next step results has positive effects on usability. The aim of this investigation is to improve the limited collection of methods for quantifying web application usability, which have not changed for years. The Authors have developed a model which describes the relationship between usability dimensions and success variables. Then hypotheses are validated by conducting an experiment for testing Internet Banking applications.

The outcome of the test showed that increased recognizability, real-world metaphors, compliance with dominant design, and anticipating support proved to lead to higher perceived ease of use. So, in the discussion, the authors mentioned that usability consists of single, distinguishable factors, which affect a system's user-friendliness. (Roman Zollet, 2010)

Dr. Roshan Lal, Dr. Rajni Saluja(2012), in their research paper entitled ,'*E-banking: The Indian Scenario'* has addressed the challenges faced by Indian banks in the adoption of technology and made recommendations to tackle these challenges. The authors also discussed the benefits and risks associated with the different delivery channels offered by CBS. The research paper analyzes the progress made by the Indian banking industry in the adoption of technology.

After doing the analysis, the authors have given the recommendation that customers should be made literate about the use of e-banking products and services. Employees of banks should be given special technical training. Seminars and workshops should be organized on the healthy usage of e-banking. E-banking services should be customized based on age, gender, occupation, etc so that the needs and requirements of people are met accordingly. (Dr. Roshan Lal, 2012)

Bhavesh J. Parmar, Darshan B. Ranpura, Chirag R. Patel, Nainesh kumar P. Patel(2013), conducted a study and mentioned the findings of their paper entitled *'Rural*

Banking through Internet: A study on the use of Internet banking among rural consumers. The authors mentioned in the research paper that technological development in banks has benefited customers, but still, there is evidence of increasing frustration in dealing with technological-based systems.

To conduct this research, the researcher has collected data from 200 consumers using Internet banking accounts in public or private sector banks in the north Gujrat region. Their study showed that the expectations of consumers towards Internet banking are, it should be time-saving and convenient to use, should be user-friendly, and best in security. Also, reasons for using Internet banking facility is having a traditional account in the same bank and excellent services provided by it. (Bhavesh J. Parmar, 2013)

J. Ramola Premalatha& N. Sundaram(2014), in their paper '*Reasons for Non-Adoption of Internet Banking: A Study with Reference to Vellore District of Tamil Nadu, India'* concluded that - Common Man is not aware of the security measures taken by the banks, hence has his own reservations in the using Internet Banking. Hence it is the duty of the banks to educate the consumers regarding the safety measures taken by the banks to avoid phishing and encourage their clientele to open Internet banking.

This study was exploratory in nature in which primary data was collected using a structured questionnaire that is circulated to the consumers of private sector banks in the Vellore district. The researcher developed a four-point scale with 17 questions on the adoption of banking technology in semi-urban areas. After analyzing the collected data, the researcher suggested that even if Internet banking has vast benefits, but semi-urban area consumers are not using it, and some of the important reasons for non-adoption are the need for technical assistance, unfriendly website, less speed and very interestingly some of the consumers were unaware that their banks are providing internet service. (J. Ramola Premalatha, 2014)

Tomas Hustak, Ondrej Krejcar(2015), in his research paper titled – *'Principles of Usability in Human-Computer Interaction'*, addressed the problems faced by the users while using the software. The main aim of the paper is to explore different ways to improve the overall efficiency of the user while achieving their tasks. The researcher has explored all main parts of usability issues according to Human-Computer Interface (HCI).

According to the researcher, many web designers develop their projects without taking any feedback from the target audience thinking that they don't have adequate technical knowledge. Whereas users are the ones who know exactly what they need and that is something web designers cannot ignore. In this research paper, researchers have focused on different usability aspects as well as various elements that designers should consider while designing the software. Also, the paper talks about the difference between Graphical User Interface (GUI) and Web User Interface (WUI). (Tomas Hustak, 2015)

Monzer Moh'd Qasem (2015) in his research survey '*A Comparative Analysis of the Usability for Internet Banking in Saudi Arabia'*, mentioned that security and usability trade-off in online banking systems is challenging, because users focus on their primary goal of accomplishing their financial transactions, while they dismiss the security to be the primary production task. To carry out this research, the author has formulated and evaluated two frameworks, the security evaluation framework and the usability framework between five Saudi banks. (Qasem, 2015)

Dr. Geeta Sharma(2016), in her research article, '*Study of Internet Banking Scenario in India*' has elaborated on technologies used behind Internet Banking. In the paper, the author has carried out the survey. The data demonstrated that a very less percentage of customers, around 7% are using internet banking. (Sharma, 2016)

Research article – *'Acceptance and acceptability criteria: a literature review'*, by **Boris Alexandre, Emanuelle Reynaud, Francois Osiurak, Jordan Navarro (2018)**, is very useful, and informative literatur from the point of technology acceptance. They addressed the problem that why some tools are chosen, accepted and used by the users while others are rejected. The authors directed to find out if there any criteria related to the tool exist that can explain the decision.

The researchers reviewed different approaches for acceptance and acceptability. Such as ergonomics, Social Psychology, Productivity -Oriented approach, Hedonic approach, User-Experience approach, and Independent Criteria. Along with this researchers have also studied various theories and models used for acceptance based on above mentioned approaches such as the Theory of Reasoned Action(TRA), Theory of Planned Behavior (TPB), and Technology Acceptance Model (TAM). (Boris Alexandre, 2018)

Ivan Flechais, Cecilia Mascolo, and M. Angela Sasse(2007)have given an emphasis in his research paper entitled '*Integrating security and usability into the requirements and design process*' that users of the online system can have massively different levels of experience, knowledge, and expertise. So designing a system that properly holds these differing levels of users, training is vital. He also mentioned that designing and developing such a secure software system requires one more important parameter usability.

Flechais and his team have presented a method, Appropriate and Effective Guidance for Information Security (AEGIS), which provides important tools for developing secure and usable systems. It is a software development process and uses the semantics of Unified Modelling Language (UML). **(Ivan Flechais, 2007)**

Mohammad Mannan, P.C. van Oorschot (2008), in their paper '*Security and Usability: The Gap in Real-World Online Banking*' concluded that security is a 'shared responsibility' Of banks and customers.
In the research work, authors have given an insight of different security-related issues, such as bank site authentication – SSL certificate, Anti-malware requirement, software updates, and user authentication. Along with this, authors have conducted a survey of participants having different levels of educational qualifications, mostly from the computer science field. Specifically, the authors have not conducted this survey on general online banking users but chosen the highly technical and security-aware users fulfilling the bank's requirements and recommendations.

Analysis and survey suggest that the users' share of this responsibility is large. Most participants did not fulfill all the listed requirements in the survey. So, the authors concluded that if such technical and security-aware participants fail to satisfy online banking requirements, then average users using online banking are ineligible to perform online banking with confidence. (Mohammad Mannan, 2008)

F. Sahar (2013), in his research paper "Tradeoffs between Usability and Security", discussed potential trade-offs between usability and security in the software development process by proposing policies. Usability and security are becoming key issues of modern computer software design. Nonetheless, there are studies that have been conducted in various combinatorial ways on these subjects. However, there is still room for improvement

in the relationship when it comes to properly providing these functions in software applications. (Sahar, 2013)

M Mujinga , MM Eloff , JH Kroeze(2013),in their research article '*Towards a Heuristic Model for Usable and Secure Online Banking*' suggested a heuristic model for usable and safe Internet banking. In the domain of online banking security, the author has established heuristics that help with usable security design. When assessing the efficacy of security systems, little research has been done on the balance between usability and security in online banking authentication mechanisms. The study of heuristics created from current studies shows that Nielsen's 10 usability principles are still crucial for creating usable secure systems. Users opting for online banking are inclined to several ongoing and emerging online security threats. Online bankers and users can both gain from research into the usability of security design components.

Examining the usability aspects of security design can be beneficial to both Banks providing online facilities and users to create a secure and user-friendly banking environment. Authors have given their suggestions after the analysis that there is a gap between the system expectations of users and what users can do regarding security – users do not have a single model of security. Also, the authors have mentioned that their work is not yet finished, and they intend to refine this model. **(M Mujinga, 2013)**

Eric Fischer, senior specialist in science and technology (2017), in his report – 'Cyber Security Issues and Challenge: In brief', has elaborated cyber security concept in depth. According to him cybersecurity is used to protect concerns related to Information and Communication Technology (ICT). Cybersecurity can be a means of protecting against unwanted investigation and collection of information from an information system

The author has given a brief overview of security threats, vulnerabilities, and their impact on the system.
Issues that are addressed by the authors are Cybersecurity Laws, Data breach Notification, Privacy held CI, etc. While discussing this, the author has also listed some of the long-term challenges that the system has to face such as design, Incentives, Consensus, Environment etc. **(Eric A. Fischer, Sr. Industry Acrchitect, 2017)**

Brian Jackson, Sr. Industry Architect(2017), in the research article 'Security versus usability: overcoming the security dilemma in financial services' said that more the secure system less the usability of that system.

This dilemma is due to the information security itself because the systems will not function as per the user's expectation. The system denies access to the user for requested information unless the user successfully completes the required security steps. Of course, it is necessary to follow the security steps, so this problem will remain as it is, and this forces the information system designers to choose between usability and security.

For increasing employee productivity and customer satisfaction, implemented security should be more usable. For this new phase, a new set of technologies that address today's security concerns while enabling innovative customer experiences are required. Artificial intelligence and machine learning-based cybersecurity solutions can play an important role in delivering such usable security. **(Brian Jackson, Sr. Industry Architect, 2017)**

Jacob Nielsen (1994), in his research paper ' *Enhancing the Explanatory Power of Usability Heuristic*' proposed 7 Usability thumb rules or factor – called as Nielsen's Heuristics for User interface design. Later, those are increased to 10. Each factor is descriptive and has an underlying usability phenomenon. Those are visibility of the system, the proposed system and real system match, user control, standard and consistency, prevention of errors, recognition, flexibility, and use of ease. Each factor is rated on a 5 scale. This heuristic is excellent in users recognize, diagnose, and recover from errors. **(Nielsen, 1994)**

2.5 Conceptual Development after Reviewing the Literature

After reviewing the literature, the next step is to analyze the reviewed literature. The below table illustrates the analysis of the reviewed literature in the form of books, PhD thesis, reports, research papers, Journal article, web article etc. in the previously mentioned areas, i.e. From the implementation status of CORE Banking Solutions (CBS) and its repercussions on its users (employees and customers) and Various aspects of usability of CBS that can enhance and improve the overall experience of the system from its user's (employees and customers) point of view.

Table 2.1 Analysis of Theoretical findings

Sr. No.	Researcher/s Name	Country / City	Year	Key components of Reviewed Literature			
				Digitization / CBS impact on bank	Usability/ Security of CBS Emp. Perspective	Usability / Security of internet banking Customer Perspective	Technology study (Usability / Security/ Usable security/ TAM/HCI)
1	Davis F. D.	Cambridge, MA	1986				✓
2	Jacob Neilsen - Book	Boston	1994				✓
3	Jacob Neilsen	Boston	1994				✓
4	Badre, A. N.	Boston	2002				✓
5	Ivan Flechais	London	2007				✓
6	Lorrie Faith Cranor, Simson Garfinkel	USA	2008				✓
7	Mohammad Mannan, P.C. van Oorschot	Canada	2008				✓
8	Jhumkee Iyengar and Manisha Belvalkar	India	2010			✓	✓
9	Roman Zollet, A. B	Slovenia	2010			✓	✓
10	Neha Dixit and Dr. Saroj K. Datta	India	2010			✓	
11	ROSHAN LAL ;RAJNI SALUJA	India	2012	✓			
12	Kebkab A.	Boras	2012	✓			✓

13	Bhavesh J. Parmar, Darshan B. Ranpura, Chirag R. Patel, Naineshkumar P. Patel	India	2013	✓		✓	
14	M Mujinga , MM Eloff , JH Kroeze	Australia	2013			✓	✓
15	Prachi Mittal, Sneha Singh Jadaun ,Manoj Kumar Dash	India	2013	✓			
16	Safar F.	Finland	2013				✓
17	M. Revathy Sriram	India	2013	✓			
18	Janardan Choubey and Bhaskar Choubey	India	2013			✓	✓
19	J. Ramola Premalatha1 & N. Sundaram1	India	2014			✓	
20	Kuntal Shaha	India	2014	✓			
21	Domenic Potter	England	2014				✓
22	R. T. Khenat	India	2014	✓			✓
23	J. Shifa Fathima	India	2015	✓			
24	Hatwra, M. R	India	2015	✓			
25	Dr.Monzer Moh'd Qasem	Saudi Arabia	2015			✓	✓
26	Tomas Hustak, OndrejKrejcar	Italy	2015				✓
27	Johny A.	India	2016	✓			
28	Dr. Geeta Sharma	India	2016			✓	
29	G. Subashchandira Bose, Dr. P. Nagarajan	India	2016	✓			
30	Burhan SuryoAmbodo, Rudy Suryanto, HafiezSofyani	Indonesia	2017				✓
31	Eric A. Fischer	USA	2017				✓
32	Sven Kiljan	Netherland	2017			✓	✓
33	Madhura Ayachit	India	2017	✓			
34	Prof. Bijoy Bhattacharyya, Dean Banking & Ms. Swati Pradhan,	India	2017	✓			

	Deputy Manager – Research						
35	Brian Jackson, Sr. Industry Architect,	USA	2017	✓			✓
36	Boris Alexandre, Emanuelle Reynaud, François Osiurak, Jordan Navarro	London	2018				✓
37	Malathay K., Dr. Subhashini Srivastsa	India	2018		✓		
38	Shahena Z.	India	2018	✓			
39	Lasantha Thennakoon	UK	2019		✓		
40	Ms. Ashwini Chavhan, Dr. R. D. Kumbhar, Dr. S. D. Mundhe	India	2019	✓			

Source: Compiled by Researcher

As illustrated above, the researcher has tried to review the literature from all concerned areas under study. Both Banking and IT are dynamic fields, so researchers have attempted to review the data from past to present time. Also, Literature has been reviewed worldwide to understand the diversity of the study under consideration. An effort was also taken by the researcher to capture a minimum of two to three empirical findings belonging to each key component of the literature. The researcher has also made an effort to review the various literature available from the technology point of view which can be used to strengthen the research area under consideration.

Details of the key components reviewed under the literature are as follows. Also, important findings and their applicability to the research can be reviewed in the succeeding paragraphs.

2.5.1 Digitization and CBS Impact on the Banks.

Most of the literature reviewed to investigate the impact of digitization/computerization of Banks or CBS is from India. The literature has been reviewed from urban as well as rural areas of banks. Unfortunately, lesser literature is available on CBS implications with

reference to Cooperative banks. After evaluating the complete literature, researchers have come across mixed reviews.

The researcher learned that reviewed literature talks about benefits of the digitization or CBS implementation. The digitization of banks has changed the attitude of the work culture. From branch banking to bank banking, banking style, and banking belief has been transformed. Anytime, Anywhere banking is possible due to the implantation of CBS in the banks. According to Kuntal Shaha **(Kuntal Shaha, 2014)** Customers are happy with more and more delivery channels. It has given flexibility to customers. Report generation has become an easier task than traditional manual banking.

Also this literature has raised some issues related to the digitization or implementation of CBS. CBS requires more people with extra technical knowledge along with educational qualifications. Also in rural areas or in the case of the small-scale bank's cost of implementation is the biggest issue. Specifically cooperative banks, societies implementing CBS, infrastructure cost, hardware cost along with technology cost is more than the benefits that banks achieve. Software knowledge is one of the issues. Malathy K. **(Malathy.K, 2018)** in her recent study noticed that even after providing the training to the employees, they do not feel comfortable while using the software. More user-friendly software in rural languages is required in the rural, remote branches of banks.

2.5.2 Usability/ Security of CBS – Employee & Customer Perspective

The researcher treats this as an important key component of the literature review. While reviewing the literature from this area researchers found that unfortunately, very little literature is available from the employee's perspective as compared to the customer. The customer does not directly deal with CBS. CBS implemented in the banks provide various delivery channels such as the internet or online banking, ATM, NEFT, etc. to the customers to enhance their banking experience.

The researcher, (Bhavesh J. Parmar, 2013), mentioned that Internet banking should be time-saving, convenient to use, user friendly. Also, Customers should feel secure while using Internet banking because there is no physical entity that exists while doing banking operations. Many of the customers are reluctant to join the new technology that contains risks whereas some are interested but due to little technical knowledge they are not using Internet banking.

While accessing the literature, some of the literature showed the tradeoff between the usability and security of the software system. Various research papers suggested that these two parameters are very important from an implementation point of view of software.

2.5.3 Technological Concepts – Theories and Frameworks

The researcher has also studied the latest technologies that can be used for the banking domain. Apart from CBS, research studies also concentrate on the usability aspect of CBS. Different usability theories and frameworks are available in the literature. While reviewing this literature, the researcher come across the Technological Acceptance Model devised by (Devis, 1986). Many of the researchers have used TAM to evaluate the usability of CBS. Where Usability is a multidimensional concept that is measured by 5 attributes. **(Neilsen, 1993)**. One of the important aspects of any system is Security. And when CBS is there, security is core. Some literature specified that as we increase the security of the banking system its performance from a Usability perspective decrease.

2.6 Research Gap and Conclusion

The above literatures have given ample insights about the banking services and use of technology in banking system, but the literature shows a huge gap in assessing the impact of the Core Banking System (CBS) on the Indian banking system, more precisely Cooperative banks. Thus, the study would help in a great sense to bring newer insights and open the path for further study.

Most of the literature reviewed revealed that while providing different functionalities to banking software (CBS and its delivery channels) less focus is given to the usability perspective of the system. Banking software has used many security mechanisms for securing the system from threats and attacks. But again, Usability with respect to security has been given very little emphasis making that interaction vulnerable to attacks.

Keeping all this in mind the researcher has listed the research gaps and decided to look and probe into these critical gaps that have come to the notice and to conduct the study to throw some light.

1. Both public and private sector banks were the focus of the previous study. Hardly any research has been done on cooperative banks. Care is therefore desperately needed.

2. There is a need to better understand CBS implementation from a usability standpoint because the majority of prior research has concentrated on subjects like the influence of developmental variables on bank growth, financial growth, customer happiness in online banking, etc.

3. One of the important viewpoints of CBS is security. Almost all banks have taken adequate care of security but hardly anyone has thought of providing security which is usable.

4. Most of the literature has shown its concern about Customer satisfaction about use of internet/online banking which is one of the delivery channels of CBS but seldom efforts are taken to measure the satisfaction of the employees who are using it for betterment of banks.

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Chapter – 3 Conceptual Framework

3.1 Overview

The Critical Literature Review of the prior work in the relevant research subject is one of the most crucial procedures in any research endeavour. Finding out the current level of knowledge in your study topic is essential to building the "conceptual bridge."

'Core Banking Service (CBS)', 'Cooperative banks in Pune District', and 'Usability of technology' were the three main parts of the research that were taken into account by the researcher in order to create a conceptual framework around the topic. The usability of technology is chosen as a critical component in addition to "CBS" to broaden the search because empirical data on "CBS in the Cooperative Banks in the Pune district" are few.

The researcher aims to strengthen the conceptual framework around the research subject by essentially reviewing the issues related to the interaction between humans and computers, and its expected output (Potter, 2014). To measure this, the ‘Technology Acceptance Model’ (TAM), which helps in analyzing the IT acceptance behavior of users, introduced by Davis (Davis, 1986) is useful.
The main essence of the research study is ‘Usability’ and for that, the Researcher has decided to consider the ‘Usability Engineering process designed by Jacob Nielsen. (Neilsen J. , 1993). In comparison to cooperative banks, the implementation of CBS in private and public sector banks is easy. The adoption of technology is a step forward for the cooperative sector because it has always faced difficulties.

3.2 Core Banking Solution (CBS)

A core banking system, as defined by Gartner, is a back-end system that performs daily banking operations and uploads modifications to accounts and other financial data. Centralised Online Real-time Exchange is known as CORE. Commonly, core banking systems may process deposits, loans, and credit in addition to being connected to general ledger systems and reporting tools. A network of interconnected bank branches that offers core banking allows customers to access their accounts and perform basic financial transactions from any of the participating branch locations.

Banking has evolved over a very short period and grown a lot delivering a range of products and transactions. The researcher has given insight into the Digitization and adoption the of CORE banking system in the Indian Banking Industry. The Reserve Bank of India (RBI) has significantly aided India's banking industry in adopting technology. As a kind of support for all banks, the Reserve Bank formed various committees to encourage the use of technology in enhancing customer service in the banking industry. Figure 3.1 shows the phases of technology adoption by Indian Banks.

Figure 3.1: Phases of technology adoption by Indian Banks

1970-80	Manual					
1980-85	Manual	Electro-Mechanical LPM				
1985-1990	Manual	Electro-Mechanical LPM	Advance Ledger Posting Machine			
1989-2000	Manual	Electro-Mechanical LPM	Advance Ledger Posting Machine	Total Branch Automation		
2000-2010	Manual	Electro-Mechanical LPM	Advance Ledger Posting Machine	Total Branch Automation	CORE Banking System	
2010 onwards						CORE Banking System

(Source- Compiled by Researcher)

The RBI has established a strategic objective: enabling the banking sector to employ ICT to enhance the systemic efficiency of banking as a whole. The RBI is sure that information technology will continue to be the main driver of the country's logical banking operations and effective transformation of transactions. (RBI Circular on Core Banking Solution Dated: Sep 10)

The word "CBS" for a bank refers to the overall management of the bank's transactions utilising a centralised database. A perfect core banking solution would combine all customer services, products, procedures, user information, and management tools, and would administrate them all through a single database of the bank's branches and channels. In essence, it offers total front-end and back-end automation for banks that can be accessed anywhere, at any time, in contrast to the "Total Branch Automation" system (TBA).

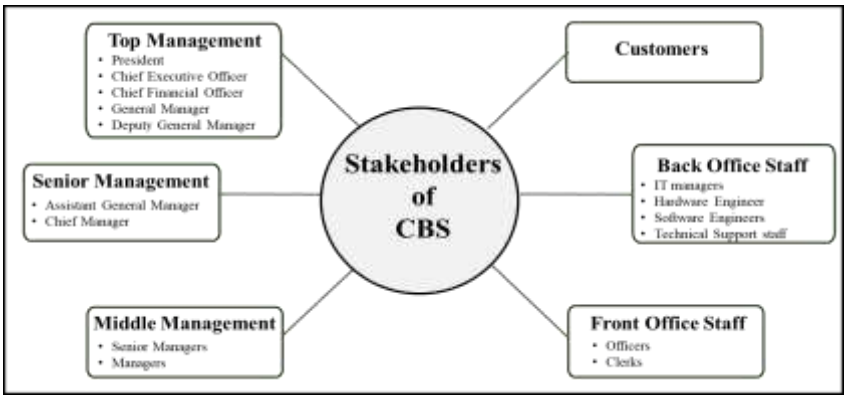
Core Banking Solutions have gradually equipped the branch with a computerized back end that is rule-based and technology-driven; this has reduced many of the frequent manual interventions that plagued the bank's offices; as a result, branch employees now have more time and have access to solutions that are technology-enabled for satisfying their customers. It can provide automation across multiple delivery channels. In the case of CBS, customer can operate their account from various locations such as opening an account in one place and can depositing a cheque, checking bank balances, withdrawing cash, transferring funds, and other transactions from various. CBS is only one component of the complex architecture of modern banking, which handles all the fundamental financial operations.

The banking systems have been redesigned and their entire way of working has changed in the age of information technology. Cooperative banks, in contrast to other sector banks, deploy CBS at a moderate rate.

3.2.1 Stakeholders of CBS

The banking sector benefits greatly from CBS. An individual who is associated with an organisation, society, or other entity who, as a result, has obligations to it and a stake in its success is referred to as a stakeholder. All parties involved in the bank, including the management group, clients, and employees, have received equal attention from CBS. The standard for customer satisfaction was increased by Anywhere Anytime Banking. The simple but precise modules have been particularly welcomed by CBS Bank staff members. The figure-3.2 represents different stakeholders of the CBS.

Figure 3.2: Stakeholders of CBS



(Source – Compiled by Researcher)

- **Management Level –**

These are the main decision-makers of any bank. They occupy the fiduciary position in the bank. Based on their organizational position, they can further be positioned into Top Management, Senior Management, and Middle Management. These are the people who takes the decisions to fulfill the bank's objectives. They are the ones who formulate the bank policies based on the RBI's directives and circulars. In the context of CBS, these are the responsible people who take the decisions about purchase, management, maintenance, infrastructural requirement, and technical assistance.

- **Front-office staff –**

Users of the CBS System are employees who hold various jobs with a bank. Within bank institutions, there are many different employment positions. Bank tellers are an example of a customer service role, whereas internal auditors and data processing officers are mid-management positions, and loan officers and branch managers are executive-level positions. The organizational structure of any bank will include these crucial jobs.

These are the people who use the many CBS modules used at the Head Office and Branch Office to give services to the Customers and for MIS. They serve as the bank's face. Their effectiveness in using CBS is closely correlated to the Bank's success.

- **Back-office staff –**

Due to the implementation of technology in the banking field, technical staff has become the essential and Core employees of the banking industry. They are the backbone of CBS implementation in the bank. Their technical knowledge is the kernel for the proper functioning of CBS. The IT manager has become one of the important people, who works as a bridge between the CBS and management level, front-office staff, and customers.

- **Customers**

The bank staff uses CBS as a Service Provider User whereas Customers use CBS as Service Receiver User. The customer is the main stakeholder of the (CBS). Customers are connected to the CBS via different delivery channels such as Automatic Teller Machines (ATM), POS machines, Internet banking, mobile applications, Unified Payment Interface (UPI), and of course direct bank transactions.

3.2.3 Modules of CBS

Modules are nothing but the different functionalities which are provided by the system. Each module's functionality is predetermined by the system. All modules, or all relevant files of data, are kept in the standard master file and normalized with one another so that data sharing and updating happen whenever a change is made in one area. Through the relational database and the Structured Query Language, data can be retrieved from any place or from any file.

Everyone who uses these modules needs to authenticate them first and then can access the functionalities defined in them. Also 'Who can access What?' depends upon the authorization of that user.

The CBS modules can be broadly categorized into two sections.

- Head Office Module- (HO)
- Branch Office Module – (BO)

Head Office Module – Functionalities defined in this module are majorly used by the head office for auditing, account & ledger checking, branch consolidation information, etc. Most of the time the IT department is placed at the head office branch which takes care of all the technological requirements. Below listed are some of the functionalities provided by the Head Office module.

- Accounts & General Ledger
- Branch Consolidation
- Inter-branch / Intra-bank Transactions Reconciliation
- Transactions Reconciliation
- Human Resource Management
- Human Resource Information System
- Funds and Investment Management
- Credit Appraisal, Recovery & Rehabilitation
- Audit & Inspection
- Asset Liability Management

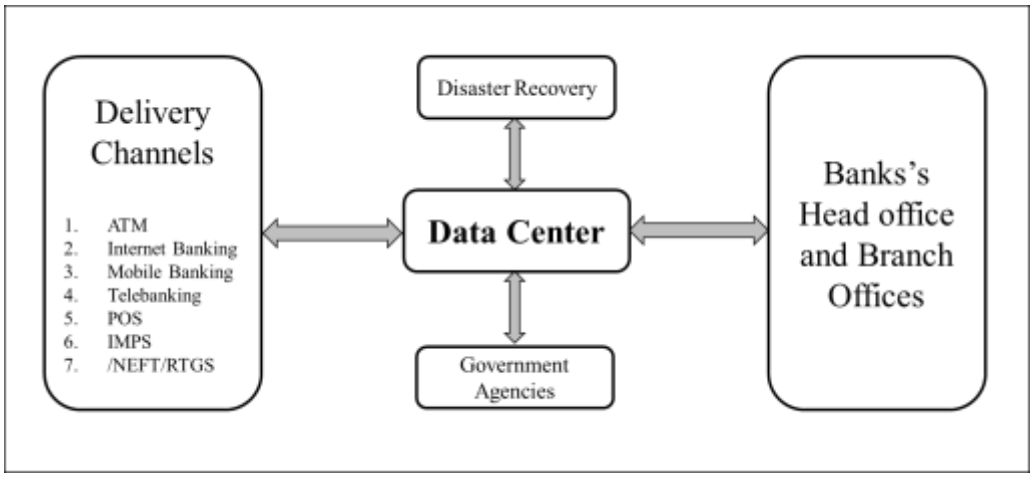
Branch Office Module – Functionalities defined in this module are majorly used by various branches of the banks to perform their day-to-day bank operation. Below listed are some of the functionalities used by the Branch office module.

- Accounts opening
- Managing Deposit accounts
- Service Branches and Clearing
- General Ledger
- Inward/ Outward Clearing
- Cash management
- Safe deposit/ safe custody Facility (Lockers)
- Non-Profitable Assets (NPA)
- Delivery channels
- Chequebook / Passbook Facility

3.2.3 Architecture of CBS

CBS is mainly divided into three parts, head office, branch office, and delivery channels. All these three parts relate to each other via Data Center. Along with that, the Data center is also connected with Government agencies and disaster recovery servers. All the servers used by CBS, including the central database server that houses the bank's data and the central application server that runs the main banking solution, are centralized in the bank's central data center. All the branches are securely connected to the data center using leased lines or other types of network access. Figure 3.3 shows the general architecture of the CBS.

Figure 3.3: Architecture of CBS



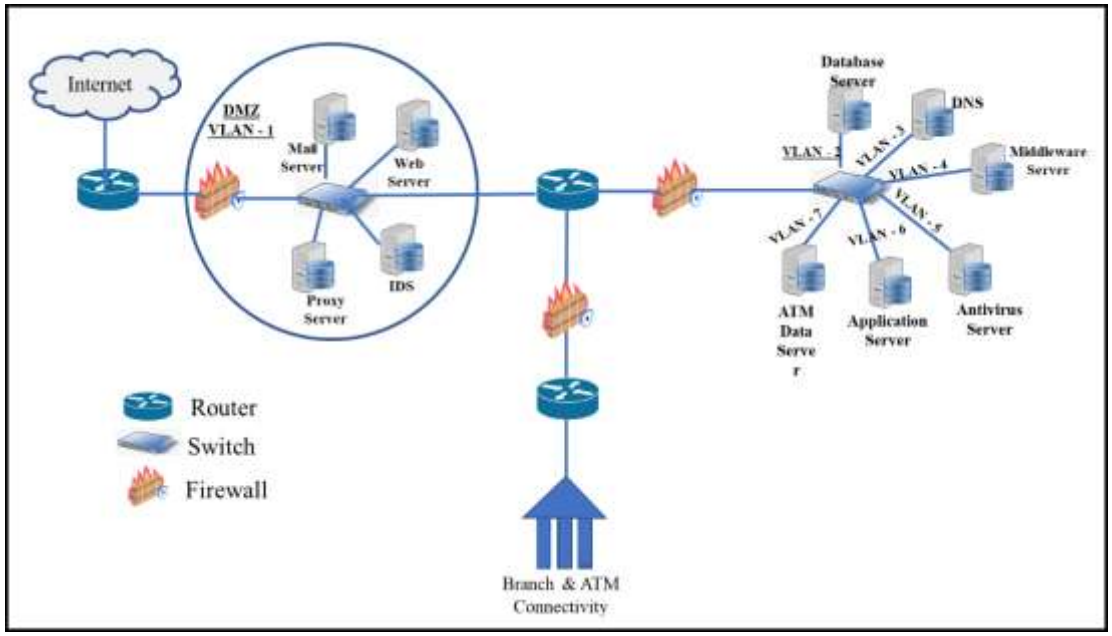
(Source – Compiled by Researcher)

The delivery channels are another aspect of CBS's infrastructure needs. The numerous delivery channel alternatives that CBS infrastructure businesses produce include ATM, Internet Banking, Mobile Banking, RTGS, NEFT, and POS. Additionally, banks can employ CBS tailored to their requirements.

Technically if we see, the data servers are shielded from unauthorized access and hidden behind a firewall. There are different local area networks for each of the servers. The idea of a Virtual Local Area Network (VLAN), which has its own built-in security, is used to separate them. Figure 3.4 shows the Data Center-Network Connectivity of CBS. The circled portion in the diagram would be in the Data Centre.

There are a variety of servers in the data center, including application servers, database servers, web servers, mail servers, etc. It must be made clear that although while all the servers are in the same data center, they are not connected to the same local area network (LAN). Using the idea of a Virtual Local Area Network (VLAN), each server is isolated. A virtual network can be created inside a physical network using VLAN. Thusly produced virtual networks will function independently of one another.

Figure 3.4 Data Center-Network Connectivity in CBS



(Source – Compiled by the researcher)

It should be noted that the data for the bank is only stored on this database server, which is centrally placed. This implies that the data for all the bank branches is stored on this central

database server. Additional infrastructure is required for automated teller machines (ATM) and Internet banking operations.

A Core Banking Solution (CBS) manages the fundamental banking solution. From a central location, the branches make connections to the application server. Just a few of the leading banking systems and suppliers on the market right now are Finacle, produced by Infosys, Flexcube, developed by I-Flex Systems, Bankmate, developed by HCL Technologies, and Quartz, developed by TCS. There are many different CBS products, some of which are made jointly by the banks and others by outside businesses. Additionally, banks can employ CBS tailored to their requirements.

Next section onwards, different fields related to the Usability of systems, such as HCI, TAM, Usability and Utility, Security, and Usable security are explored. Which can be used to address the problem of Usability with regard to CBS.

3.3 Cooperative Banks and CBS

The most significant socioeconomic development in the world is cooperative development. It contributes to the creation of productive jobs, the reduction of poverty, and the promotion of social cohesion in the country. Cooperative societies are an important aspect of regional and rural organizations in India. A cooperative association is a group of people that are financially disadvantaged. It is a tool for economically disadvantaged groups such as agriculture laborers, producers, small farmers, and craft workers to help them strengthen themselves and defend themselves against exploitation. In Chapter 1, we discussed the status of Cooperative banks in India.

Banks are now attempting to provide their consumers with a quick, accurate, and excellent banking experience following digitization. As a result, financial systems have been re-engineered, changing the way they function. Cooperative banks are more accessible in both urban and rural locations, and they offer the financial services that the public requires. So, these institutions must be strengthened. Furthermore, the RBI has directed cooperative banks to become CBS-compliant by March 31, 2013.

Currently, in addition to IMPS, RTGS, and NEFT Automated Teller Machines (ATMs), net banking, mobile banking, and other services are also rapidly becoming a more significant component of the services offered by the Cooperative Banks. Additionally, IT has made it possible to manage the increasing transaction volume that comes with a growing client base in a quick, accurate, and effective manner.

The Management Information System (MIS) is a crucial component of CBS for internal purposes in Cooperative Banks. The MIS reports produced, serve as a valuable risk management and strategic decision-making tool for the top management.

The cooperative banking industry is quite diverse, with a concentration in only a few states like Gujarat and Maharashtra. To address the strain of competition, it is anticipated that the technological solution to be provided would assist these banks in increasing the effectiveness of their transaction processing capabilities, housekeeping, and customer service. To put it another way, the proposed solution must offer these banks an equal opportunity to acquire IT technologies.

The Reserve Bank of India has played a critical role in the banking industry's adoption of information technology. The RBI formed a number of committees to address this issue. The Maharashtra government and the Reserve Bank of India have signed a Memorandum of Understanding (MoU) to foster the growth of the cooperative bank sector in the state. Based on this Memorandum of Understanding, a State Level Task Force for Co-operative Urban Banks (TAFCUB) has been formed for Maharashtra. As part of its development function, the Reserve Bank will also assess cooperative banks' training and computerization needs with the goal of modernizing their technological infrastructure and human resource capabilities to boost operational efficiency. (Reserve Bank of India, 2006)

3.4 Human-Computer Interaction

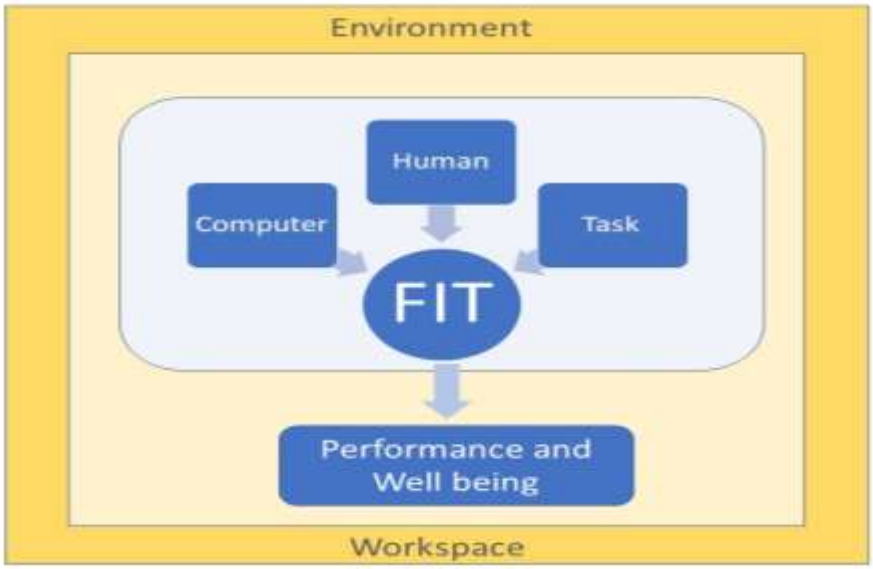
The phrase "Human-Computer Interface" (HCI) refers to how people interact with computers, or more specifically, how people instruct computers what to do and how computers respond. Furthermore, HCI is concerned with creating computer systems that enable people to use them in a safe and effective manner.

HCI, or human-computer interaction, is a field of study that focuses on how people (or users) and computers interact with computer technology. They could be regular users of desktop or laptop computers, users of mobile devices like smartphones and tablets, or even users of sensors like Fitbits who are tracking how they interact with the outside world. In HCI, the user directs the system's actions, and the system responds as a result. The goal of HCI is to create systems that both organizations and individuals may utilize to safely do their tasks. To increase user satisfaction and provide work that is more productive, HCI is also implemented.

Understanding the connections between users, tasks, IT, and the environments in which the systems are utilized facilitates the development of effective HCI systems. Performance and well-being are enhanced by a good fit between the human, the computer, and the required activities. Figure 3.5 depict the ‘fit’ amongst human, computer, and tasks. Here, performance refers to the effectiveness with which a task is carried out and the caliber of work that is produced, whereas well-being refers to the concern for a person's general comfort, safety, and health, or, to put it another way, their physical as well as psychological state. In their designs, analysts always seek the optimal fit. (Potter, 2014)

To make sure that our systems are user-centered and that they effectively consider both organizational needs and user needs Understanding HCI concepts is one thing; thinking about interfaces in the context of HCI challenges is another; and applying conventional design principles to computers in novel ways because of an HCI approach is still another.

Figure 3.5: Fit – Human, Computer, and Task: HCI perspective



(Source: Compiled by the researcher)

The main strategy of HCI in systems analysis and design is to repeatedly ask users for feedback about their interactions with prototyped designs (which could be screens, forms, interfaces, and the like), to revise the design in response to the suggestions, to test the changes with users once more until the design is satisfactory, and finally to freeze the design by the analyst.

The foundation of human-computer interaction is knowledge about how people, tasks, task contexts, IT, and the surroundings in which the systems are utilized interact.

3.5 Technology Acceptance Model (TAM)

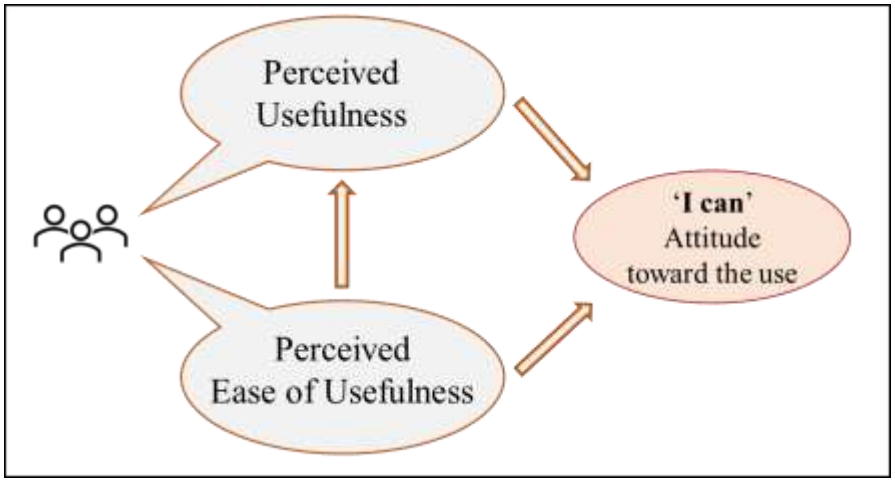
Devis proposed the Technology Acceptance Model (TAM) in 1986. TAM enables system analysts to think clearly about whether users will find a system valuable, accept it, and begin using it. Technology Acceptance Model (TAM) is used during the development stage as well as after the development stage of the system.

1. In the development stage - TAM can be used in the early development process to collect user reactions to prototypes so that changes can be made in the system early during the development process to increase the likelihood of their adoption and use.

2. After development – After the development of the system TAM can be used to design a training of the system.

The Technology Acceptance Model is used to compare how effective a system is thought to be in improving work performance to how simple a system is perceived to be to use when a user completes a task. Here, the term "perceived usefulness of the system" refers to how much a person thinks that utilizing a system improves performance. The extent to which a person thinks using the system won't need much effort is known as “perceived ease of use”. Thus, perceived usefulness and perceived ease of use are treated as the two metrics by which the effectiveness of TAM is evaluated. Both can be used to learn about users' intended interactions with a proposed system. In short, TAM contends that the system's usability depends in part on how easy it is to operate.

Figure 3.6: Technology Acceptance Model (TAM)



(Source: Compiled by the researcher)

The Technology Acceptance Model focuses on the importance of whether users find a system useful. The system's usefulness can be checked by examining whether the system provides support for an organizational member's individual tasks or not. One more aspect of measuring usefulness is to check that the user of the new system can perform the important tasks easily which they are not able to perform prior to its implementation. TAM also measures user satisfaction with the human–computer interface, as well as users' overall satisfaction with the system. Post-implementation interviews and observations play an important role to determine whether users find the use of the system rewarding.

There are, however, additional factors that can influence users' acceptance and use of the system depending on its purpose. For example, In the case of the Core Banking System (CBS), security is the major concern along with usability. So, technology acceptance of CBS users depends upon the ease of use of the system along with the ease of use of security of the system which is implemented.

3.6 Usability & Utility

Usability and Utility are two important attributes that developers should consider while designing any system. The utility attribute pertains to the design's functioning, but the usability attribute evaluates how simple user interfaces are to use: Can it meet consumers' needs?

Usability and utility are two sides of a coin. Usability and utility together determine whether the designed system is useful or not. For e.g., if the system is easy to use but if it's not working according to your expectation then it's of no use. Also, it's not good if the system can provide the functionality that you want, but to do that you have taken an extra effort since its user interface is too difficult. So, we can say that a useful system is one which combines utility and usability attributes.

The term "usability" also refers to techniques for increasing ease of use during the design phase. The International Organisation for Standardisation (ISO9241-11:2018, 2018) defines usability as "*the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.*"

While using any digital system, usability is necessary for survival. If people find your system difficult to use, they will stop using it. Also, if the system fails to give easy-to-use utilities, in this case also people will stop using the system. From an organization's point of view, usability is a matter of employee productivity. If users, specifically employees of an organization waste their time pondering difficult instructions, then the money that is given to them for doing their job is wasted because the organization is paying them without getting work done.

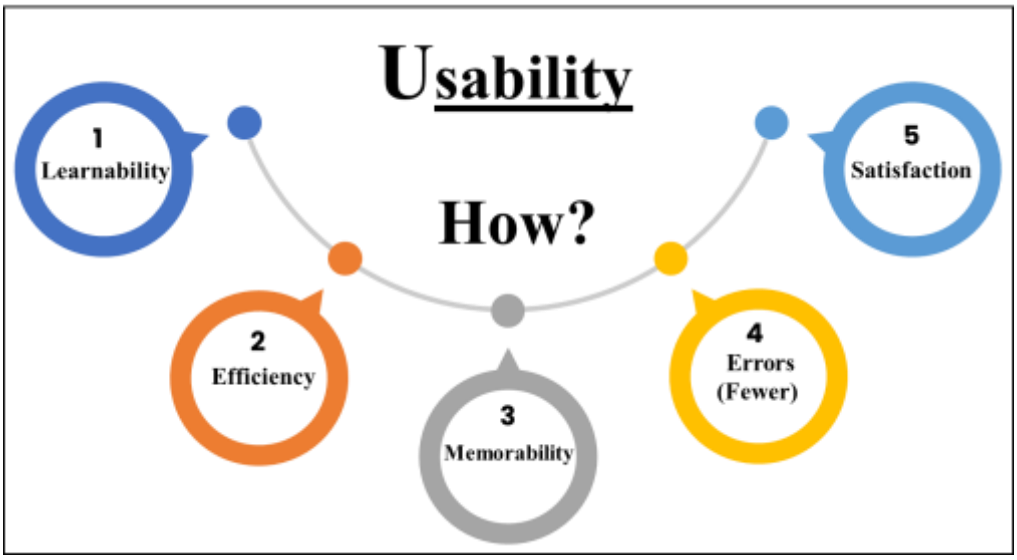
Albert Bedre in his book mentioned (Badre, 2002) "The same fundamental HCI concepts that control software interface design may be used to create websites and web apps. While a poorly designed Web interface, despite its dazzling aesthetics, can send the customer to another site with a single click, a poorly planned software product, despite its complicated functionality or the power of its technology, can doom a software product."

Usability can be defined by asking five 'How' questions to the system. They are referred to as the usability quality components:

1. How effortlessly are users able to execute basic system activities while using it for the first time? - Also known as the system's **learnability**.
2. How soon can users complete activities after learning the system design? - Also known as the system's **efficiency** (in terms of speed).
3. How easily can the user re-establish competency in using the system when returning to the system design after a period of inactivity? - Also known as the **Memorability**.
4. How many errors do users make while using a system, how serious are these faults, and how easy can users recover from the errors? - also known as the **Errors (fewer errors)**. It is essential in this circumstance to deliver acceptable or more precisely comprehensible error messages.
5. How at ease does the consumer feel when using the design? - Also known as **Satisfaction**.

Below figure-3.7 depicts the system usability components

Figure -3.7 System Usability Components



(Source: Compiled by the researcher)

Apart from these, many other crucial quality characteristics exist. Utility, which relates to the design's functionality, is a significant one that refers to Does it accomplish user needs?

Combining Usability with Utility, the system becomes Useful.

3.7 Security Implementation

Security is a critical component of the digital world. People will not use digital media until they feel safe doing so.

3.7.1 Designing a Security

The most frequently accepted definition of information security is a set of properties that must be maintained. Information security can be defined as the safeguarding of data for its confidentiality, integrity, and availability. Known colloquially as the CIA Triad of Security (BS7799/ISO17799, 1999).

1. **Confidentiality** - The information should only be accessible to authorized users. In a nutshell, safeguarding sensitive information against unauthorized disclosure or understandable interception.

2. **Integrity** - No one other than the authorized user should be able to make modifications to the information. In a nutshell, it ensures the accuracy and completeness of information and computer systems.

3. **Availability** - Authorised users should be able to access information when they require it. In a nutshell, ensuring that users have access to information and critical services when they need them.

One of the crucial aspects of the CIA model is the requirement for balance among the three components of the triad because focusing too much on one might have an adverse effect on the others. For instance, overprotecting secrecy might have a negative effect on availability.

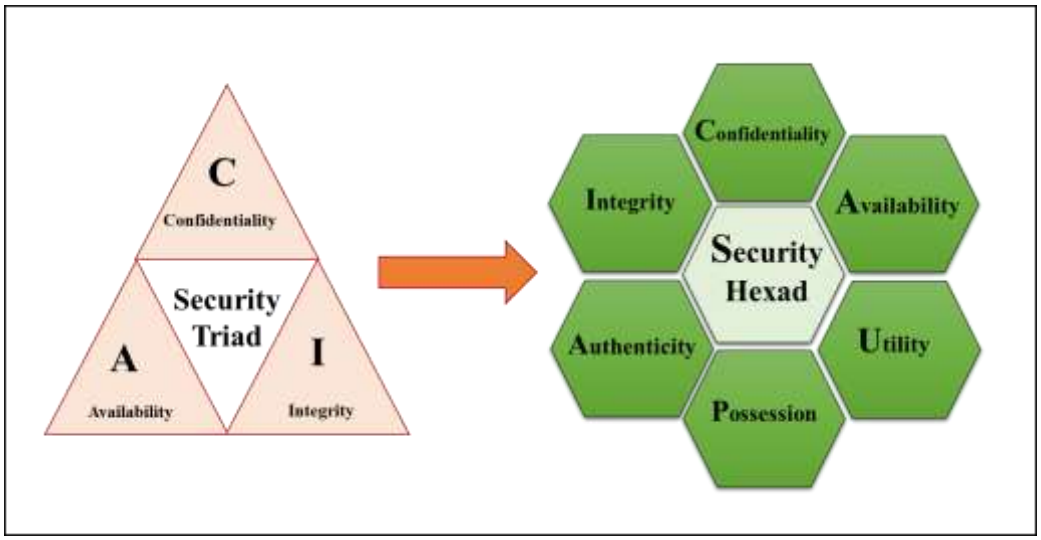
The drawback of the CIA triad is it holds true only when actions are taken at the owners' direction. It does not cover third-party activities like interception, repudiation, or misrepresentation. Repudiation is the capacity of a third party to disavow a prior interaction. Further, in 1998, The Parkerian Hexad is proposed by Donn B. Parker. Three additional elements are added to the CIA triad, Hence the name Perkerian Hexad. Figure 3.8 depicts the

enhanced CIA Triad with newly added three more elements, Authenticity, Utility. And Possession.

In this new Parkerian Hexad definitions of security are changed a little bit which states -

- **Availability** - Usability of information for a definite purpose.
- **Utility** - Usefulness of information for a definite purpose.
- **Integrity** – The information's quality, readability, completeness, and wholeness remain unaltered from a previous condition.
- **Authenticity** - Validity, conformance, and genuineness of information.
- **Confidentiality** - Observation and knowledge disclosure are limited.
- **Possession** – The ownership, management, and capacity for use of information.

Figure-3.8: CIS Triad Enhance to Parkerian Hexad



(Source: Compiled by the researcher)

These new definitions have a problem in that they involve very subjective ideas like usefulness, authenticity, or readability. Yet the process of planning and constructing security obviously requires subjective assessment. It is crucial to talk about the necessity of these ideas and how significant they are to a particular system.

Keeping this in mind, completely safe systems can be built via Security Engineering. As a discipline, security engineering focuses on the tools, processes, and methods needed for the

creation, application, testing, and adaption of complete systems as well as for the upkeep of existing systems in dynamic contexts. (Anderson, 2008)

Instead of being added as an afterthought, security must be built into a system. It should thus be considered from the system's initial design onward. Software engineering categorizes security requirements as non-functional requirements. A functional need is one that defines a task that a system or system component must be able to do, whereas a non-functional requirement is typically described as a restriction on how the system may act.

For the research under consideration, which focuses on the Usability of the Core Banking System of Cooperative banks, the system represents the combination of technical, managerial, and human components working together for the accomplishment of specified goals: Security deals with deterrence, avoidance, prevention, detection, and reaction to events in a system that are undesirable.

In addition, the definition of a system to include both technical and human components reflect the need for security to address socio-technical issues, as well as technical and organizational concerns.

3.7.2 Usable Security

System lacking a Security is no use but if the user is required to perform complex security actions in addition to functional actions, it inherently decreases the usability of the system since the user must perform more actions than what is strictly necessary to fulfill the user's job or goal. Usable security is more than simply the usability and security of the separate word combined. It must be since otherwise; the term would be little more than an oxymoron. Since the user must put in more effort to use the system, introducing the security action sacrificed some usability for security. Any security action will do this to some degree if it involves the user.

A secure system needs to keep unauthorized people out, so authentication is an important topic. However, a secure system needs to maintain security once an authorized user is logged in and working. The system needs to allow users to do what they need to accomplish their tasks. And a secured system should do that while protecting the security of the user's computer and the larger system they're interacting with.

How can we design a computer system to safeguard the interests of its legitimate user is the overarching question we consider when designing secure systems. After a person has been properly verified, several high-profile security problems arise. Viruses are obviously a problem. A significant issue is spyware, which is becoming more prevalent. People frequently divulge private information to phishing scams and forged emails, which can then be used to compromise a system by evading authentication or by enabling bad actors to act inappropriately in other ways. Bypassing authentication is not the root cause of any of these issues. Even while it's simple to accuse the user of doing something wrong, it's not always their responsibility. These issues arise when computers perform differently from what a user might anticipate or comprehend. This might be avoided by creating security technologies that are easy to use.

According to Whitten and Tygar usability principles for interface design are not adequate to cater for the design of usable security (Whitten, 1999). There are a lot of ways that we want to think about security and usability together.

Technical safeguards to protect systems have been the focus of computer security research. But it is now evident that technical solutions alone are insufficient. Most existing security design methodologies do not consider human elements, even though security is a socio-technical system with both technical and human components. This may result in design decisions that do not address the demands and requirements of both social and technological parts of the system. Also, there is a possibility that, although the security design process may handle both technological and human aspects, developers do not always use it as intended. This might be the consequence of several things, such as the method being incompatible with other design tools, functional considerations taking precedence over security design, or the design process being challenging to apply.

Security research and the creation of secure systems have typically given little consideration to human aspects and usability difficulties. Because they frequently overlooked the significance of human factors and lacked the knowledge to handle them, security specialists have mainly disregarded usability difficulties. However, there is a growing understanding that tackling usability and human factors concerns is the only way to resolve the security challenges of today. More frequently than not, well-publicized security incidents are blamed on human

errors that could have been avoided with better software. Indeed, the adoption of security technology that is widely usable by non-technical computer users will determine the future of global cyber world.

However, a lot of individuals think that usability and computer security are inherently at odds. People need computers, and they will use insecure ones if they can't use secure ones. Unfortunately, unprotected systems are also quickly rendered useless. They get compromised, hacked, and otherwise unusable.

If we don't provide the security which is usable, according to user's expectations and beliefs, they will bypass the security making system vulnerable. And that's why Bruce Schneier mentioned in this research paper that - *"People are the weakest link in the security chain."* (Schneier, 2003)

3.8 Concluding Remarks

Perceived usefulness and Perceived ease of usefulness are two important elements of any system to become acceptable by their users. In the case of the Core Banking System (CBS), RBI has also made it compulsory to adopt CBS gradually by large Urban cooperative banks by Dec31,2013, tier-I banks by June 30, 2014, and unit banks by Dec 31, 2014. (RBI/201 2-13/437 UBD.BPD.(PCB). Cir No.42/09.18.300/201 2-13) Due to this, almost all the Cooperative banks are using CBS for their day-to-day banking.

While implementing CBS, more focus was given to the Utilities or modules and Security that are provided by the CBS. And it was accepted at that time due to the availability of very less alternatives or many choices. Security being a crucial part of any banking system, and the ultimate stress is on the implementation of the highest possible security. Not much stress is given to the usability aspect of the system.

The primary goal of any system is to provide the actual functionality for which it is designed, and the secondary goal of the system is security. The way functionality designing starts from the early stages of software development, security design should also start from the early stages. Also, the way utility (or functionalities) and usability are two sides of one coin, Security and Usability should also work like same.

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Chapter 4. Data Analysis and Interpretation

4.1 Introduction – Profile of Sample Banks

The primary goal of this study is to examine how well the Cooperative's Core Banking System works. From 48 cooperative banks and their branches in Pune, the researcher has gathered sample data. The researcher has specifically gathered primary data from,

- Management level people
- Branch staff/ Front office staff
- Technocrats or IT people
- Customers

Research gap analysis and thorough literature studies helped identify the aspects that affect CBS usability. Additionally, the researcher considered the security-related issues from usability perspective those are important for the implementation of CBS. The aspects highlighted in the literature review on the topic have been recognized and included by the researcher. Based on that, the instrument has been designed in the form of a Questionnaire. The researcher performed a pilot survey among a select set of cooperative banks. The questionnaire was finalized after pilot research. Four separate questionnaires are designed to gather the data by the researcher. For managerial staff and branch staff of the bank, the first 19 questions are common and are related to the demographic information of respondents and the banks. The Collected data has been categorized into following parts for the analysis,

1. Demographic Responses Received from Managers, IT and non-IT Staff Members of Cooperative Banks.
2. CBS Implementation Responses Received from Managerial and Staff Members on CBS.
3. Responses Received from Managerial and Staff Members regarding basic usability and security aspects of CBS.
4. Responses Received from Respondents Working in Managerial Positions.
5. Responses Received from Respondents Working as Bank Teller/Cashier/ Clerks etc.
6. Responses Received from Technocrats from the cooperative banks.
7. Responses Received from Customers of the cooperative banks.

The researcher has used Microsoft Excel – 365 and IBM SPSS to process collected data. Additionally, the researcher employs both descriptive and inferential statistics in the quantitative study. The analysis made use of correlation, average, mean, and standard deviation. With the aid of the statistical program SPSS 22.0, hypothesis testing was conducted. This chapter presents and interprets the resulting data. Table 4.1 shows the details of the sample banks' profiles.

Table 4.1 - Sample banks profiles

Sr. No.	Bank Name	Establishment	Branches	Bank Category	Delivery Channels
1	Indrayani Cooperative Bank Ltd	2001	7	Tier -I	ATM, RTGS, NEFT, IMPS, POS, UPI
2	Jai Bhavani Cooperative Bank Ltd	1972	2	Tier -I	ATM, RTGS, NEFT
3	Jai Hind Urban Cooperative Bank Ltd	1999	1	Tier -I	ATM, Mobile Banking, RTGS, NEFT, IMPS
4	Janata Sahakari Bank Ltd	1949	71	Tier -III	ATM, Telephone Banking, Net banking (Online banking), Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
5	Janseva Sahakari Bank Ltd	1972	30	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI,Internet banking-Viewonly
6	Jijamata Mahila Sahakari Bank Ltd	1974	15	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
7	Mahesh Sahakari Bank Ltd	1972	16	Tier -III	ATM, Net banking (Online banking), Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
8	Pavana Sahakari Bank Ltd	1973	22	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS
9	Pune Cantonment Sahakari Bank Ltd	1973	11	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
10	Pune District Central Cooperative Bank Ltd	1917	283	Tier -III	ATM, Net banking (Online banking), Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
11	Pune Merchant's Co-operative Bank Ltd	1924	10	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS
12	Pune People's Cooperative Bank Ltd	1952	22	Tier -I	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
13	Rajashree Shahu Sahakari Bank Ltd	1985	17	Tier -II	ATM,RTGS, NEFT
14	Ramrajya Sahakari Bank Ltd	1997	9	Tier -II	ATM, SMS Banking, RTGS, NEFT
15	Sadhana Sahakari Bank Ltd	1979	29	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI,
16	Sampada Sahakari Bank Ltd	2005	9	Tier -II	ATM, RTGS, NEFT, IMPS, POS, UPI
17	Sant Sopankaka Sahakari Bank Ltd	1997	19	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS
18	Shri Gajanan Lokseva Cooperative Bank Ltd	1999	2	Tier -I	ATM, RTGS, NEFT, POS
19	Shri Ganesh Sahakari Bank Ltd	1997	1	Tier -I	RTGS
20	Shri Laxmi Co-op Bank Ltd	1971	4	Tier -II	ATM, RTGS, NEFT
21	Shri Laxmi Krupa Sahakari Bank Ltd	1998	2	Tier -I	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
22	Suvarnayug Sahakari Bank Ltd	1973	22	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI
23	Udyam Vikas Sahakari Bank Ltd	1974	9	Tier -II	ATM, RTGS, NEFT, IMPS, POS
24	Vidya Sahakari Bank Ltd	1974	13	Tier -II	ATM, RTGS, NEFT, IMPS, POS, UPI
25	Vishweshwar Sahakari Bank Ltd.	1972	29	Tier -II	ATM, Mobile Banking, RTGS, NEFT, IMPS, POS, UPI

(Source: Compiled by Researcher based on primary and Secondary data)

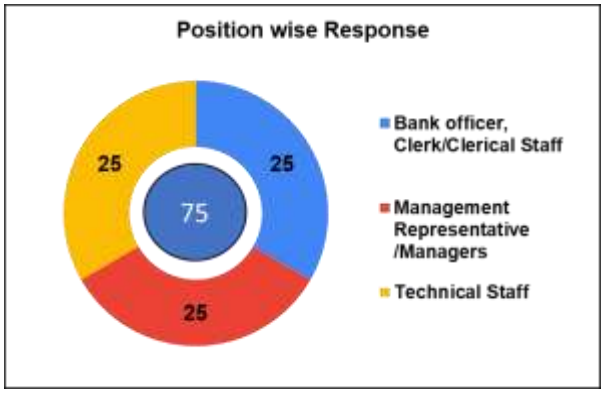
4.2 Descriptive Statistics of the Data and Inference

4.2.1 Demographic Responses Received from Managers, IT and non-IT Staff Members of Cooperative Banks

a) Position-wise respondents

When respondents are asked for their opinion on the usability of CBS, their positions and roles play a significant role. The same question may elicit diverse responses from respondents holding various positions.

Figure 4.1 Position-Wise Respondents



Respodents	Grade
Bank officer, Clerk/Clerical Staff	25
Management Representative /Manage	25
Technical Staff / IT staff	25

(Source: Compiled by Researcher based on primary data)

Observations and Inferences –

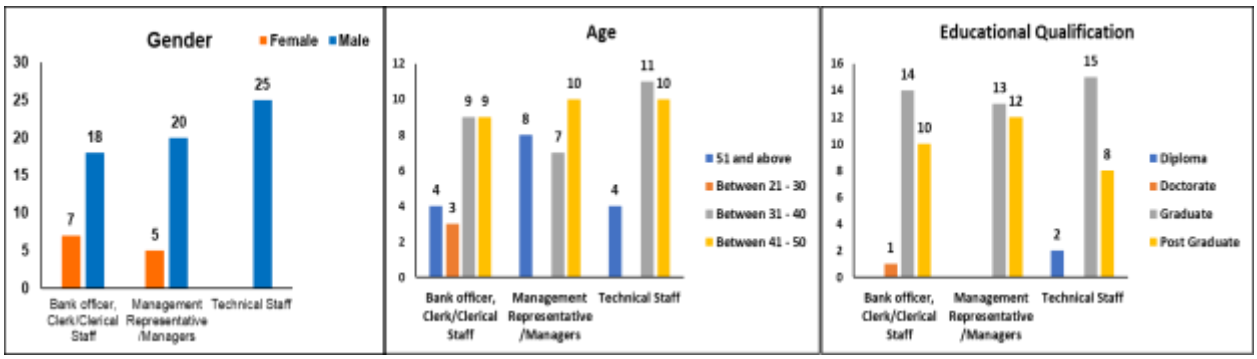
The researcher has selected samples from 25 different cooperative banks. From selected sample banks, the researcher has collected data from respondents holding managerial positions, technical staff, and Clerical staff.

Position-wise responses received from respondents are of the same in number (i.e 25.)

b) Position-wise Responses of the respondent

This section talks about the demographic data of all the respondents holding the positions discussed above,

Figure 4.2: Position-wise Responses



(Source: Compiled by Researcher based on primary data)

Observations and Inferences –

The gender of respondents was asked. Understanding gender bias in various user positions within cooperative banks is made easier by this. Three categories were provided to record the response. The above figure 4.2 clearly depicts that from sample cooperative banks, the maximum responses i.e., out of 75, 63 responses are given by male respondents, and remaining are the 12 are from female respondents from three positions.

The demographic element of age has an impact on how people use modern technologies. The age of the respondents is divided into four categories for the study. Out of 75 respondents, very few respondents (i.e., 3) are from the age group 21-30 years. All these 3 respondents are working with the banks as clerical staff or officers. None of this age group respondents belong to managerial or technical staff.

Employees of cooperative banks hold a variety of managerial and technical jobs. Researchers have divided educational credentials into four categories for easier understanding: all relevant diplomas, undergraduate degrees, postgraduate degrees, and doctorates. Figure 4.2 shows the employees' educational backgrounds in cooperative banks. Thus, from a sample of cooperative banks, 2 respondents have earned diplomas, 40 have earned degrees, 30 have earned postgraduate degrees, and 1 has earned a Ph.D.

None of the responses from the technical staff for the sample bank data is from Female respondents.

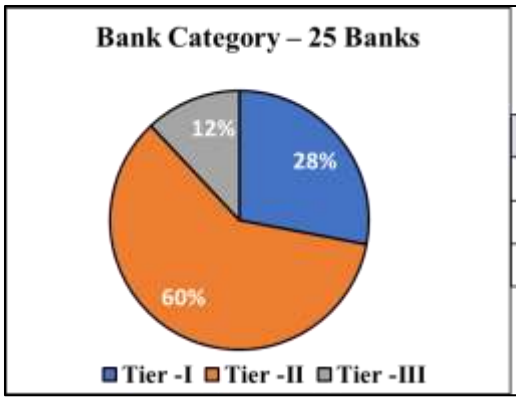
The younger generation group can quickly adapt to CBS, a new technology. While it is evident from Figure 4.2 that most of the employees in sample cooperative banks working in clerical or technocrat positions are in the middle age range, or between 31 and 50 years old. Also, more respondents in managerial positions are above the age of 41 years. The cooperative banks' adoption of CBS is significantly influenced by employee age.

4.2.2 CBS Implementation Responses Received from Managerial and Staff Members on CBS

a) Category of the Cooperative Bank

According to RBI regulations, cooperative banks that operate in a single district and have deposits under Rs. 100 Crore are classified as Tier 1 category banks. Tier 2 banks are those with deposits between Rs. 100 Crore and Rs. 1000 Crore, while the remaining institutions are all classified as Tier III banks. Figure 4.3 shows the summary categories of the sample bank.

Figure 4.3: Category of Cooperative Banks



Bank category	Count
Tier -I	7
Tier -II	15
Tier -III	3

(Source: Compiled by Researcher based on primary data)

Observations and Inferences –

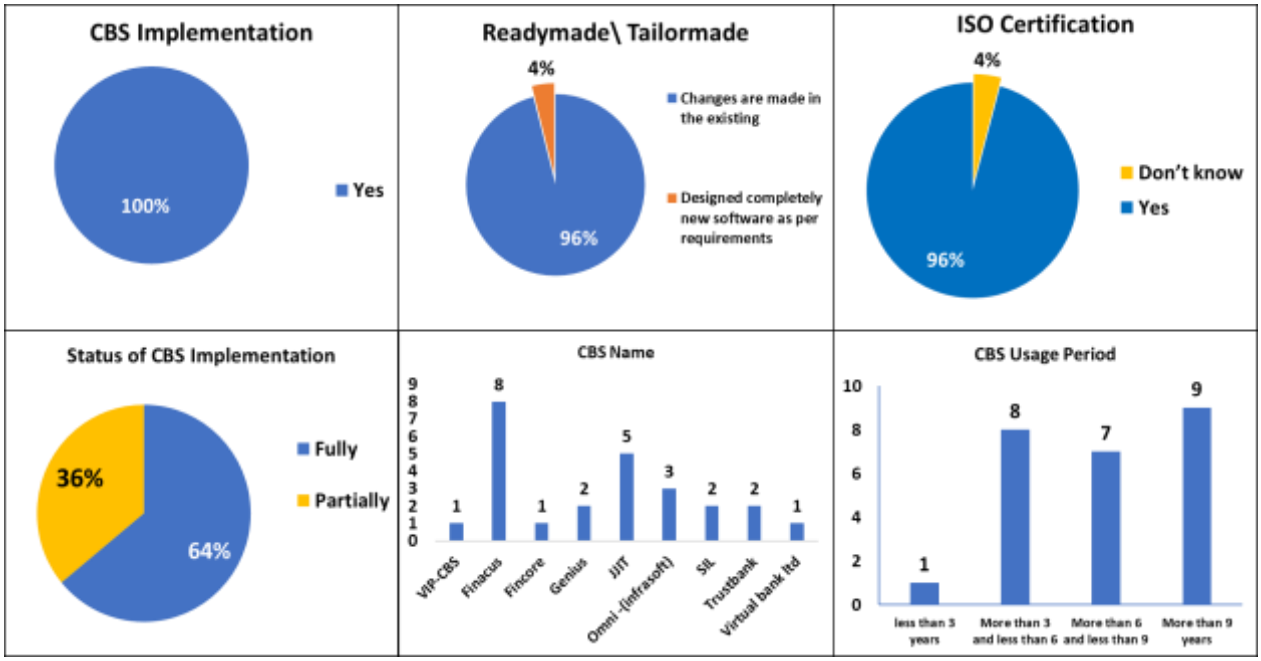
From the Pune district, 75 respondents belong to various 25 Cooperative Banks. 25 cooperative banks make up this group, with 7 of them falling into Tier I, 14 into Tier II, and 3 into Tier III.

One of the key guidelines from the RBI is that cooperative banks must have deposits of over Rs. 1000 crores before offering Internet Banking with transactional features; the remaining banks may only offer this service with non-transactional capabilities. Tier-II banks make up most of the banks in the sample. Therefore, it is evident from Figure 4.3 that only 3 cooperative banks that come under Tier III can offer Internet banking with transaction capability. The remaining cooperative banks, which are 7 in Tier-I and 14 in Tier-II, can offer non-tractional Internet Banking services.

b) Status of the CBS Implementation

Reserve Bank of India (RBI) had made it compulsory to adopt Core Banking Solutions (CBS) in all cooperative banks across the country before December 20214. According to data received by the respondents, all the sample banks under consideration (25 banks) have implemented CBS.

Figure 4.4: CBS Implementation Status in the Cooperative Banks



(Source: Compiled by Researcher based on primary data)

Observations and Inferences –

Figure 4.4 shows the status of the implementation of CBS in the sample cooperative banks and denotes that from the sample banks:

- 24 banks (96%) have made modifications to the CBS software in accordance with their needs. and only one bank (4%) has created its own version of the CBS software.
- 24 banks (96%) are using CBS software that has received ISO certification. The remaining bank responder (4%) is unaware of the ISO certification of the CBS that is implemented.
- 9 banks (36%) have partially used CBS software, 16 banks (64%) have fully embraced it.
- The market is filled with several CBS sellers. Vendors can offer products that are functionally appropriate, economical, and individually designed. JJIT, Finacus,

FinCore, Genius, SIL, Omni – (Infrasoft), Trustbank, Virtual Bank, VIP-CBS are the listed CBS software used by the sample cooperative banks.

- Most banks, i.e., 10 banks have adopted CBS software for more than 9 years, and the remaining 16 banks have adopted CBS software below that.

With the above data, the researcher has inferred that,

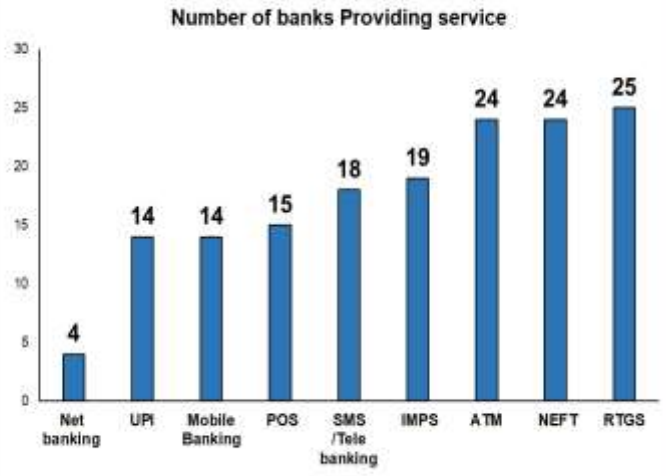
a) All the sample Cooperative banks under consideration have adopted CBS software.
b) But data reveals that 6 banks have not adopted it fully. They have not used some of the functionalities or services from the Head Office or Branch Office Module. 16 banks that are enjoying complete functionality must be able to work more efficiently.
c) RBI mandated the use of CBS before December 2014, but sample data inferred that more than 50% of banks i.e., 16 banks have started using CBS after that. One of the banks has started using CBS in the last 2 years.
d) Also, except one, all banks have made changes in the CBS, purchased from the vendors which suggests that these banks are dependent on the vendor for changes or updates.
e) JJIT is the preferred vendor of all the available CBS vendors, among the sample banks under consideration.

c) Delivery Channels Provided by the Cooperative Banks

CBS implementation relies heavily on delivery channels. This is how banks give their consumers with anytime, anywhere banking. There are numerous online and offline delivery channel choices available, including ATMs, telephone banking (SMS service), net banking, mobile banking, RTGS, and POS. Figure 4.5 depicts the adoption and execution of delivery channels in a sample cooperative bank.

Figure 4.5: Status of Delivery Channels

Delivery Channel	Number of banks Providing service	%
Net banking	4	15.38
UPI	14	53.85
Mobile Banking	14	53.85
POS	15	57.69
SMS /Tele banking	18	69.23
IMPS	19	73.08
ATM	24	92.31
NEFT	24	92.31
RTGS	25	96.15



(Source: Compiled by Researcher based on primary data)

Observations and Inferences –

RTGS is used by all 25 banks, according to sample data. In addition, 24 cooperative banks provide NEFT and ATM services. IMPS is available in 19 of them. 18 offer SMS banking. 15 banks offer POS services, while fifteen offer mobile banking. Customers now utilize UPI as one of their delivery methods, and 13 banks offer it. Just four banks offer net banking, Internet banking, or online banking services, with 3 of them offering transactional services and one offering non-transactional Internet banking.

With this sample data, we can infer that RTGS, NEFT, and ATM are the most popular delivery channels used by most of the cooperative banks. Some of the cooperative banks such as Jai Bhavani Cooperative Bank, Shri Ganesh Cooperative Bank, Shri Laxmi Krupa Cooperative Banks etc. are using ATM services of other private sector banks. Even though Net Banking, Mobile Banking App, and UPI are the most convenient delivery channels in today's digital world, they are nevertheless the most neglected delivery channels in the majority of banks. For Internet banking transactional options, RBI has imposed some

restrictions based on deposits and other parameters. So many of the banks are not able to provide the facility.

4.2.3 Responses Received from Managerial and Staff Members on some common questions asked on basic usability and security aspect of CBS

While designing three separate questionnaires for managerial level and clerical and technical staff members of the CBS, the researcher realized that some of the questions related to the usability and security of the CBS are common for all three. Below listed are those questions.

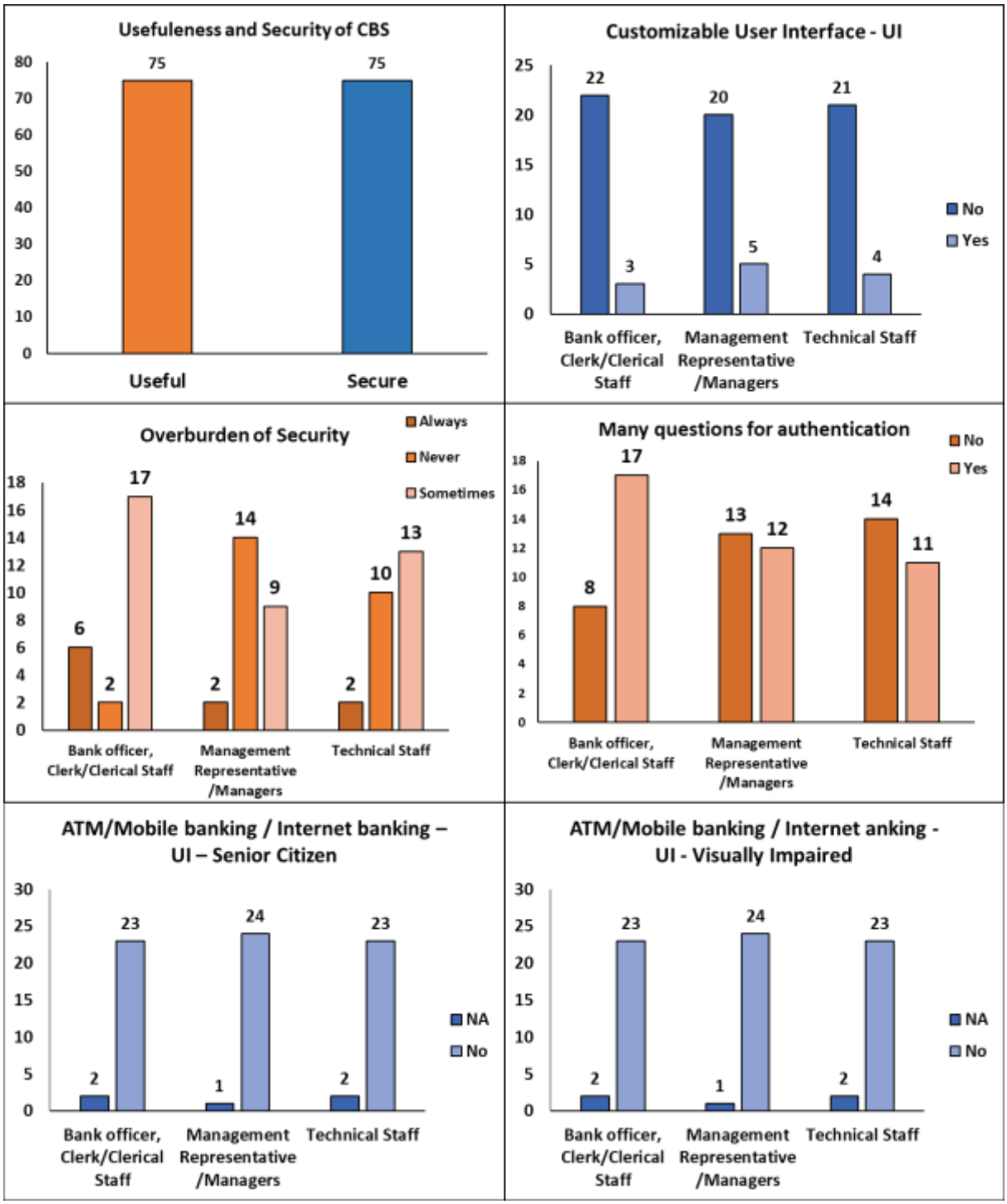
a) Do you find CBS useful?
b) Do you find CBS transactions secure?
c) Do the Security measures implement by the current CBS system overburdened you?
d) Does your current CORE Banking Software ask you many questions to provide you secure environment?
e) Is the User Interface (UI) provided by the current CBS Software by your bank customizable as per your needs?
f) Does your ATM / Internet Banking/ Mobile banking software provide additional facilities in terms of User Interface (UI) to Senior Citizen Customers?
g) Does your ATM / Internet Banking/ Mobile banking software provide additional facilities in terms of User Interface (UI) to Visually Impaired Customers?

The researcher has analyzed the answers to the above questions in Figure 4.6

Observations and Inferences –

According to the replies received from all 75 respondents, everyone considers CBS software Useful and Secure, implying that all the sample cooperative banks have recognized the value of CBS and that all respondents agreed that CBS is useful and that transactions conducted using CBS are secure.

Figure 4.6: Opinions of Responders on Usefulness & Security Aspect of CBS



(Source: Compiled by Researcher based on primary data)

For the question '**Do the Security measures implement by the current CBS system overburdened you?**', The sample data also depicts that,

a) For Clerical staff/ Bank staff - out of 25 responses, 23 respondents (6 +17) feel implemented security is overburdened to them always or sometimes

whereas only 2 responses suggest that it has never overburdened them. Refer Table 4.2

b) For Managerial People – out of 25 responses,11 responses (2+9) suggest that implemented security is overburdened to them always or sometimes and the rest 14 recommend that they never get overburdened due to security implementation. Refer Table 4.2

c) For Technical staff – out of 25 responses, 15 responses (3+12) suggest that implemented security is overburdened to them always or sometimes, and the rest 10 suggest that they never get overburdened due to security implementation. Refer Table 4.2

Table 4.2 – Status of Overburdening Security

Respondent	Always		Never		Sometimes	
	Freq	%	Freq	%	Freq	%
Bank officer, Clerk/Clerical Staff	6	24%	2	8%	17	68%
Management Representative /Managers	2	8%	14	56%	9	36%
Technical Staff	2	8%	10	40%	13	52%
Total	10	13%	26	35%	39	52%

(Source: Compiled by Researcher based on primary data)

With this sample data, the researcher has observed that Clerical staff are feeling more overburdened by security use than technical staff and managerial-level people. And another observation is, in all out of 75 respondents, 49(10+39) respondents (i.e.,13+52=65 %) have felt the burden of the implemented security at some or other time.

For the question '**Does your current CBS ask you many questions to provide you secure environment?**', The sample data also depicts that,

a) For Clerical staff/ Bank staff - out of 25 responses, 17 responses (i.e., 68%) suggest that implemented security measures are asking many questions and the remaining 8 responses are opposite to that Refer to Table 4.3

b) For Managerial People – out of 25 responses, 12 responses (i.e., 48%) suggest that implemented security measures are asking many questions and the remaining 13 responses are opposite to that Refer to Table 4.3

c) For Technical staff – out of 25 responses, 11 responses (i.e., 44%) suggest that implemented security measures are asking many questions and the remaining 14 responses are opposite to that Refer to Table 4.3

Table 4.3 – Status of 'Many Questions for Security'

Respondent	Yes		No	
	Freq	%	Freq	%
Bank officer, Clerk/Clerical Staff	17	**68%**	8	**32%**
Management Representative /Managers	12	**48%**	13	**52%**
Technical Staff	14	**44%**	11	**56%**
Total	43	**57%**	32	**43%**

(Source: Compiled by Researcher based on primary data)

In this case, the researcher observed that from 75 total respondents, 43 respondent's opinion is that - Implemented CBS security measures are asking many questions, which in 57% of responses from the sample. Also, in this question again, responses from Clerical staff are of opinion opposite to the technical staff and managerial-level people.

Next three questions are related to the usability of the User Interface (UI). From those questions '**Is the User Interface (UI) provided by the current CBS Software by your bank customizable as per your needs?**' The sample data depicts that,

a) For Clerical staff/ Bank staff - out of 25 responses, 22 responses (i.e., 88%) state that the implemented User Interface is not customizable according to the respondent's usage and the remaining 3 responses are opposite to that. Refer to Table 4.4
b) For Managerial People – out of 25 responses, 20 responses (i.e., 80%) state that the implemented User Interface is not customizable according to the respondent's usage and the remaining 5 responses are opposite to that. Refer to Table 4.4
c) For Technical staff – out of 25 responses, 21 responses (i.e., 84%) state that the implemented User Interface is not customizable according to the

respondent's usage and the remaining 4 responses are opposite to that. Refer to Table 4.4

Table 4.4 – Status of CBS UI-Customization

Respondent	Yes	%Yes	No	%No
Bank officer, Clerk/Clerical Staff	3	12%	22	88%
Management Representative /Managers	5	20%	20	80%
Technical Staff	4	16%	21	84%
Total Staff	**12**	**16%**	**63**	**84%**

(Source: Compiled by Researcher based on primary data)

Here, the researcher observed that, from all 75 respondents, 63 (i.e., 84%) responses are negative stating that customization is not possible in the User Interface of CBS provided by the vendor.

'Does your ATM / Internet Banking/ Mobile banking software provide additional facilities in terms of User Interface (UI) to Senior Citizens? or Visually Impaired Customers?' For this question, sample data shows that, of all 75 respondents, 70 respondents (i.e., 93%) stated that there are no additional facilities in terms of User Interface to Senior Citizens or Visually Impaired customers provided for the use of ATM/ Internet Banking or Mobile Banking. Out of these, 5 respondents have not given any response to this question.

For visually impaired Customers also, the researcher has observed the same pattern of response in which 93.33 respondents state that they don't have any separate provision in their software for operations.

Table 4.5 – Status of UI-Customization for Senior Citizens / Visually Impaired Person

Respondent	Yes	%Yes	No	%No
Bank officer, Clerk/Clerical Staff	2	8%	23	92%
Management Representative /Managers	1	4%	24	96%
Technical Staff	2	8%	23	92%
Total Staff	**5**	**7%**	**70**	**93%**

(Source: Compiled by Researcher based on primary data)

After analyzing the data for the usability and security of CBS, the researchers determined that while all the respondents supported the CBS owing to its usefulness and secure transactions, data suggests that many of them, notably Clerical staff respondents, are not satisfied with the security procedures employed to make the system secure. One reason for this could be that many of these Clerical staff members do not have technical skills, therefore they may find the security measures burdensome. Second, because Managerial-level respondents do not interact with CBS daily, they are unconcerned with the security measures implemented to keep the system secure. Furthermore, being part of the implementation team of CBS, these managerial-level people will not directly give any negative response to their decision.

From a User Interface perspective, around 84% of CBS vendors do not provide the customization option, which is certain to limit staff performance. Furthermore, banks have not considered any extra services that could be provided to senior citizens or visually impaired customers. In this event, these persons will be unable to use the delivery channels given by the sample cooperative banks, such as ATMs, mobile banking, and Internet banking.

4.2.4 Responses Received from Respondents Working on the Managerial Positions

This section of the Chapter concentrates on analyzing different questions asked to the Managerial post people of the cooperative banks. The researcher has received a total of 75 responses from different 25 cooperative banks situated in the Pune District. Out of these, 25 responses are received from the respondents working in the managerial post. As mentioned at the beginning of this chapter, questions asked to these respondents are based on their roles. They are not actual users of the CBS, but they are responsible for choosing the CBS, purchasing it, Finalizing the budget, Implementing the CBS, and its infrastructure in the banks, training the staff and customers, and many more.

For analysis, the researcher has categorized the questions into two categories,

I. Questions asked for evaluating the process before finalizing and exploring the CBS at the time of purchase.
II. Questions asked for evaluating the preparedness for implementation of the CBS.

I. Questions asked for evaluating the process before finalizing and exploring the CBS at the time of purchase.

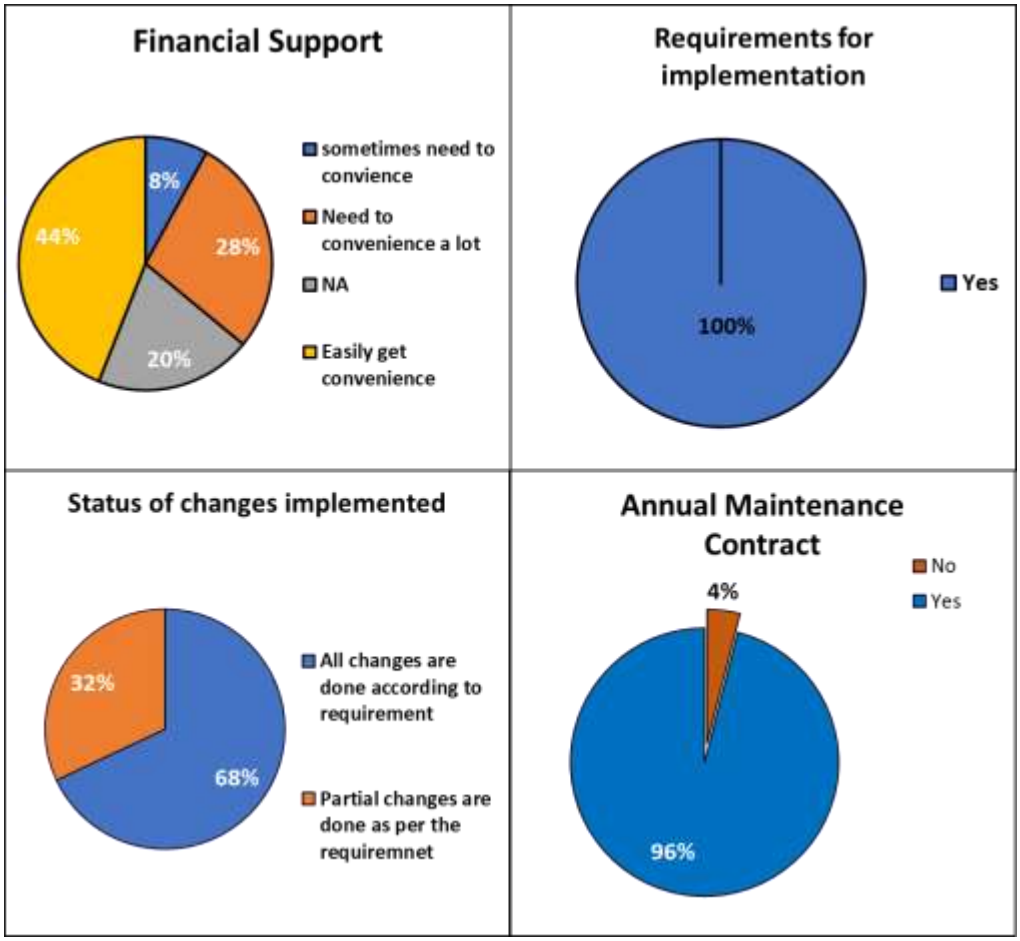
a) Does Top level management support finance to purchase a good/required CBS system?
b) Did the vendor (software) development team ask about your requirement before implementing the CBS system?
c) Has the vendor made changes according to your requirement or CBS system was implemented as it is?
d) Has the vendor development team consulted about the User Interface (UI) of your CBS system before implementation?
e) Has the vendor development team consulted about the Security Features of your CBS system before implementation?
f) Do you have an Annual Maintenance Contract (AMC) with the vendor from whom you have purchased CORE Banking software?

Observations and Inferences –

Evaluation of the responses received for the above-mentioned questions is shown in Figure 4.7. The observation states that for purchasing or making updates in the CBS, 11 (44%) respondents mentioned their '**management gets easily convinced**', 7 (28%) mentioned, they

'need to convince a lot to management', 5 (20%) have not given any response to the question, and two of the respondents (8%), mentioned that '**sometimes they need to convince**' the management for the purpose.

Figure 4.7 – Responses for the process before finalizing and exploring the CBS



(Source: Compiled by Researcher based on primary data)

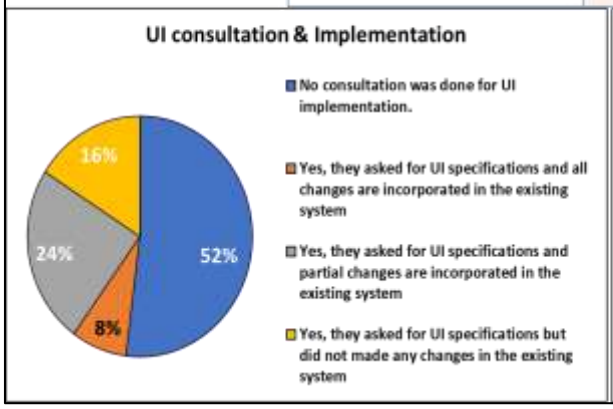
The researcher also observed from 25 (100%) responses that vendors have asked about the requirement before implementing the CBS, from which responses from the bank management suggest that 17 (68%) vendors have implemented '**All the changes as per requirement**' and 8(32%) has implemented '**Partial changes as per requirement**' in the CBS.

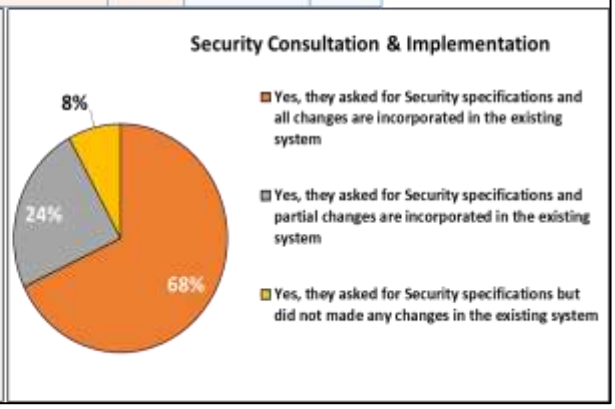
Apart from the general implementation requirement from the vendor, the researcher specifically asked two questions that focus on the implementation of User Interface (UI) and Security requirements from the vendor. Table 4.6 summarized the opinion given by the respondents.

It is clear from the table, 13 (52%) respondents said that '**No consultation was done for UI implementation**' by the vendor whereas 12 (48%) respondents said the vendor '**Has asked for the UI requirements**' from which, 2(8%) vendors have '**incorporated all the changes'** in the design, 6 (24%) have **'incorporated partial changes'** in the design and 4 (16%) of the vendor has '**not incorporated any specified change**' in the design.

Table 4.6 – Status of User Interface (UI) and Security Requirement

Repondent's Opinion	UI Specification	%	Security Specification	%
No consultation was done for UI implementation	13	52	0	0
Yes, they asked for UI specifications and all changes are incorporated in the existing system	2	8	17	68
Yes, they asked for UI specifications and partial changes are incorporated in the existing system	6	24	6	24
Yes, they asked for UI specifications but did not make any changes in the existing system	4	16	2	8





(Source: Compiled by Researcher based on primary data)

Also, table 4.6 clearly stated that 25 (100%) vendors '**have asked for the security specification'**, from which 17 (68%) '**have incorporated all the changes'** according to the security specifications, 6 (24%) have '**incorporated partial changes'** according to the security specification, and 2 (8%) of the vendors have '**not incorporated any input'** given on the security specification.

After studying this data, the researcher has understood that, even if superficially sample data suggest that half of the top-level management is ready to provide finance for the CBS implementation, after critical analysis of the data, the researcher has observed that, 20% of

the respondents have not given their opinion on this and 36% of the respondents who are not from the top-level management responded that they need to take an effort to convince the top level management for finance. Details are included in Table 4.7.

Table 4.7 – Details of management-level responses on finance

Responder's Opinion	AGM	Branch Manager	Branch Manager - Head office	CEO	Dy. Chief officer	GM	Manager	Officer	Grand Total	%
Sometimes need to convince		1						1	2	8
Need to convenience a lot		2					4	1	7	28
Easily get convenience	3		1	1	1	2	2	1	11	44
NA		2	1			1	1		5	20

(Source: Compiled by Researcher based on primary data)

Data represented in Figure 4.7, also predicts that all the cooperative banks have an Annual Maintenance Contract (AMC) with the vendors, which is the most required thing for timely reviewing of the system and essential to recover from the sudden breakdown and repair.

Status of the user requirement asked by the vendors before implementation of the CBS inferred that vendors are asking for the requirements, but 32% of the vendors have made partial changes due to which CBS users are not able to use its services according to their requirements.

52% of vendors have not given importance to the User interface (UI) since they have not asked for any requirements for that from the respondents of the sample banks. One notable thing in the discussion is that all vendors have asked for and implemented the security specifications.

This infers that the User Interface (UI) requirements are given less priority during implementation by the vendors. Even if some of them have asked for it, they have partially implemented that or not at all implemented it. This will lower the performance of to use while using the system. Both vendors and users are much more conscious about providing the security of the CBS and which is an important factor.

II. Questions asked for evaluating the preparedness for implementation of the CBS

a) Do you have a separate IT department? if yes, then tick the members who are all part of IT department.
b) Do you have an IT security policy?
c) Have you conducted training programs on the CBS system implemented in your bank for your staff members?
d) Have you conducted a Security training program/ workshop for your employees?
e) Have you evaluated the conducted training?
f) Have you taken the Employee Satisfaction Survey on the CBS system that they are currently using?
g) Have you forwarded the feedback received from the Employee Satisfaction Survey to the development team for the enhancement of the CBS system?
h) Do you provide online or offline training to your customers regarding the use of E-banking? (Apart from a Guided tour/ FAQ from your internet banking/mobile banking website)
i) Have you conducted an Online/offline Security Awareness Program on Internet Banking/Mobile Banking for your customers? (Apart from flashing messages on the website)
j) Have you taken the Customer Satisfaction Survey about their experience of E-banking that your bank is currently using?
k) Have you forwarded the feedback received from the Customer Satisfaction Survey to the development team for the enhancement in the Internet Banking/ Mobile

Observations and Inferences –

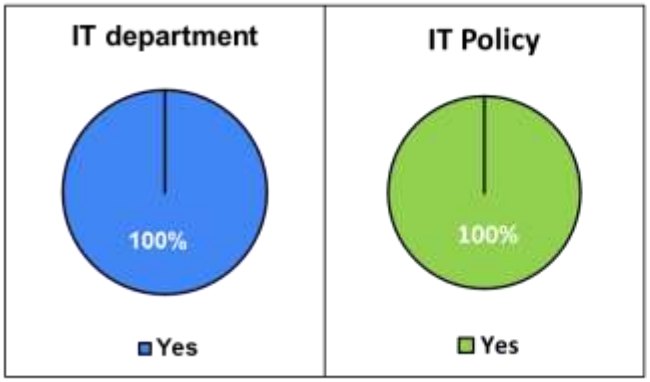
Status of IT- Department

To implement technology in cooperative banks, they need a separate IT Department with good technical staff having expertise in the implementation of various technical sections, such as hardware, networking, security etc.

The researcher asked questions based on this and responses received are shown in Figure 4.8. It is very much clear from the sample data that all the respondents associated with their bank have separate IT department having their own IT policies. Furthermore, the researcher has observed the inconsistency in the designation of people working in the IT department. For

this, the researcher has given some of the IT personnel designation options for reference. (Refer to Figure 4.8)

Figure 4.8 – Status of IT Department



Positions	Count
IT Manager/ EDP Manager	25
Security Admin	4
Hardware Admin	9
Software Admin	8
Network Admin	12
Others (Technical help)	15

(Source: Compiled by Researcher based on primary data)

Status of CBS & Security Training to Bank Staff-

Next, a necessary requirement for implementing technology is training. The researcher has asked questions based on the CBS training given to staff members and the conduct of an employee satisfaction survey. Figure 4.9 shows the result of the same.

After observing the result, the researcher noticed that out of 25 respondents, 22 (88%) have conducted CBS training for the staff, 16(64%) have conducted security training for the staff, whereas only 6(24%) have conducted the evaluation of the training. Also, figure 4.8 shows that less than half, i.e., 10 (40%) respondents have conducted the Employee Satisfaction Survey and from that 8(32%) have forwarded the feedback of employees to the vendor for betterment.

Figure 4.9 – Status of Staff Training And feedback

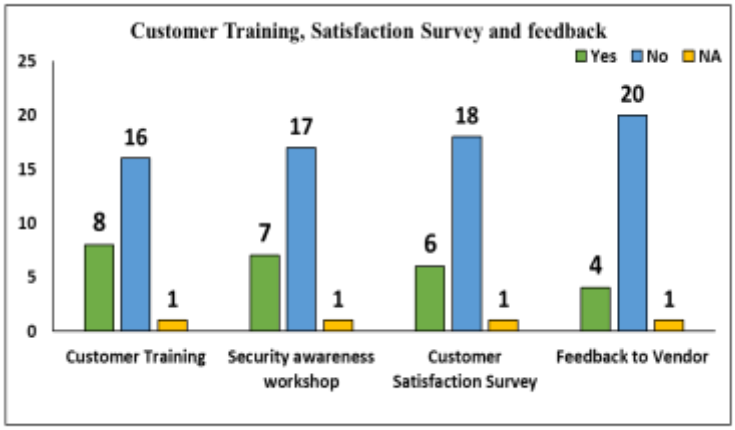
Responses	Yes	No	Yes%
Staff Training	22	3	88%
Security Training	16	9	64%
Evaluation of the Training	6	19	24%
Employee Satisfaction Survey	10	15	40%
Feedback to vendor	8	17	32%

(Source: Compiled by Researcher based on primary data)

Status of Delivery Channel & Security Training to Bank Staff-

Customers of the cooperative banks are connected to CBS via Delivery Channels. So, training in using this needs to be given to them. The researcher has asked questions based on the e-banking (ATM, Mobile banking, Internet Banking) training given to the bank customers apart from flashing messages on the website or sending SMS and the conduct of a customer satisfaction survey of their overall experience of e-banking. Figure 4.10 shows the result of the same.

Figure 4.10 – Status of Customer Training And feedback



Responses	Yes	No	NA	Yes %
Customer Training	8	16	1	32%
Security awareness workshop	7	17	1	28%
Customer Satisfaction Survey	6	18	1	24%
Feedback to Vendor	4	20	1	16%

(Source: Compiled by Researcher based on primary data)

The result depicts that, out of 25, only 8 (32%) respondents mentioned that they have conducted online/offline training for customers related to e-banking (ATM, Mobile banking, Internet Banking), and 7 (28%) of respondents said that they have conducted security awareness program or training online/offline for customers. Figure 4.10 also shows that 6 (24%) respondents have conducted the customer satisfaction survey and out of which only 4 (16%) forwarded the customer's feedback on the e-banking to the vendor.

After observing and studying the responses received by managerial level people from the sample banks, the researcher has inferred that all responded banks have a separate IT Department with IT policy. This implies that the cooperative banks under consideration are aware of the need for a separate IT department. But the data shows that there is an unevenness in the positions of staff working under the IT Department and there is no fixed structure of IT Departments of the sample cooperative banks under consideration.

Sample banks under consideration are making efforts towards training their staff members to get acquainted with CBS technology and the security world. But they are not evaluating the

training since it is important to check whether they have grasped the process well and can use it effectively to improve their performance. Also conducting feedback in terms of satisfaction surveys is necessary. The above data shows that 60% of banks are failing in it and those who are taking the survey are not taking any action on that.

The data also depicts that banks are lacking in taking appropriate efforts to make customers comfortable and confident while using delivery channels like ATMs, internet banking, and mobile banking. If banks fail to make customers comfortable in using these technologies, there is no use in providing these facilities. It is important that banks should conduct periodic training and feedback from the customers as a part of the Customer Help Desk.

4.2.5 Responses Received from Respondents Working as a Bank Teller/Cashier/ Clerks

This chapter's portion focuses on examining different questions made to the sample size of 25 cooperative banks' office staff. These are the everyday CBS users that are employed by banks. The researcher has designed a separate questionnaire for them that deals with the usability and security they are currently using and expecting from the CBS software.

The researcher has divided the questions into the different categories discussed below,

I. Suggestions on & Training of CBS
II. Availability of Infrastructure
III. Usability aspect of CBS
IV. Problems faced during using CBS

I. Suggestions on & Training of CBS

Questions asked in this category are,

1. While implementing this CBS, have your management asked for your suggestions/requirements?
2. Has it been incorporated?
3. Have you received any training before using/implementing the current CBS System?
4. Rate the training you have received., If not received any training tick NA.
5. Is the evaluation of the training done?
6. Opinion - Evaluation after training will improve performance.

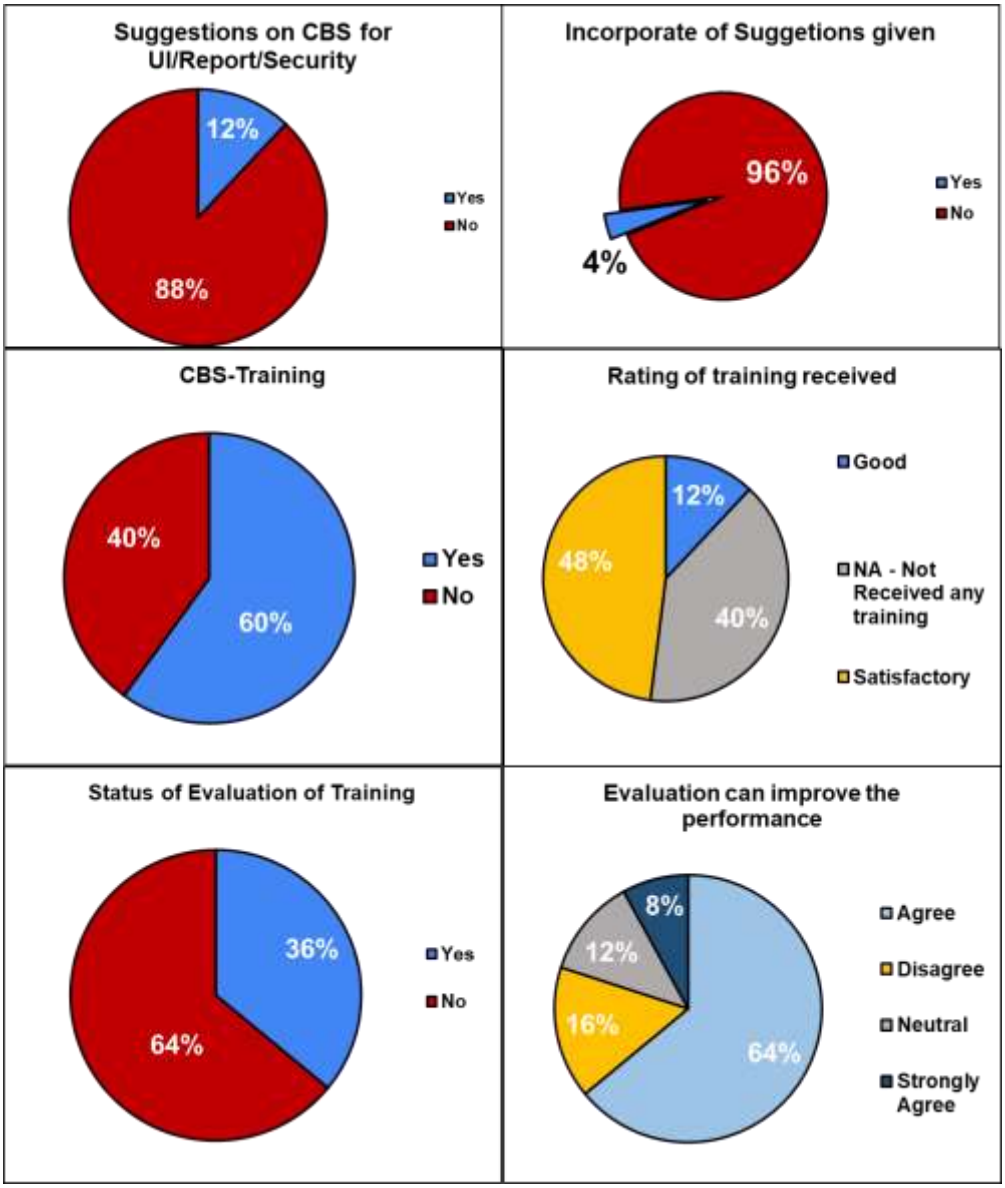
Observations and Inferences –

The person utilizing the system should be well-versed in it before using it. So, the researcher posed the aforementioned queries. The answers to the questions above are shown in Figure 4.11.

Data gathered following question analysis revealed that, of the sample banks (25 banks) under examination, 88% of bank management did not consult any of the office employees while deciding on the CBS. Additionally, of the 12% of banks where staff members were involved, 4%, or only one bank, adopted the staff member's advice.

Furthermore, the researcher asked about the training of the staff on CBS and security measures that should be taken by the staff during using banking software. Data shows that 60% of the banks have conducted the training whereas 40% failed to do that. From this, 9% of banks conducted the evaluation followed by the training. For the received training, the researcher asked members to give their rating in which only 12% rated the training as *Good* and 48% rated it *Satisfactory*.

4.11 Status of Suggestions asked and training on CBS by Management



(Source: Compiled by Researcher based on primary data)

Along with this, one of the questions was, "Can training evaluation improve performance?" 72% of respondents said that an evaluation should be there, whereas 16% had the opposing perspective and 12% of staff members did not express an opinion.

The statistics make it quite evident that bank office personnel must be involved in or asked to give feedback on CBS functionality since they will ultimately utilize it. The current proportion is relatively little. Even when suggestions are made by them, the adoption rate is still quite low.

Evaluative training is one of the crucial components of usability, however, it is inadequate in the present situation. The status of conduct of training evaluation reveals that no one has given it an exceptional rating, and the staff members are just content with it.

II. Availability of Infrastructure

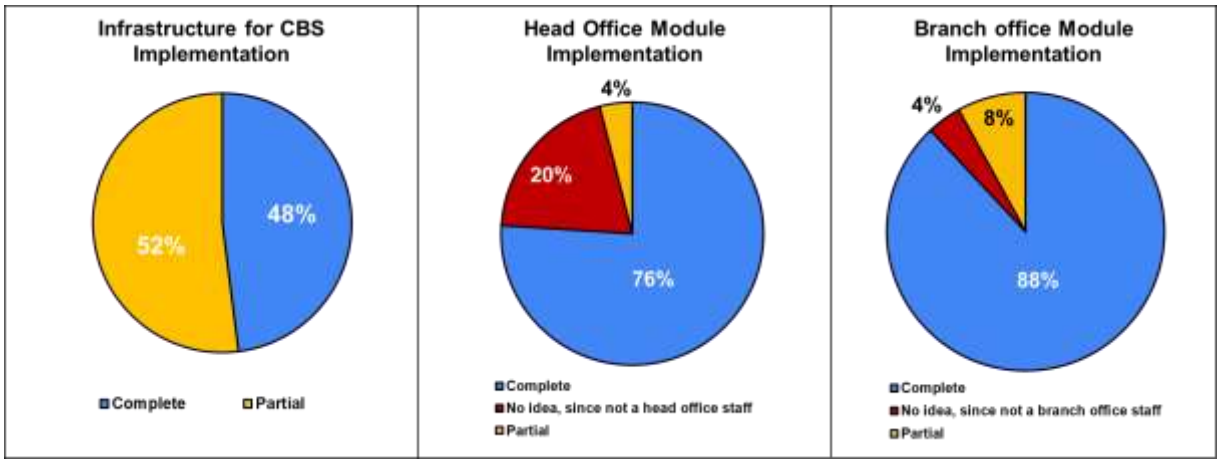
Questions asked in this category are,

1. Do you have the complete infrastructure required for executing the CBS system?
2. Have you implemented subsystems of the Head Office Module? (For e.g. account & general ledger, shares, branch consolidation, transaction reconciliation – inter-branch or bank, HRM, HRIS etc.)
3. Have you implemented subsystems of the Branch Office Module? (For e.g. account opening, deposit, advances, Bills, Delivery channels, and many more)

Observations and Inferences –

Infrastructure is one of the important parts of the use of any technology. Figure 4.12 depicts the status of the CBS infrastructure of the sample banks under consideration.

4.12 Status of CBS Infrastructure



(Source: Compiled by Researcher based on primary data)

According to data acquired from the office personnel, 52% of banks, or more than half, have the whole infrastructure needed to conduct CBS, whereas 48% of banks only have a portion of it. According to respondents, 76% to 88% of banks have fully integrated the head office and branch office modules, while 12% of institutions stated they are only using a partially

implemented CBS module. Since some have never worked at head office, 20% of the respondents had no knowledge of the execution of the head office module.

According to statistics, the majority of banks already operate completely functional head office and branch office modules, but they lack the necessary network, hardware, and software infrastructure to run these modules. There is little doubt that this may have a detrimental effect on the bank office staff members' ability to perform efficiently.

III. Banks tellers - Usability aspect of CBS

For all cooperative banks in India, the RBI mandated the implementation of the CBS in 2014. As was noted in the analysis at the beginning of this chapter, 100% of the sample banks under consideration have done so. Staff members utilize it, but there hasn't been much research done on the usability, or how easy it is to use, of CBS.

Observations and Inferences –

The researcher has formulated seven questions based-on-the-Likert scale which are mapped to usability components discussed in Chapter 3. Table 4.8 shows the details of the questions, their mapping to usability components, and the responses given by the bank office staff.

Along with this the user has also asked questions such as,

1. How many times you required to use the manual of your CORE Banking Software to search the requires functionalities?
2. How many times have been you required to take the help of other staff members to complete your task?

Figure 4.13 answers the above questions. In the context of manual use, 68% of the respondents indicated they sometimes need one, 4% said regularly, and 12% said they've never needed one to carry out activities. 16% of respondents said that they don't have a Manual.

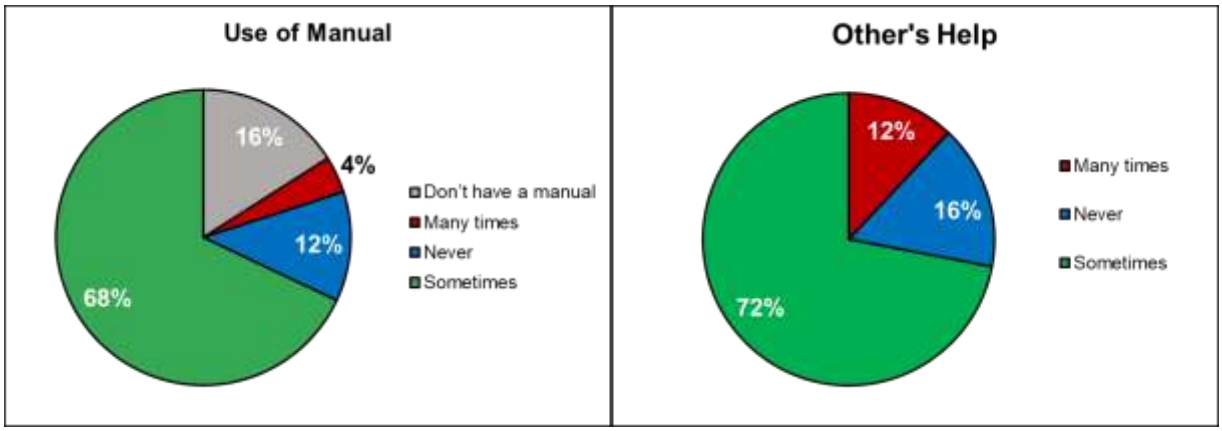
72% of bank employees say they sometimes ask a colleague for help, 12% say they do so many times, and 16% of employees say they never ask a colleague for assistance.

Table 4.8 – Bank Teller- Usability Rating

Sr. No.	Questions	Mapping to Usability Component	Poor		Satisfactory		Moderate		Good		Excellent	
			Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	Ease in carrying out functionality	Learnability / Memorability	0	0	13	52	10	40	2	8	0	0
2	User Interface (Graphical User Interface)	Learnability / Memorability	0	0	12	48	11	44	2	8	0	0
3	Use of Security features	Learnability / Memorability	1	4	7	28	9	36	8	32	0	0
4	Ease in Report Generation	Learnability / Memorability	0	0	11	44	10	40	4	16	0	0
5	Navigation through Modules	Memorability	1	4	4	16	15	60	5	20	0	0
6	Understandability of the error.	Fewer Errors	1	4	11	44	13	52	0	0	0	0
7	Increase in the speed of work	Efficiency	0	0	5	20	10	40	10	40	0	0

(Source: Compiled by Researcher based on primary data)

Figure 4.13: Status of Help Required while using CBS

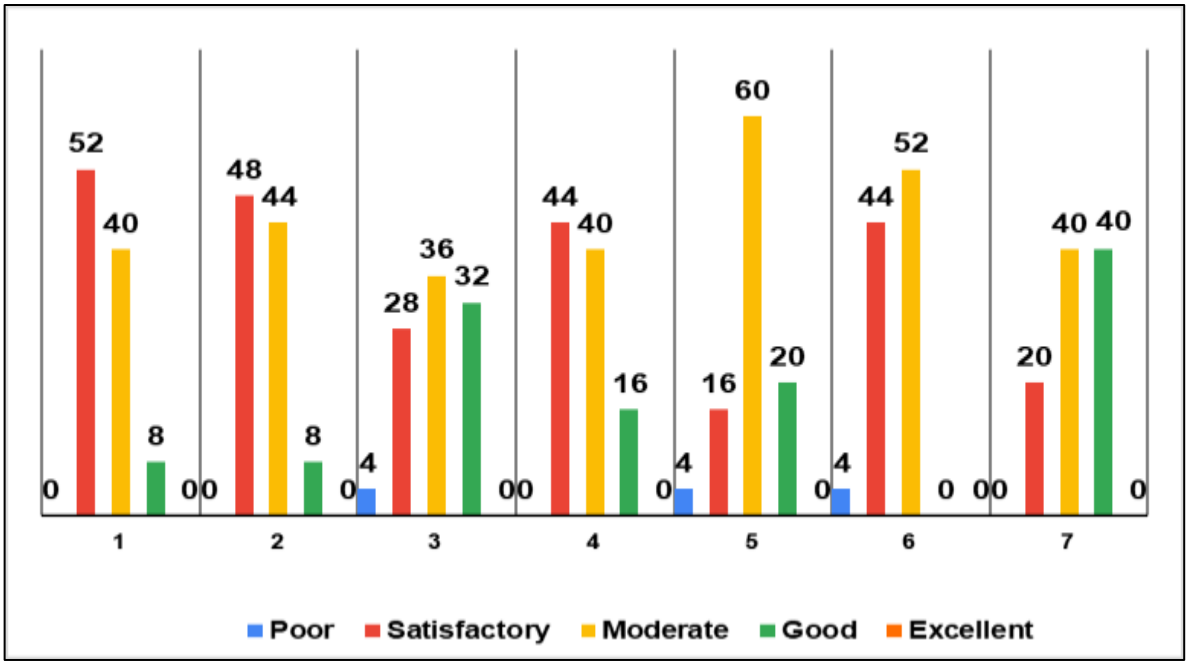


(Source: Compiled by Researcher based on primary data)

Figure 4.14 gives the graphical representation of the data presented in Table 4.8. The data and above chart clearly mention that none of the participants has rated any of the above questions as '*Excellent'* and very few participants have given a rating as *'Poor'* to the functionalities like - Use of security measures, Navigations through the module, and Understandability of the errors.

With this data, the researcher has inferred that, from sample bank data, office staff are not at all *'Good'* in understanding the technical error which increases their dependency on IT staff ultimately increasing the burden of the IT staff.

Figure 4.14: Graphical representation of Bank Teller- Usability Rating



(Source: Compiled by Researcher based on primary data) *Data is in percentage.*

The average rating of the questions focusing on Learnability & Memorability is *'Satisfactory'* and *'Moderate'* i.e., around 50% to 55% which implies ease of use of the above-mentioned functionalities needs to be improved which ultimately can result in improving the overall performance of the banks.

Analysis from figure 4.14, depicts that these employees occasionally seek assistance from their coworkers or the CBS user handbook. However, one startling finding that has been made here is that 16% of banks don't have user manuals, which can't be disregarded. User manuals should always be handy in case someone gets stuck while carrying out the functionalities since they will undoubtedly be of assistance.

IV. Problems faced during using CBS

Questions from these categories focus on the problems faced by the bank office staff while using CBS. The researcher has identified 11 such questions and asked respondents to mark their responses on a Likert scale of 4.

Observations and Inferences –

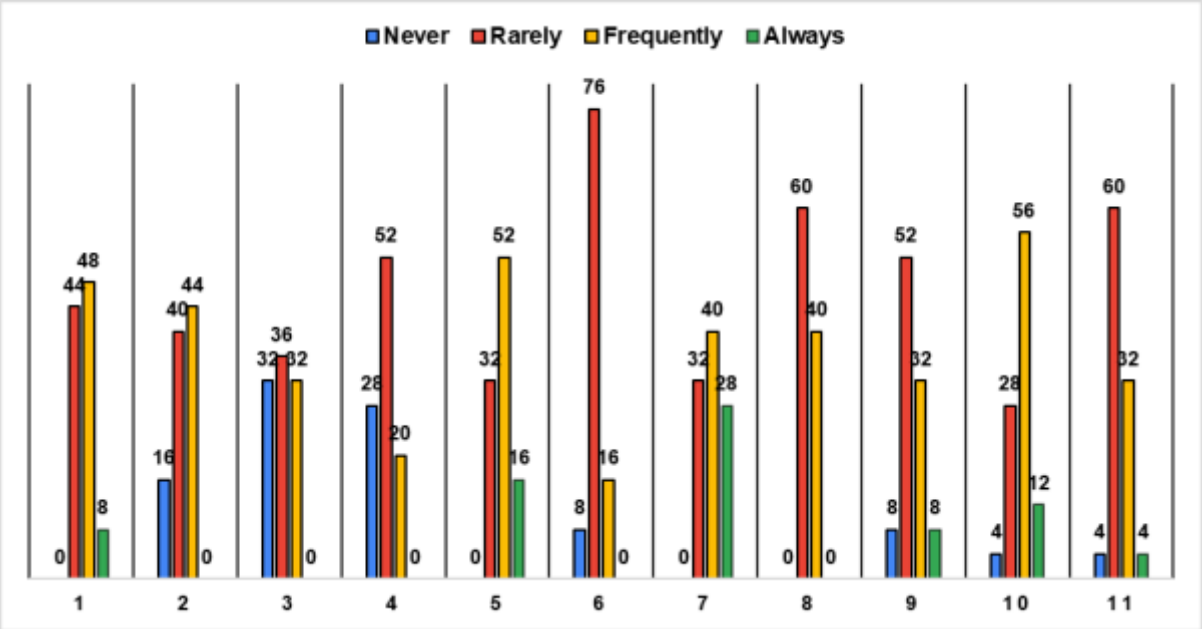
Table 4.9 – Bank Teller- Problems faced while using CBS

Sr. No	Question	Never		Rarely		Frequently		Always	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Application Runs Slowly	0	**0**	11	**44**	12	**48**	2	**8**
2	Changes implemented (CBS) without prior information	4	**16**	10	**40**	11	**44**	0	**0**
3	Data loss due to system update	8	**32**	9	**36**	8	**32**	0	**0**
4	External threats like virus, worm, phishing, trojan horse etc	7	**28**	13	**52**	5	**20**	0	**0**
5	Network connection issues	0	**0**	8	**32**	13	**52**	4	**16**
6	Employee IT Illiteracy	2	**8**	19	**76**	4	**16**	0	**0**
7	Customer IT Illiteracy	0	**0**	8	**32**	10	**40**	7	**28**
8	Breakdown of ATMs	0	**0**	15	**60**	10	**40**	0	**0**
9	Error in Delivery Channels	2	**8**	13	**52**	8	**32**	2	**8**
10	Vendor Support	1	**4**	7	**28**	14	**56**	3	**12**
11	Server down/ Data accessibility issue	1	**4**	15	**60**	8	**32**	1	**4**

Source: Compiled by Researcher based on primary data

The data shows that, more than or equal to 40% of the times front office staff are frequently or always facing problems of application execution speed, changes made in the application without prior information, Delivery channel error, customer IT literacy, ATM breakdowns, network connection issues and vendor support.

Figure 4.15: Graphical representation of Bank Teller- Problems faced during using CBS



Source: Compiled by Researcher based on primary data

Table 4.9 is shown graphically in Figure 4.15, which makes it obvious that these issues must be resolved if the bank is to perform better. And having a strong and professional IT staff that can successfully handle these technological issues is important. One of the significant issues that is apparent is vendor support. Banks should thus work to reduce their reliance on their vendors. Banks should have an appropriate operational infrastructure and a competent technical team who can customize it according to requirements if they want to increase application execution speed and server-down issues.

4.2.6 Responses Received from Technocrats from the cooperative banks

The whole task of establishing and administering the bank's entire IT infrastructure falls on technocrats or the employees who serve as technical staff in the banks. They must also respond to questions posed by the managerial staff and employees working in the bank office. In this instance, some of the questions the researcher posed to the technocrats were comparable to those posed to the bank office workers, but some were unique. Because various technocrats and office workers may have diverse perspectives on the same issue.

So, to analyze the issues faced by the technocrats, the researcher has categorized the questionnaire into the following categories.

I. IT Infrastructure and Department
II. Involvement during the implementation of CBS
III. Technical and Security Training of CBS
IV. Usability aspect of CBS
V. Status of Network Aspect handled by technical staff
VI. Status of Security Aspect handled by technical staff
VII. Authentication and Security to Customer
VIII. Problems faced during using CBS

I. IT Infrastructure and Department

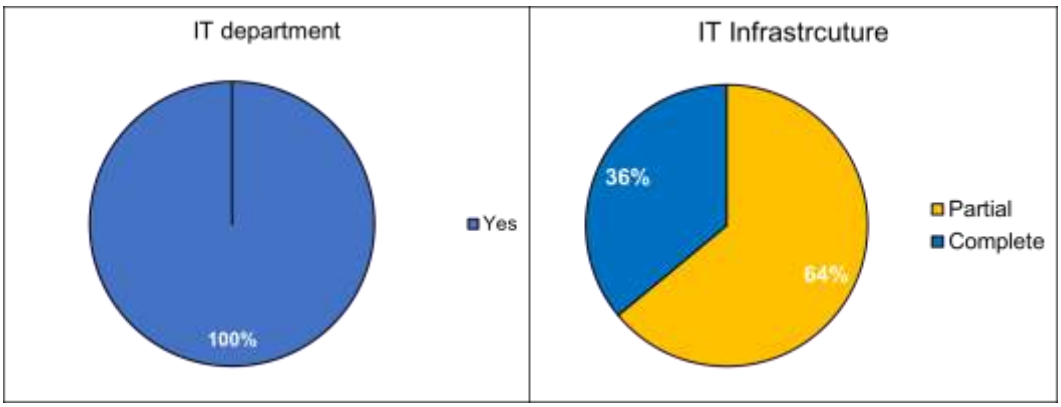
To implement any technology, the IT department is a must. The researcher asked the question about the same to the technical staff of the bank such as,

1. Do you have an IT department?
2. Do you have the complete IT infrastructure in the banks?

Observations and Inferences –

Figure 4.16 shows the data received from the technical staff of the bank which states that all the banks under consideration have separate IT departments but only 36% banks have the complete IT infrastructure, other banks, 64% are working with partial capacity.

Figure 4.16 Status of IT Infrastructure and Department Received from Bank Technical Staff



(Source: Compiled by Researcher based on primary data

The data above indicates that in order for banks to operate to their maximum CBS functional potential, IT infrastructure must be completely implemented. Additionally, the technical staff's response to the question of whether the bank has an IT infrastructure differs from the bank office staff's response (see figure 4.12), who state that only 36% of banks have a complete infrastructure in place. The bank office staff stated that 52% of banks have a complete infrastructure in place.

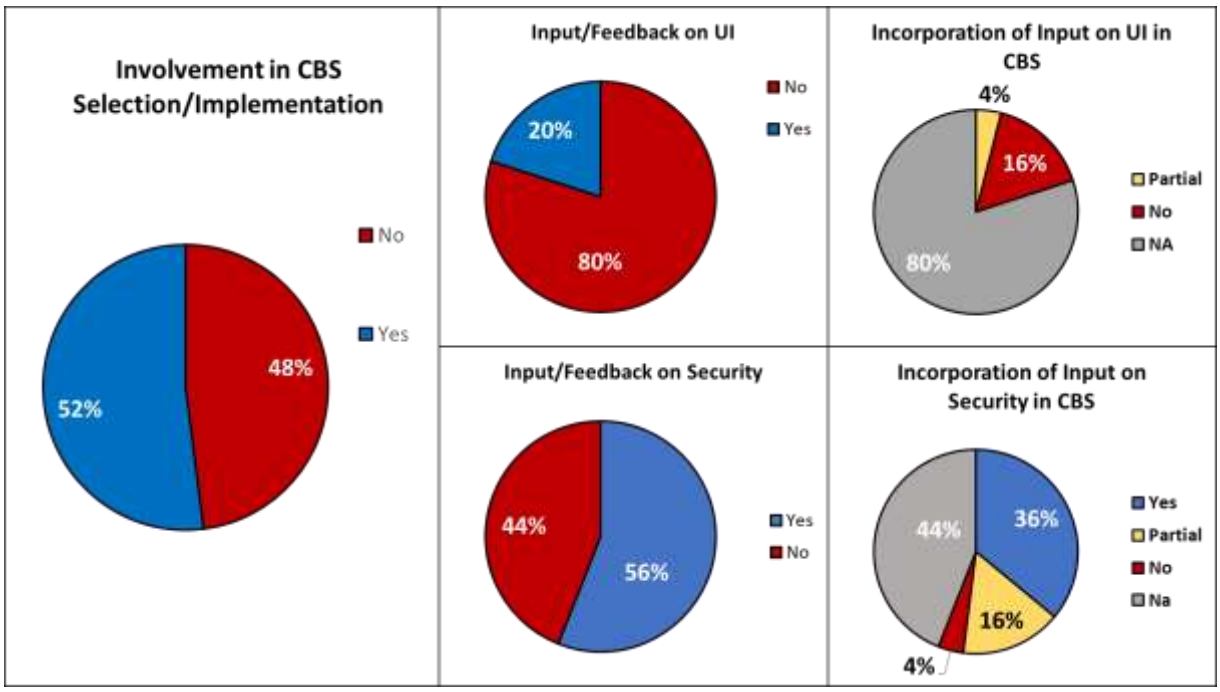
II. Involvement during the implementation of CBS

Questions asked in this category are listed below,

1. In the development/implementation stage of the CBS, has your management involved you in the discussion with the development team?
2. Has the vendor development team of your CBS asked your input/feedback on the design of User Interface (UI)?
3. If you have suggested any changes, have those changes related to User Interface (UI) been incorporated in the software?
4. Has the vendor development team of your CBS asked your input/feedback on the CBS Security Measure implemented in your bank?
5. If you have suggested any changes, have those changes related to CBS Security Measures been incorporated in the software?

Observations and Inferences –

Figure 4.17 Status of Involvement and Suggestions on CBS by Management



(Source: Compiled by Researcher based on primary data

Figure 4.17 clearly shows that 52% of sample banks involve their technical staff in the CBS selection and implementation phases. The research also shows that 56% of CBS vendors request input/feedback on security from the bank's technical personnel, but just 5% of CBS

venders request feedback/input on User Interface. That to-integration ratio of modifications or feedback is quite low from the vendor side, namely 42% for security, of which 16% indicated they had done partial changes, and 4% for user interface, which is also partial.

With the above data, the researcher has inferred that banks should involve their technical staff right from the implementation stage of CBS. This will help them to understand the system and its drawbacks. Also, it is very evident from the data that vendors or the banks are more worried about the security of the system than its usability, whereas if users are not able to use system easily and effectively, security vulnerability changes increases.

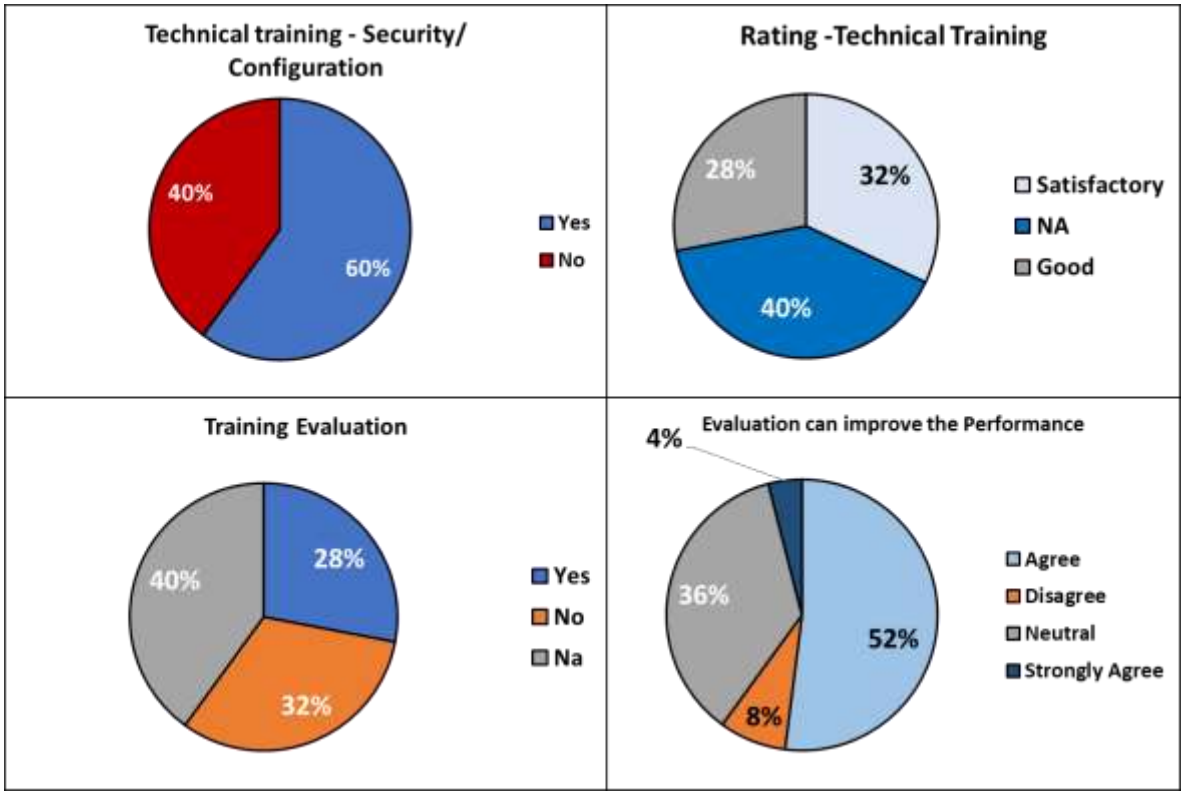
III. Technical and Security Training of CBS

As technical professionals, their knowledge must be kept up to speed with current technological advancements. As a result, regular training is essential. In this area, the researcher asked questions based on the training provided by banks for technology and security knowledge upgradation.

1. Have you received any training from the technical training from implementing the current CBS System as well as security point of view?
2. Rate the training received?
3. Is the evaluation of the training done?
4. Do you think - evaluation after training can improve the performance?

Observations & Inference-

Figure 4.18 Status of technical training on CBS



(Source: Compiled by Researcher based on primary data

60% of the bank's technical workers said they had received training, while 40% said they had not. The received training was rated 'Good' by 28% of the 60% workers, and 'Satisfactory' by the remaining 32%. Only 28% of the instruction was evaluative; the rest was not. Similarly,

to the banking personnel, researchers asked if training assessment may increase performance, to which 4% strongly agreed, 52% agreed, and 36% were neutral.

After evaluating the data, the researcher concluded that banks should focus on providing evaluative technical and security training to their employees, which will undoubtedly help banks reduce their reliance on vendors or outsourcing of technical services.

IV. Usability Aspect of CBS for technocrats

At the beginning of this chapter, while analyzing the data, the researcher has reviewed that all 100% of the sample banks under consideration have implemented the CBS. Following set of questions talks about the usability of implemented CBS from the technical staff's perspective. These questions are based on 5 scales Likert scale.

Observations and Inferences–

Table 4.10 contains the specifics of the queries and responses provided by the technical staff.

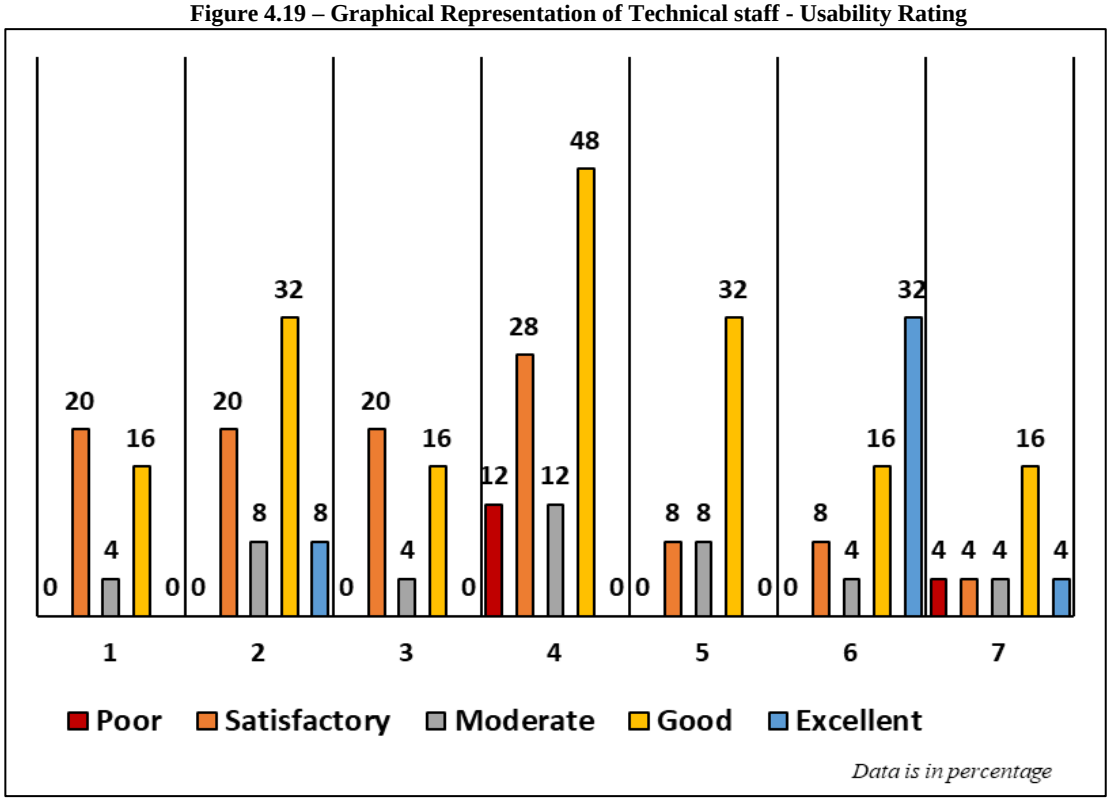
Table 4.10: Technical Staff-Usability aspect

Sr. No	Questions	Mapping to Usability Component	Poor		Satisfactory		Moderate		Good		Excellent	
			Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Ease in carrying out functionality	Learnability / Memorability	0	0	5	20	1	4	19	76	0	0
2	User Interface	Learnability / Memorability	0	0	5	20	2	8	16	64	2	8
3	Use of Security features	Learnability / Memorability	0	0	5	20	1	4	19	76	0	0
4	Ease in Report Generation	Learnability / Memorability	3	12	7	28	3	12	12	48	0	0
5	Navigation through Modules	Memorability	0	0	2	8	2	8	21	84	0	0
6	Understandability of the error	Fewer Errors	0	0	2	8	1	4	14	56	8	32
7	Increase in the speed of work	Efficiency	1	4	1	4	1	4	21	84	1	4

(Source: Compiled by Researcher based on primary data

According to the statistics, technical personnel assessed the usability of the CBS functionality as *'Good'*, while error understandability was rated as *'Excellent'* by 32% of technical staff. The highest grade of *'Good'* was given by 84% of technical staff who cited navigation through modules and increased execution speed, and 76% of employees who mentioned easy of carrying out functionality and use of security measures. In comparison to several of the preceding functions, report generating has a lower usability grade. Some 12% of the employees has also given it a *'Poor'* rating.

Figure 4.19 – Graphical Representation of Technical staff - Usability Rating



(Source: Compiled by Researcher based on primary data)

Out of 7, only 2 functionalities have received an *'Excellent'* rating. Also usability of the report generation according to the data is 'Poor'. There is a scope of improvement in the usability of the fucntionalities provided by the CBS.

V. Status of Network Aspect Handled by the Technocrats

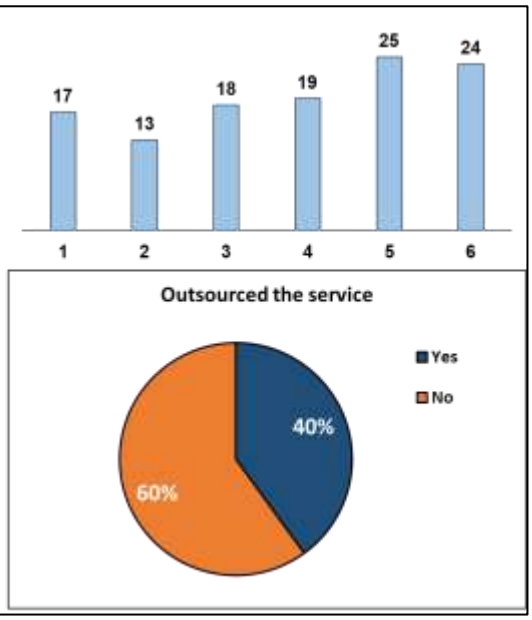
The following questions related to network implementation in banks are asked by the researcher.

1. Tick the network aspects handled by the Network administrator- the set of networking configuration questions is provided. Respondents just need to tick the one which is handled by the bank.
2. Do you need to outsource the services to maintain the HW/Network infrastructure?

Observations & Inferences –

Figure 4.20 - Status of Network Aspect Implemented by Technical Staff

Sr. No.	Network Aspect Handled	Banks
1	Network monitoring for security violation	17
2	Intrusion Detection System (IDS) deployment	13
3	Firewall deployment	18
4	Vulnerability assessment at periodical levels	19
5	Restriction on secondary Device connect	25
6	No access to bank WiFi	24



(Source: Compiled by Researcher based on primary data)

The researcher has observed that almost all banks have restricted the use of secondary devices in the banks by the staff members and 96% have also restricted the use of bank Wi-Fi only for CBS activities. 76% have responded that periodic vulnerability assessment is done in the bank network as well as 70 to 74% have deployed Firewall and doing Network monitoring. As compared to these only 64% of banks have deployed Intrusion Detection Systems (IDS). But to implement these network security aspects, 40% of the banks have outsourced the services.

More than 60% of Sample banks under consideration are concerned about the network security aspect in the banks but many of the banks 40% are outsourcing these services which increases the dependency on the service provider and also creates a risk to the system.

VI. Status of Security Aspect Handled by the Technocrats

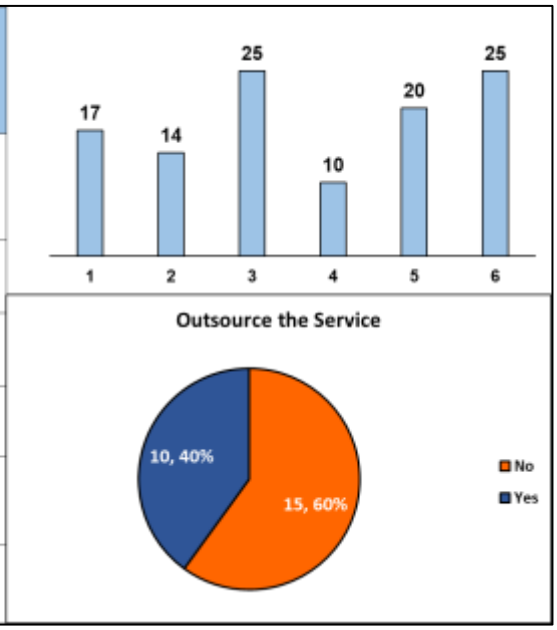
Security is the most important part of any financial institution. The researcher has designed the following questions to understand which security aspects are covered by the technical staff of the banks for security.

1. Tick the security aspects handled by the technical person.
2. Do you need to outsource the services to maintain the security infrastructure?

Observations and Inferences -

Figure 4.21 - Status of Security Aspect Implemented by Technical Staff

Sr. No.	Security Aspect	Banks
1	Changes in the default Password	17
2	Netted IP address id used	14
3	Licensed OS	25
4	Security Patch Update in OS	10
5	Maintenance and review of logs	20
6	Authentication and Access Control	25



(Source: Compiled by Researcher based on primary data)

Data shows that all banks have a licensed operating system but only 40 % updated the security patches in that and they have implemented authentication and access control mechanisms. 80% are maintaining and reviewing the logs. In this case, also, the researcher has observed that % have outsourced the services for implementation of security.

Most of cases, they have outsourced this service through CBS vendors only which increases the dependency on the service provider and also creates a risk to the system.

VII. Authentication & Security for Customers

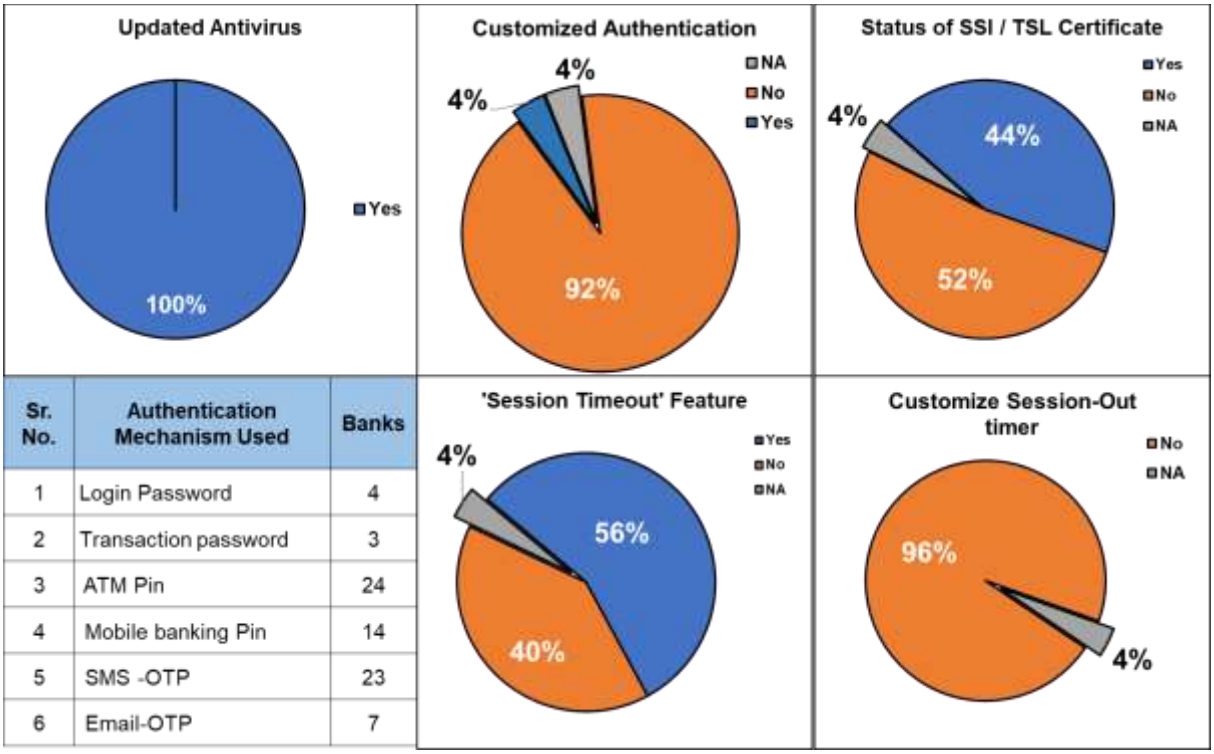
Different banks have different authentication and security mechanisms implemented in their delivery channels which are used by the customers. The researcher has asked questions based on that to the technical staff of the bank to understand what all features are provided to the customers.

1. Tick the authentication you are providing to the customers.
2. Do you provide options to the customer to choose his security mechanism?
3. Do you have a 'Session timeout' security feature implemented in your e-banking?
4. Can the Customer adjust his 'session timeout ' period?
5. Do you have an updated antivirus in your Network?
6. Do you have Secure Socket Layer (SSL) / Transport Secure Layer (TSL) certificate for Internet banking / Mobile Banking/ ATM?

Observations and Inferences -

Figure 4.22 depicts the answers to the above questions.

Figure 4.22 - Status of Authentication and Security provided to the Customer



Sr. No.	Authentication Mechanism Used	Banks
1	Login Password	4
2	Transaction password	3
3	ATM Pin	24
4	Mobile banking Pin	14
5	SMS -OTP	23
6	Email-OTP	7

(Source: Compiled by Researcher based on primary data)

The data clearly shows that while 100% of banks have upgraded their antivirus, only 44% have issued SSL/TSL certificates for secure financial transactions for E-banking.

According to the earlier analysis, only 3 of the 25 sample banks provide Internet banking services, so these institutions provide all the authentication mechanisms described in Figure 4.22. From the sample banks under consideration, ATM services are provided by 24 banks and mobile banking is provided by 14 banks. SMS-OTP is used as an authentication mechanism by 23 banks, whereas Email-OTP is used by 7 banks. As an authentication method, 14 banks use the session timeout functionality.

Furthermore, data suggests that none of these security features are customizable. Customization of the authentication technique can improve the usability of the security that banks enforce. Obviously, banks must be more vigilant in this regard, but it is critical that customers have the option of selecting their own security solution.

VIII. Problems faced by the Technocrats.

Questions from these categories focus on the problems faced by the bank office staff while using CBS. The researcher has identified 11 such questions and ask respondents to mark their responses on the Likert scale of 4.

Observations and Inferences -

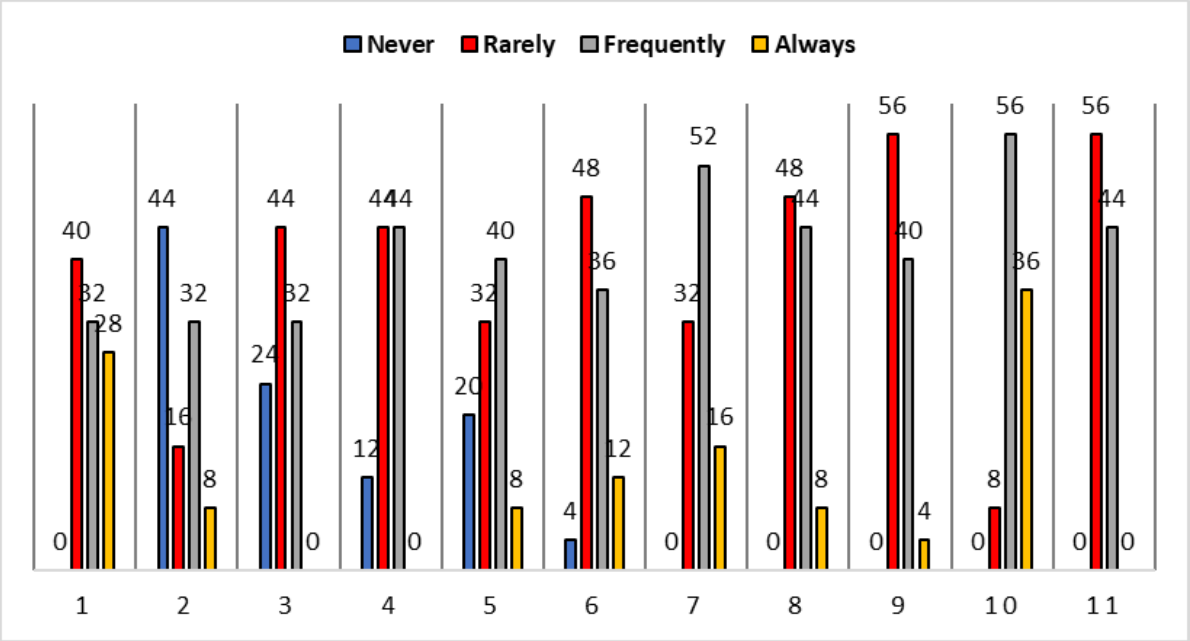
The researcher has observed that 92% of respondents have very less vendor support. Apart from those most frequent / always problems those banks have to face, are ATM breakdown, Server down, Errors in the delivery channels, Customer IT literacy and technical people are also facing problems of employee IT literacy.

Table 4.11: Technical Staff - Problems faced while Using CBS

Sr. No	Question	Never		Rarely		Frequently		Always	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Application Runs Slowly	0	**0**	10	**40**	8	**32**	7	**28**
2	Changes implemented(CBS) without prior information	11	**44**	4	**16**	8	**32**	2	**8**
3	Data loss due to system updation	6	**24**	11	**44**	8	**32**	0	**0**
4	External threats like virus, worm, phishing, trojan horse etc	3	**12**	11	**44**	11	**44**	0	**0**
5	Network connection issues	5	**20**	8	**32**	10	**40**	2	**8**
6	Employee IT Illiteracy	1	**4**	12	**48**	9	**36**	3	**12**
7	Customer IT Illiteracy	0	**0**	8	**32**	13	**52**	4	**16**
8	Breakdown of ATMs	0	**0**	12	**48**	11	**44**	2	**8**
9	Error in Delivery Channels	0	**0**	14	**56**	10	**40**	1	**4**
10	Vendor Support	0	**0**	2	**8**	14	**56**	9	**36**
11	Server down/ Data accessibility issue	0	**0**	14	**56**	11	**44**	0	**0**

(Source: Compiled by Researcher based on primary data)

Figure 4.23 – Graphical representation -Technical staff- Problems faced while using CBS



(Source: Compiled by Researcher based on primary data)

Figure 4.23 depicts the graphical representation of table 4.11. Problems faced by the technical staff and bank office staff are similar in nature, but the severity of these problems is different to each of them. Evaluative and demonstrative training will surely help to reduce these problems.

4.2.7 Responses Received from Customers of the cooperative banks

Customers are connected to the banks via these delivery channels (ATMs, internet banking, and mobile banking). It is clear from figure 4.5 that out of 25, there are 14 banks which provide E-banking facilities like ATMs, internet banking, and mobile banking to the customers. The details of these banks are given in table 4.12.

Customer sample size, calculated using finite population formula is 139. For this research study, the researcher collected data from 225 customers having their bank account in the banks mentioned in the table 4.12, using google form. (Refer page no. 18 for more details)

Table 4.12: Banks Details with customer count

Sr. No.	Bank Name	E-banking service			Customer Count
1	Janata Sahakari Bank Ltd	ATM	Net banking	Mobile Banking	174608
2	Janseva Sahakari Bank Ltd	ATM	Net banking-Viewonly	Mobile Banking	40431
3	Jijamata Mahila Sahakari Bank Ltd	ATM		Mobile Banking	10891
4	Mahesh Sahakari Bank Ltd	ATM	Net banking	Mobile Banking	11826
5	Pavana Sahakari Bank Ltd	ATM		Mobile Banking	11507
6	Pune Cantonment Sahakari Bank Ltd	ATM		Mobile Banking	19217
7	Pune District Central Cooperative Bank Ltd	ATM	Net banking	Mobile Banking	10999
8	Pune People's Cooperative Bank Ltd	ATM		Mobile Banking	37341
9	Rajashree Shahu Sahakari Bank Ltd	ATM		Mobile Banking	10239
10	Sadhana Sahakari Bank Ltd	ATM		Mobile Banking	19564
11	Sampada Sahakari Bank Ltd	ATM		Mobile Banking	12087
12	Sant Sopankaka Sahakari Bank Ltd	ATM		Mobile Banking	10421
13	Suvarnayug Sahakari Bank Ltd	ATM		Mobile Banking	20853
14	Vishweshwar Sahakari Bank Ltd	ATM		Mobile Banking	22777
Total Cutomer Count					**412761**

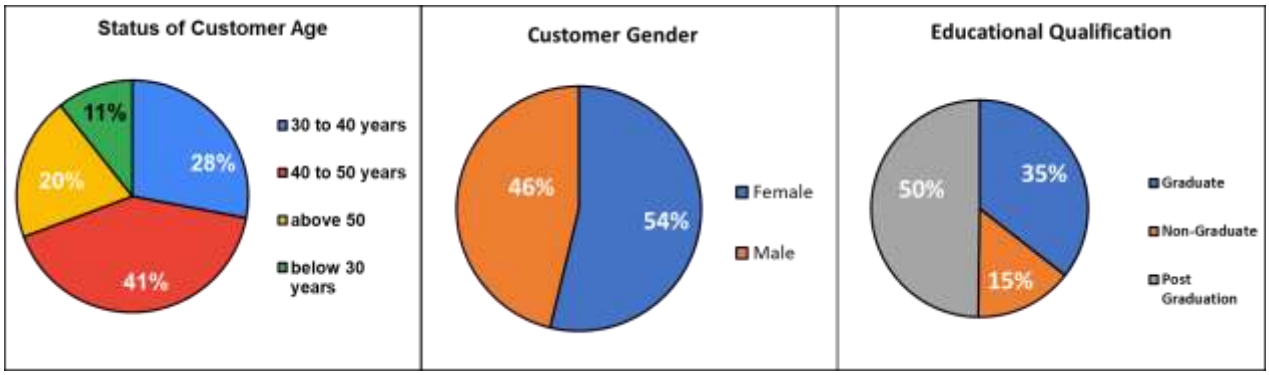
(Source: Compiled by Researcher based on primary data)

Along with demographic questions, the questionnaire contains questions based on the customer's experiences with usability and security experience while using e-banking facility.

I. Reponses of customers on Demographic questions

Figure 4.24 shows the responses received by the researcher from customers on demographic questions.

Figure 4.24: Customer Details



Age	Respondents
30 to 40 years	63
40 to 50 years	93
above 50	45
below 30 years	24

Gender	Count
Female	121
Male	104

Educational Qualification	Count
Graduate	80
Non-Graduate	33
Post Graduation	112

(Source: Compiled by Researcher based on primary data)

Observations and Inferences -

According to the customer information we have, just 11% of respondents from the sample banks are under the age of 30. customers between the ages of 30 and 50 make up 69% of the total, while customers over 50 make up 20% of the total. Of these 225 clients, 54% of the responders are women and 46% are men. Additionally, according to the data, 35% of respondents have graduated, and 50% of respondents are highly qualified.

With this, the researcher has deduced that the majority of the cooperative banks' clients are highly qualified based on the sample banks under examination. However, the number of respondents under 30 years old is lower, which suggests that relatively few young people are associated with cooperative banks.

II. Opinion about usability and security of the E- banking facility provided by the banks

Usability and Security factors affecting technology use have been discussed in chapter 3. Based on that the researcher has designed the questions from questionnaire. The respondents were asked to rate these 12 factors. Table 4.13 gives the analysis of the responses received from the customers.

Table 4.13: Usability & Security Aspect - Customer

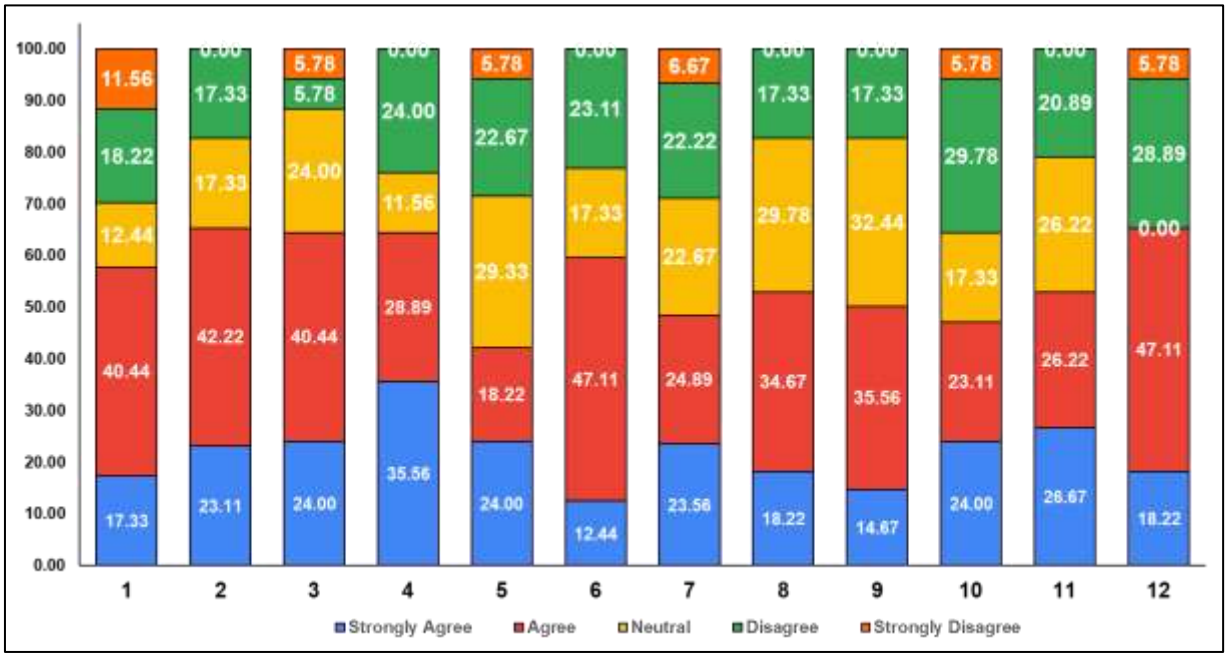
Sr. No.	Questions	Usability Components	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
			Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
1	Remembering the e-banking user-name along with account number is difficult	Memorability	39	17.33	91	40.44	28	12.44	41	18.22	26	11.56
2	Remembering various passwords is difficult	Memorability	52	23.11	95	42.22	39	17.33	39	17.33	0	0.00
3	Password policies enforced by the banks are demanding	Learnability	54	24.00	91	40.44	54	24.00	13	5.78	13	5.78
4	Changing password/pin is challenging	Learnability/Memorability	80	35.56	65	28.89	26	11.56	54	24.00	0	0.00
5	Login process of my e-banking is difficult	Learnability/Memorability	54	24.00	41	18.22	66	29.33	51	22.67	13	5.78
6	OTP generation does not happen withing given time limit	Efficiency	28	12.44	106	47.11	39	17.33	52	23.11	0	0.00
7	Not able to finish work before session time out	Efficiency	53	23.56	56	24.89	51	22.67	50	22.22	15	6.67
8	Navigation through the website/ App/ interface is complex	Learnability/Memorability	41	18.22	78	34.67	67	29.78	39	17.33	0	0.00
9	Error messages are not understandable	Fewer Error	33	14.67	80	35.56	73	32.44	39	17.33	0	0.00
10	It's difficulty to deal with different interfaces for different bank's ATM centre	Learnability / Fewer Error	54	24.00	52	23.11	39	17.33	67	29.78	13	5.78
11	I know security is important but Security Measures Implemented are overburdening	Satisfaction	60	26.67	59	26.22	59	26.22	47	20.89	0	0.00
12	Security Customization	Satisfaction	41	18.22	106	47.11	0	0.00	65	28.89	13	5.78

(Source: Compiled by Researcher based on primary data)

Observations and Inferences -

The researcher has observed that, on average more than 65% of respondents agree that they are facing the problems mentioned in the above table. Figure given below shows the graphical representation of the data depicted in table 4.13.

Figure 4.25 – Graphical representation - Usability & Security Aspect - Customer



(Source: Compiled by Researcher based on primary data)

Further, it has been observed that,

a) 58% of the respondents very strongly concurred that Remembering the e-banking user name along with the account number is difficult and More than 65% of the respondents strongly agreed that Remembering various passwords is difficult. Both of these factors really reduce the memorability aspect of usability.

b) 64% of responses predicts that Password policies enforced by the banks are demanding that hinder the learnability aspect of the usability.

c) Changing password or pin is difficult for 63.89% of represents, 42.22% of respondents find login process difficult, and around 53% are not able to find the appropriate functionality which hampers memorability and learnability aspect of usability

d) While 48% of respondents are experiencing session timeout problems, 59.55% of respondents have trouble generating OTP. The usability issue of efficiency in terms of time is hampered by all these issues.

e) When 47% of respondents are unable to deal with the various interfaces for various banks' ATM centres, 50% of respondents are unable to comprehend technical errors that occur when working with banking websites. The usability issue of less mistake and learnability is hampered by these issues.

f) While 53% of respondents believe that security is vital, they feel that the security measures in place are burdening them, and 65.3% believe that security has to be customised. It is the satisfaction aspect of the usabaility

According to the statistics, it is clear that while offering customers the option of using electronic banking, both system usability and security must be taken into account.

4.3 Hypothesis Testing

A research hypothesis (or scientific hypothesis) is an assumption regarding the expected relationship between variables that is straightforward, explicit, testable, and verifiable. A hypothesis is developed by the researcher based on knowledge gathered through a literature review, existing models, frameworks, established hypotheses, and so on. Following that, the hypothesis is validated using the appropriate statistical approach and statistic value.

In this research, the researcher has proposed four hypotheses. These hypotheses will address the research objective established at the outset.

Table 4.14: Hypothesis Statements

Hypothesis No	Statement
H1	The Usability perception of the Core Banking System (CBS) varies depending on the position of the staff working in the banking organization.
H2	The proper training provided to the bank employees is correlated to the usability of the Core Banking System (CBS)
H3	The involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.
H4	Cooperative bank customers are not satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking).

The following steps are involved in the hypothesis testing described in this study.

1. Formulating a null hypothesis
2. Formulating an alternative hypothesis in response to each null hypothesis
3. Establishing the significance threshold (a) for testing the hypothesized value
4. Determine the test statistic and the associated p-value.
5. Drawing conclusions from test statistics.

4.3.1 Hypothesis Testing-1

The first hypothesis is formulated to understand the perceptions about the usability of CBS from staff members working in the different positions in the banks.

Null Hypothesis:

H_0: The Usability perception of the Core Banking System (CBS) does not vary depending on the position of the staff working in the banking organization.

Alternative Hypothesis:

H_a: The Usability perception of the Core Banking System (CBS) varies depending on the position of the staff working in the banking organization.

The usability aspect of the implemented technology has been studied through 5 components mentioned in the Chapter-3.

To better understand the above problem, the researcher has divided the users of CBS in cooperative banks into two groups, i.e., technical staff and non-technical staff (Bank Offic /Clerical staff). There are varieties of usability issues of CBS are there that are faced by the bank employees. The intensity of the problem depends on the technological knowledge of employees in the bank.

The researcher has analyzed usability issues in table 4.7 and table 4.9 for bank office staff and technical staff. The following table represents the information about various usability issues in CBS implementation faced by technical staff and clerical staff.

Table 4.15: Hypothesis-1 Data

Sr. No.	Particular	Clerical Staff		Technical Staff		d=Rx-Ry	d^2
		Wt. Avg	Rank	Wt. Avg	Rank		
		x	Rx	y	Ry		
1	Use of Security features	5.13	5	6.000	5	0	0
2	Ease in carrying out functionality	5	6	5.87	6	0	0
3	User Interface (Graphical User Interface)	5.3	3	6.1	4	-1	1
4	Ease in Report Generation	4.4	7	4.73	7	0	0
5	Navigation through Modules	5.6	2	6.13	3	-1	1
6	Understandability of the error.	5.9	1	6.8	1	0	0
7	Increase in the speed of work	5.22	4	6.27	2	2	4

(Source: Compiled by Researcher based on primary data)

To determine if there is a correlation between usability issues amongst the above-mentioned groups, **Spearman's Correlation** coefficient is used. Where, n=7

$$r = 1 - \frac{6 \cdot \sum d^2}{n\left(n^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 6}{7 \cdot \left(7^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 6}{7 \cdot (49 - 1)}$$

$$= 1 - \frac{36}{336}$$

$$= 1 - 0.1071$$

$$= 0.8929$$

$$\underline{\mathbf{r = 0.8929}}$$

The rank correlation coefficient is 0.89, which is greater than P-value (0.05). So, the researcher has failed to accept the Null Hypothesis and accepted the Alternative Hypothesis which states that - **The Usability perception of the Core Banking System (CBS) varies depending on the position of the staff working in the banking organization.**

4.3.2 Hypothesis Testing -2

This hypothesis is formulated to understand the efforts taken by the cooperative banks for the adoption of CBS from the usability perspective by the staff members.

Null Hypothesis:

H_0: The Usability of the Core Banking System (CBS) does not depend on the training provided to the bank employees.

Alternative Hypothesis:

H_a: The Usability of the Core Banking System (CBS) depends on the training provided to the bank employees.

To better understand the above problem, the researcher has divided the users of CBS in cooperative banks into two groups, employees of the banks who have received the training and employees who have not received the training. Data suggests that 15 banks have conducted the training for their employees whereas employees from the remaining10 banks have not received the training. Refer figure 4.17.

The table 4.14 represents the information about various usability issues in CBS implementation faced by trained and non-trained employees of the banks.

Table 4.16: Hypothesis-2 Data

Sr. No.	Particular	Trained Staff		Non-Trained Staff		d=Rx-Ry	d^2
		Wt. Avg	Rank	Wt. Avg	Rank		
		x	Rx	y	Ry		
1	Use of Security features	3.6	5	2.1	6	-1	1
2	Ease in carrying out functionality	3.47	6	2.3	3	3	9
3	User Interface (Graphical User Interface)	3.73	4	2.27	4	0	0
4	Ease in Report Generation	3.2	7	1.52	7	0	0
5	Navigation through Modules	3.87	2	2.2	5	-3	9
6	Understandability of the error.	4.27	1	2.53	1	0	0
7	Increase in the speed of work	3.8	3	2.47	2	1	1

(Source: Compiled by Researcher based on primary data)

To determine if there is a correlation between usability issues amongst the above-mentioned groups, **Spearman's Correlation** coefficient is used. Where, n=7

$$r = 1 - \frac{6 \cdot \sum d^2}{n\left(n^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 20}{7 \cdot \left(7^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 20}{7 \cdot (49 - 1)}$$

$$= 1 - \frac{120}{336}$$

$$= 1 - 0.3571$$

$$= 0.6429$$

$$\underline{\mathbf{r = 0.6429}}$$

The rank correlation coefficient is 0.6429, which is greater than P-value (0.05). So, the researcher has failed to accept the Null Hypothesis and accepted the Alternative Hypothesis which states that - **The Usability of the Core Banking System (CBS) depends on the training provided to the bank employees.**

4.3.3 Hypothesis Testing -3

This hypothesis is formulated to understand does the involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.

Null Hypothesis:

H_0: The involvement of technical staff during the implementation phase of CBS cannot reduce the problems faced while using CBS.

Alternative Hypothesis:

H_a: The involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.

Table 4.17 represents the information about various usability issues in CBS implementation faced by trained and non-trained employees of the banks.

Table 4.17: Hypothesis-3 Data

Sr. No.	Particular	IT Involvement		IT Non-Involvement		d=Rx-Ry	d2
		Wt. Avg	Rank	Wt. Avg	Rank		
		x	Rx	y	Ry		
1	Application Runs Slowly	3.4	5	1.9	5	0	0
2	Changes implemented(CBS) without prior information	4.8	1	2.6	3	-2	4
3	Data loss due to system updation	4.1	2.5	3.2	1	1.5	2.25
4	External threats like virus, worm, phishing, trojan horse etc	3.8	4	2.9	2	2	4
5	Network connection issues	4.1	2.5	2.5	4	-1.5	2.25

(Source: Compiled by Researcher based on primary data)

To determine if there is a correlation between usability issues amongst above-mentioned groups, **Spearman's Correlation** Coefficient is used. Where, n=5

$$r = 1 - \frac{6 \cdot \sum d^2}{n\left(n^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 12.5}{5 \cdot \left(5^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 12.5}{5 \cdot (25 - 1)}$$

$$= 1 - \frac{75}{120}$$

$$= 1 - 0.625$$

$$= 0.375$$

The rank correlation coefficient is 0.375, which is greater than P-value (0.05). So, the researcher has failed to accept the Null Hypothesis and accepted the Alternative Hypothesis which states that - **The involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.**

4.3.4 Hypothesis Testing -4

This hypothesis is formulated to evaluate the relationship between security and usability implemented for perceiving that security with respect to the delivery channel (ATM/Internet banking/Mobile Banking) provided to the customers of Cooperative banks.

Null Hypothesis:

H_o: The cooperative bank customers are not satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking).

Alternative Hypothesis:

H_a: The cooperative bank customers are satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking).

The satisfaction with the usability of security of cooperative bank customers is studied with 12 factors mentioned in table 4.13. In the questionnaire, respondents were asked to rate these 12 factors. This hypothesis could be tested using 'Binomial test', but since binomial test is applicable on responses of dichotomous, the researcher has decided to use **One sample KS test. (Kolmogorov-Smirnov).** Table 4.18 and table 4.19 shows description of the variables involved in the test and the test result.

Table 4.18: Hypothesis-4 Variable Description

Variable Name	Questions
Rating - 1	Remembering the e-banking user-name along with the account number is difficult
Rating – 2	Remembering various passwords is difficult
Rating – 3	Password policies enforced by the banks are demanding
Rating – 4	Changing password/pin is challenging
Rating – 5	Login process of my e-banking is difficult
Rating – 6	OTP generation does not happen withing given time limit
Rating – 7	Not able to finish work before session time out
Rating – 8	Navigation through the website/ App/ interface is complex
Rating – 9	Error messages are not understandable
Rating – 10	It's difficulty to deal with different interfaces for different bank's ATM centre
Rating – 11	I know security is important but Security Measures Implemented are overburdening
Rating - 12	Security Customization

Table 4.19: Hypothesis-4 Data- One Sample KS test at 5% level of significance. α = .005

Variable		Rating-1	Rating-2	Rating-3	Rating-4	Rating-5	Rating-6	Rating-7	Rating-8	Rating-9	Rating-10	Rating-11	Rating-12
N		225	225	225	225	225	225	225	225	225	225	225	225
Normal Parameters[a,b]	Mean	3.3733	3.61	3.65	3.57	3.39	3.42	3.44	3.45	3.32	3.49	3.76	3.64
	Std. Deviation	1.2829	1.144	1.116	1.227	1.227	1.037	1.335	1.051	0.961	1.154	1.064	1.154
Most Extreme Differences	Absolute	0.283	0.263	0.262	0.214	0.162	0.289	0.202	0.202	0.236	0.209	0.226	0.273
	Positive	0.147	0.132	0.147	0.162	0.153	0.173	0.139	0.163	0.160	0.126	0.126	0.140
	Negative	-0.283	-0.263	-0.262	-0.214	-0.162	-0.289	-0.202	-0.202	-0.236	-0.209	-0.226	-0.273
Kolmogorov-Smirnov Z		9.462	10.662	11.395	10.503	10.170	10.636	9.595	10.795	10.795	10.595	11.462	10.995
Asymp. Sig. (P value)		<.001	0.000	<.001	0.000	<.001	<.001	<.001	<.001	<.001	<.001	0.000	<.001

(Source: Compiled by Researcher based on primary data)

On the basis of the test statistic result, it is observed that all the P–values (with reference to table test result of 1-sample KS test) are less .005. Therefore alternate hypothesis is rejected and null hypothesis is accepted which states that - **The cooperative bank customers are not satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking).**

4.4 Concluding Remarks

Following table shows the summary of the hypothesis tested.

Table 4.20 : Hypotheses Testing Summary

Hypothesis	Statement	Test Applied	Status of Null Hypothesis
H1	The Usability perception of the Core Banking System (CBS) varies depending on the position of the staff working in the banking organization.	Spearman's correlation coefficient	H_o Rejected
H2	The proper training provided to the bank employees is correlated to the usability of the Core Banking System (CBS)	Spearman's correlation coefficient	H_o Rejected
H3	The involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.	Spearman's correlation coefficient	H_o Rejected
H4	Cooperative bank customers are not satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking).	One Sample KS test (Kolmogorov Smirnov Test)	H_o Accepted

(Source: Compiled by Researcher based on primary data)

With this, the researcher has concluded that,

1. The Usability perception of the Core Banking System (CBS) varies depending on the position of the staff working in the banking organization.
2. The usability of the Core Banking System (CBS) depends on the training provided to the bank employees.
3. Involvement of technical staff during the implementation phase of CBS can reduce the problems faced while using CBS.
4. The cooperative bank customers are not satisfied with the usability and security features of the delivery channel (ATM/Internet banking/Mobile Banking)

Chapter 5: Observations, Conclusion, and Suggestions

5.1 Introduction

The study concentrated on the challenges that were developing at the time of the study and the usability aspect of the current Core Banking implementation status in chosen cooperative banks. Beginning in late 2000, CBS was used in cooperative banks. Nearly every cooperative bank in the Pune District has completely adopted CBS and is taking the highest level of security precautions to ensure secure transactions. Additionally, this fosters confidence amongst the bank's stakeholders.

The data for this research has been collected from 25 cooperative banks in the Pune district related to the usability aspect of CBS (e-Banking). Data is collected from staff members and customers of these banks. Staff members of the banks are again categorized as Managerial level, Technocrats, and Bank tellers. The separate Questionnaires are designed and used as an instrument for data collection. Each questionnaire has approximately 50 questions from which the first 19 questions are common, and the remaining questions are based on their roles (manager, technocrat, bank teller, and customers).

The bank customers are connected to CBS through delivery channels provided by banks. So, questions focusing on the usability aspect of ATMs, Internet banking, and Mobile banking are asked in the questionnaire prepared for the bank customers.

Banking security is its most crucial component. Therefore, the researcher took the security component of the CBS into account when creating the questionnaire for both employees and consumers, but the emphasis is placed more on the usability of the security.

5.2 Findings

The entire result is based on assessing the Usability of the Core Banking System implemented in Cooperative banks where Security is also considered one of the key parameters in the Usability context. The results of this research study have been divided into general findings and specific findings.

5.2.1 General Findings

The researcher came to the following general conclusions throughout the discussion with the stakeholders, specifically bank personnel, both technical and non-technical.

- Some of the cooperative bank's IT administrators responded by saying that top-level management should involve IT personnel in choosing the CBS vendor. When the technical employee of the bank is not involved in the selection process, third-party dependence increases. which eventually necessitates dealing with the issues of the IT department.

- A Service Level Agreement (SLA) between banks and the vendor who provides the services, has not been observed. So, problems like SSL certificate validation come up. Since the vendor expects it from IT management, and the bank's IT department expects it of them, it must be completed.

- The bank's top management has not set aside a dedicated IT budget for technical employee training. Training thus becomes merely a formality. Additionally, providing SMS messaging, and flashing information on websites, or mobile apps is used as a tool to train customers. Customers are not given any e-Banking-related or security-related personal or group training.

- In addition to CBS training, the branch office staff requires technical and security fundamentals training. Counter Clarks should be trained in how to answer inquiries from consumers. IT personnel frequently become overworked with technical tasks because branch office employees frequently lack adequate technical competence.

- The researcher noted through the conversation that, - Due to the mandate of RBI now, all the sample banks under study have adopted CBS. But,

    - ✓ The Banks are not overly concerned about the usability of CBS. Their interest remains limited to whether the amenities or functions offered by the CBS follow RBI regulations or not.

    - ✓ The circular makes no reference to a specific IT Department or framework directive so there is no uniformity in the IT department.

- The Reserve Bank of India (RBI) sends guidelines and directives to Cooperative banks. Following that, cooperative banks will send it to their CBS vendors so they can be included in the CBS. This increases vendor dependency.

- The main problem with CBS is vendor support. Due to the vendor's failure to meet the deadline, banks have frequently been penalized by the RBI for failing to incorporate updates.

- Guidelines or Directives provided by the RBI are vague. Every Cooperative Bank interprets it as per their convenience and forwards it to their CBS vendor. So, uniformity is missing in the CBS implementation.

- Furthermore, RBI has not recommended any HR model. Cooperative banks' IT departments don't have any formal entry-level education requirements. Additionally, RBI has not recommended a certain organizational structure for IT departments. Each cooperative bank has its own organization as a result. As a result, some cooperative banks are behind schedule in creating an IT steering committee.

- It is observed during the discussion that hardly one or two banks from the sample have,
    - ✓ C-SOC, Cyber Security Operation Centre,
    - ✓ Appointed CISO, Chief Information Security Officer, or an official responsible for articulating and enforcing the policies.
    - ✓ Board-approved Cyber Security policy which should be different than IT policy.

- It is common to encounter technical challenges when planning, implementing, and maintaining CBS. Many banks are embracing CBS items that are popular rather than knowing their requirements, as was learned during the discussion with sample respondents.

- The cooperative bank’s staff has given input that their customer database suggests that there is very few customers having an age below 30 years opening their accounts in the cooperative banks. The salary account restriction is the primary reason new accounts are created with cooperative banks.

5.2.2 Specific Findings

- During the study, it is found that 29% of the cooperative banks (7) fall in the Tier I category, 58% are in the Tier II and 13% (3) are in the Tier III category following the RBI rules. (Figure 4.3)

- Data shows that all cooperative banks have implemented CBS software. However, some of the banks have implemented Head Office or Branch Office Module partially. Banks should deploy CBS with full capability to improve efficiency. (Figure 4.4)

- Additionally, some banks lack the network, hardware, and software infrastructure required to execute these modules. This will have a negative impact on the ability of bank office employees to perform efficiently. (Figure 4.12)

- Despite being the most convenient delivery channels in today's digital age, Net Banking, Mobile Banking Apps, and UPI remain the most neglected delivery channels in the majority of banks. (Figure 4.5)

- Data suggests that staff of the cooperative banks, particularly Clerical staff respondents, are unhappy with the security procedures used to keep the system secure. One reason for this could be that many of these Clerical staff members lack technical abilities, making the security measures cumbersome for them. (Figure 4.6)

- Managers do not directly use CBS on a regular basis, they are indifferent about the security procedures put in place to keep the system secure. Furthermore, as members of CBS's implementation team, these managerial-level individuals will not directly respond negatively to their decision. (Figure 4.6)

- Vendors gave less emphasis on User Interface (UI) requirements during implementation. Even if some of them requested it, it was only partially or not at all implemented. Defiantly, this will reduce the performance of the system while in use. One thing that stands out in the data is that all suppliers requested and most of them implemented security standards. Both manufacturers and users are significantly more concerned with offering CBS security, which is a crucial factor. (Figure 4.7)

- It is clear from the statistics that vendors or banks are more concerned with the security of the system than its usability, yet if bank staff are unable to utilize the system efficiently and effectively, security vulnerability changes increase. (Figure 4.17)

- The Cooperative banks have a separate IT Department with IT policy. This implies that the cooperative banks under consideration understand the importance of having a distinct IT department. However, the statistics suggest that the positions of people working in the IT Department are uneven, and there is no fixed structure of the IT Departments of the sample cooperative banks under study. It is a must needed to have a well-structured IT department with different hierarchies, which will take care of and will be responsible for implementing, managing, and maintaining various aspects of technology implementation. (Figure 4.8)

- The sample banks under consideration are making attempts to train their staff members on CBS technology and the security world. However, they are not reviewing the training because it is critical to determine whether they truly understand the concept and can use it effectively to improve their performance. It is also vital to collect feedback in the form of satisfaction questionnaires. (Figure 4.11)

- The report also shows that banks are not making adequate efforts to help clients feel comfortable and confident while using delivery channels such as ATMs, internet banking, and mobile banking. It is pointless to provide these services if banks do not make clients feel comfortable using them. Banks should conduct periodic training and client feedback and training. (Figure 4.10)

- The statistics show that bank office workers must be involved in or requested to provide feedback on CBS functioning because they will use it in the end. The current proportion is insignificant. Even when they make suggestions, the acceptance percentage is still extremely low. (Figure 4.11)

- The cooperative banks should involve their technical team in the implementation of CBS from the start. This will assist them in comprehending the system and its shortcomings. (Figure 4.17)

- Evaluative training in terms of tests, is an important component of usability, although it is currently insufficient. Also, the rating given to training by clerical staff is satisfactory. The cooperative banks should work on this positively. Also, the researcher concluded that banks should focus on providing evaluative technical and security training to their technical staff which will undoubtedly help banks reduce their reliance on vendors or outsourcing of technical services. (Figure 4.18)

- None of the banks under consideration have thought of senior citizens and visually impaired customers while designing the e-banking services. Banks should give serious attention to this issue. (Figure 4.10 / Figure 4.18).

- Most of the banks have handled network security issues and application security issues. But even if having an IT department, the banks need to outsource these services, many a time from the CBS vendors. This indicates a lack of technical knowledge of the technical staff due to which banking staff face many problems while using CBS. Also, this increases vendor dependency which is not good in terms of efficiency. (Refer to Figure 4.20, 4.21)

- Various CBS functionalities used by bank office staff and technical staff are similar in nature. After collecting and analyzing the data from office staff and technical staff, regarding these functionalities from a usability perspective, the researcher found that there is a difference in their opinion.

- All the cooperative banks under consideration have updated antivirus installed in their bank but more than 50% of banks don't have SSL/TSL certificates for secure transmission of the data which is the most important factor of any network communication. Since all banks have CBS implemented and most of the banks are providing ATM & mobile banking services, they need to have these certificates. It will help in gaining the trust of the customer. (Figure 4.21)

- Customers under the age of 30 are in fewer numbers, implying that cooperative banks are connected with fewer young people. To attract these young individuals, cooperative banks must improve their technology. Considering the fact that this generation is

technologically savvy, providing secure and user-friendly technology would undoubtedly appeal to them.

- The cooperative banks are using different authentication mechanisms for authenticating users. Also, they are using a secure mechanism like having a session timeout for in-activeness. But all these mechanisms are not at all customizable to users. Banks should give thought to customized authentication mechanisms and session timeout.

- This will increase the usability of the security. Of course, the bank should have its own bucket of authentication mechanisms and can ask the user to choose his own authentication basket. It will help customers to understand their own security duties towards banking as well as give them comfort to use their chosen authentication mechanism. Also, a Customized session timeout timer will be helpful to customers who are less competent in the use of technology such as senior citizens, customers from rural areas, etc. (Figure 4.25)

5.3 Suggestions and Recommendations

According to a study conducted by researchers on the Usability of CBS implementation in cooperative banks with reference to the Pune district, there is a lot that can be done to improve cooperative banks. Data has been collected from the management level, technical heads, officers/clerks, and customers of a sample cooperative bank by the researcher through one-on-one interactions with the respondents. The mandate of use of CBS and of course coping with this changing digital world, cooperative banks have adopted CBS. The adoption of CBS has been seen to face several obstacles, which banks have already overcome to some extent. Banks have understood and accepted the usefulness of CBS but still, they are struggling with the ease of using CBS. Since banks have crossed the one milestone of computerization, the adoption of CBS, now the next milestone is to make it easy to use.

The researcher has made the following suggestion considering the research findings.

From planning through implementation, top management all the way down to the branch level must observe and be aware of the overall intentions of the CBS implementation.

- **Budget**

  Even though the sample cooperative bank's existing budget is mostly devoted to IT maintenance, a separate budget should be set aside for the adoption of IT and related technologies, and training of employees and customers. For e.g. adoption of Open-source technologies like Linux can be beneficial to cooperative banks since it is cost-effective and secure.

- **Selection of CBS** –

  Although there are numerous CBS vendors throughout the world, not all of them are qualified to provide you with the best service. These are some things cooperative banks should think about in addition to the budget while selecting CBS.

  - When choosing a new CBS, the cooperative bank should consider both current and upcoming demands.

- Most importantly, top-level management should involve technical people while finalizing the CBS. Also, requirements from staff members should also be considered while choosing CBS.

- When picking a core banking system, technological considerations are crucial. The ideal core banking system is scalable and adaptable to new technologies, making it simple to grow as needed.

- In addition to being technologically sound, core banking software must provide you with the most functionality and ease of use. This would entail using a system that makes daily tasks simple to complete.

- Select a core banking system that automates the majority of operations so you may concentrate on other important banking tasks.

- After support is an important thing in any purchase. So cooperative banks should go for Service Level Agreement with the CBS vendors.

- **Training and Feedback**

  The key to making any system acceptable and usable is training and feedback. *'Using CBS and effectively using CBS'*, this gap can be bridged by the robust training program. For that,

  - Analyzed data shows that technical staff are more competent than clerical staff in using CBS and that is obvious also. So, the cooperative banks have to work more towards clerical staff to make them more competent. For that, they should involve the representatives of these staff members from the start.

  - As the technical requirements of clerical staff and technical staff are different, the banks should train them as per their needs. Clerical staff training should focus on how to use the CBS, and how and which security measures should be used while using the system. Whereas technical staff should get training from more technical and security perspective. Such as configurations of Network Infrastructure, Firewall, IDS deployments, Vulnerability assessment tools, Software & Hardware etc.

- Not only CBS, but training related to small hardware or software troubleshooting and cyber security is recommended so that bank employees can easily handle it, resulting in saving time and cost.

- This will minimize the vendor dependency and increase the system throughput.

- Also, it is important to get feedback on the conducted training. Their feedback needs to be verified and forwarded to the vendors for the appropriate changes in CBS.

- Here, the researcher would like to recommend that all training should be evaluated through some kind of test. So that employees will attend these training more seriously and evaluation will definitely help them to boost their confidence while using the system also management will be able to judge the competency of the employees.

- Most of the cooperative banks provide e-banking guidelines and security guidelines on their websites but the cooperative banks should also provide frequent training regarding *'Effective and secure e-banking'* to customers to improve their competency and strengthen their confidence. Training should involve effective use of e-banking delivery channels along with what security precautions customers should follow while doing the e-banking.

- Although it is difficult for banks to arrange such training for customers in person, banks can have different strategies like can take a customer survey and arrange it for those who require that or can conduct online training. But this will help customers in using e-banking. And the one who is afraid to use e-banking can think of using it.

- **Usability and Security Customization –**

  Security is of paramount importance in e-banking. When it comes to online banking, it's important to choose strong authentication mechanisms which are also easy to use. The researcher analyzed the data received from banking staff and customers related to the implemented security. Both are of the opinion that they agree on the importance of

security, but they are overburdened with security measures implemented by the bank. For example, if the bank provides different authentication methods such as SMS-based OTP, hardware tokens, or biometric authentication, the user may be allowed to choose the mechanism they want from the options supplied by the bank. Finally, the availability of user-customizable security techniques and the amount to which a bank may accept such options are determined by the bank's specific policies, technological capabilities, and regulatory limits. However, this will undoubtedly improve the user's banking experience.

Also, customization of the Session timeout timer can help non-technical people or elderly people to perform their transactions at their pace.

- **Security – Authentication techniques for Senior Citizens**

  Along with traditional authentication mechanisms, banks should start thinking of giving other mechanisms, especially for senior citizens such as physical tokens. It's important to provide clear instructions and support to senior citizens when setting up and using these authentication mechanisms.

  Tokens for physical security are small devices that produce one-time passwords. Senior citizens can be given these tokens, which allow them to produce secure codes for authentication during online banking transactions. Because most senior persons properly store their stuff, keeping physical tokens secure will not be a problem for them. They will also be able to distinguish between other messages or OTPs received on mobile devices and bank OTP. Because physical tokens will only get bank OTPs.

- **Security – Authentication techniques for the Visually Impaired –**

  The way physical token-based authentication can help senior citizens authenticate, same can be used for visually impaired persons, but in this case, this physical token should be designed in Braille. Braille is a tactile writing system that uses raised dots to represent letters, numbers, and other symbols. By incorporating Braille into physical tokens, visually impaired individuals can use them as an authentication method.

  While designing, physical token-based authentication in braille, one should consider the compact and portable design with proper embossing of braille characters on it,

instructions, and training to familiarize with the token and authentication process, and compatibility with other assistive technologies used by visually impaired persons. By designing physical tokens that incorporate Braille, visually impaired individuals can independently authenticate themselves during online banking transactions, enhancing their security and accessibility in the digital banking realm.

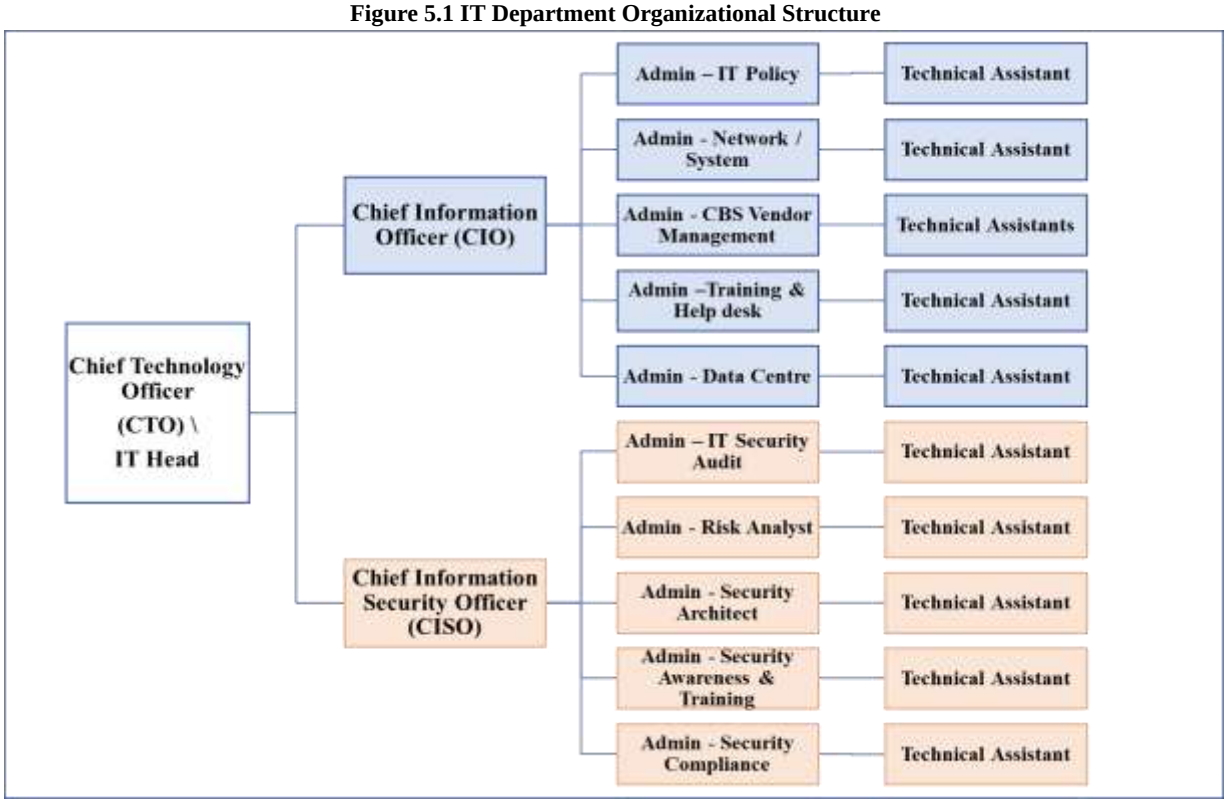
It's important for banks and device manufacturers to collaborate and ensure that physical token-based authentication in braille devices meets the necessary security standards, has robust authentication mechanisms, and offers seamless integration with e-banking systems.

- **IT Department Organizational Structure –**

  The researcher would like to propose that the proper formation of an IT Department is a must for the sample cooperative banks. Refer to Figure 5.1 for the same. This will help in increasing the overall usability and utility of the system. Members of the bank management team, IT industry specialists and Security specialist must be a part of this. In the sample banks, separate IT departments with personnel who are sufficiently technically skilled are required. The specific structure may vary depending on the size, complexity, and regulatory requirements of the cooperative bank. However, after considering the research findings the researcher would like to suggest a general **IT Departmental Structure** that can be adopted by the cooperative banks.

  Most cooperative banks have IT departments. But along with that, they must establish a dedicated Cyber Security division. This will help to monitor and improve cyber security needs continuously. If small-scale banks find it financially difficult, such banks can take help from professional agencies as per RBI guidelines.

Figure 5.1 IT Department Organizational Structure

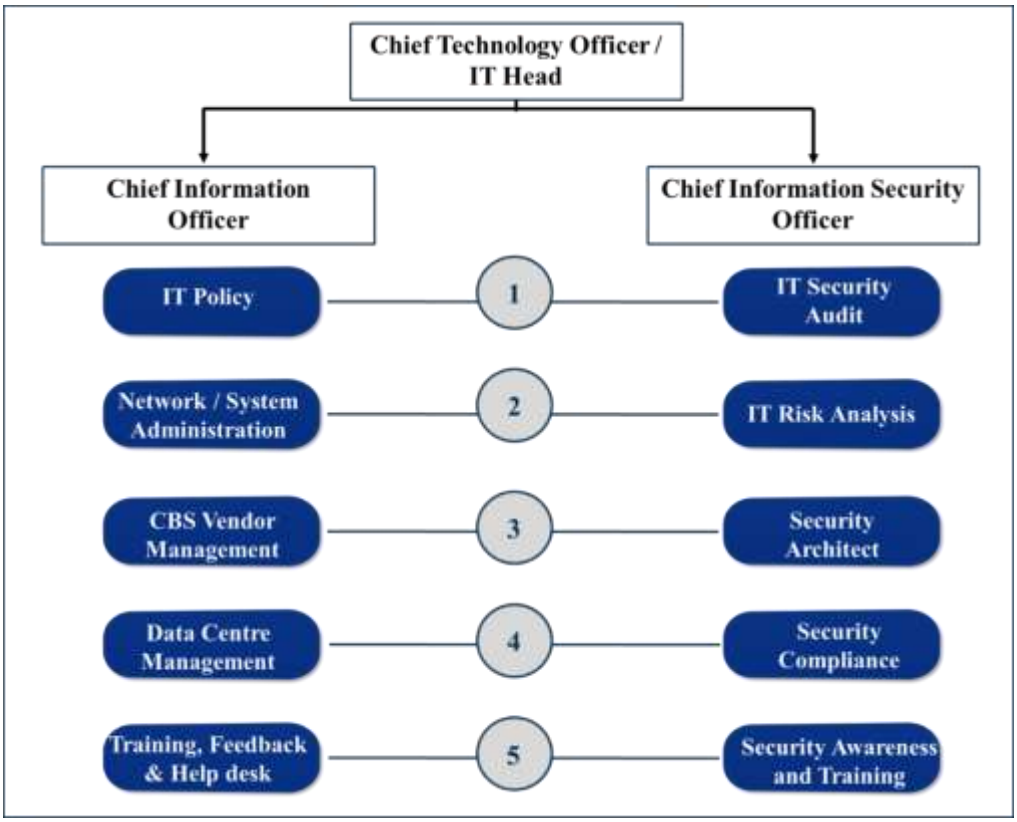


(Source: Compiled by Researcher)

This will increase customer and staff confidence in the bank. Another crucial point is that IT staff shouldn't participate in other banking clerical duties. Cooperative banks must customize their IT governance architecture to meet their specific requirements while guaranteeing adherence to all applicable laws and industry best practices.

Since security should not be an afterthought, so many of these technical activities and security activities carried out by the technical team members of the IT department should work hand-on-hand. Such as, Admin – IT policy should work with Admin – IT Security Audit, Admin – Network & System can work with Admin -Security Architect and so on. Security. Figure 5.2 depicts the activities that can go hand-on-hand.

Figure 5.2 Hand on hand activities



(Source: Compiled by the Researcher)

- **Analyze the Usability aspect of Core Banking System**

  As per RBI guidelines and Primary data collected from the sample cooperative banks suggest that all banks have implemented and are using core banking system software. Now the next step is for better throughput and working, banks should analyze the implemented core banking system software using usability components such as learnability, memorability, efficiency, error tolerance and satisfaction. For that they can conduct the employee as well as customer satisfaction survey based on these parameters and can make the necessary changes to the core banking system software through venders.

- **Proposed Working Model of Implementation of Core Banking System (CBS)**

  The Researcher has analyzed the current working model and proposed the revised working model of implementation of Core Banking System. The cooperative banks should request the Central Regulatory Body of Banking about implementation of the same.

The very first step in this is, Central Regulatory Body of Banking such as Reserve Bank of India, should analyze the core banking system software implemented by the cooperative banks considering usability aspect. This can be done by conducting CBS audit of cooperative banks which will perform the assessment of learnability, memorability, efficiency, error tolerance and satisfaction components of usability. Based on which suggestions should be given to the banks for further improvement.

Currently, whenever RBI finds vulnerability or requires any changes to be made in the system or delivery channels, such directives are sent to cooperative banks. Also, in case of any other updations in the banking rules, such as interest rates, ATM transactions, Internet banking, and mobile banking, are sent to cooperative banks. The RBI orders normally include a last date for execution, and cooperative banks who are unable to comply with the deadline must have to pay the fine.

After receiving RBI directives, the cooperative banks consult with their individual CBS providers and make the changes in the specified module of the CBS. The findings indicate that one of the important problems faced by the banks is, Vendor Support. (Table 4.10) As a result of this, banks are unable to deliver the adjustments before the deadline.

In such situations, two things can happen –

1. Bank employees must manually do calculations, report generations or other such tasks which have been impacted due to the change in the RBI directives.
2. And Sometimes banks may have to pay the fine to RBI.

To resolve this issue, The researcher is recommending the new working model shown in the figure 5.2. which will reduce the above problems faced by the cooperative banks. The authorities of cooperative banks can opt for the below mentioned model and insist the Central Regulatory body about the same This will definitely help to establish effective coordination between the Central Regulatory body, cooperative banks, and CBS providers. Figure 5.2 shows the details of the same.

Figure 5.2: Model for CBS Framework

1. **Regulatory body/bodies** should give thought to implementing the uniform framework for Core Banking Solution(CBS) Software based on functionalities, efficiency, security, usability, and performance. For this they can form a separate committee, **Regulatory Committee for CBS Framework (RCCF)** which should include Representatives of concerned regional offices, Experts from the banking industry, IT professionals (Auditors), Security Architects, and representatives from the cooperative banks.
2. This committee may have the **Regional – RCCF committee** which will take care of CBS implementation issues of the respective region.
3. CBS vendors must design their CBS product based on the framework suggested by the Regulatory Committee for CBS Framework (**RCCF**).
4. Designed CBS products need to acquire an **Indian Core Banking License (ICBL)** from Regulatory Committee from the CBS Framework (**RCCF**). **RCCF** will perform the scrutiny of the product and licensing can be done.
5. Such CBS software which has Indian Core Banking License (**ICBL**) should be recommended to the cooperative banks. The cooperative banks can tailor their CBS software to suit their unique needs, size, complexity, and regulatory requirements.
6. As these **ICBL – CBS software** are registered under RBI, every directive or guideline which needs changes in the CBS will be informed to the CBS vendors along with the Co-operative Banks.
7. This license will have an expiry date. After every specific duration that needs to be revoked.

(Source: Compiled by the Researcher)

- **CBS – Framework – Considering Usable Security Aspect**

After analysing the data received from the cooperative banks staff and customers, the researcher would like to conclude the study by proposing a framework for Core Banking System which is based on the usable security aspect. Figure 5.3 briefly depicts the framework considerations.

The researcher has referred Technology Acceptance Model(TAM), proposed by Davis, (Davis, 1986) which suggests that acceptance of the technology not only depends on its usefulness of it, but also on ease of usefulness. The statistics reveal that users have accepted the usefulness of the CBS (Figure 4.8) but at the same time, the hypothesis

proves that users are facing problems while using the system from a usability perspective. TAM can be used in the development stage as well after development.

The researcher has used TAM to measure user satisfaction with Human-Computer Interface (HCI) which defines the good fit between the human, the computer, and the required tasks. The required task can be

1. Productive tasks which aim to accomplish the system objective and generate output.
2. Supportive tasks which are not necessarily used to attain the goal, but it enables production tasks to be completed longer term and more effectively.

In the case of Core Banking System (CBS), accomplishing the banking functionality is a productive task and one of the most important supportive tasks is to provide security which should be designed to support the banking functionalities. For this, a sociotechnical software engineering approach can be used. Figure 5.3 depicts the proposed CBS-Framework Model.

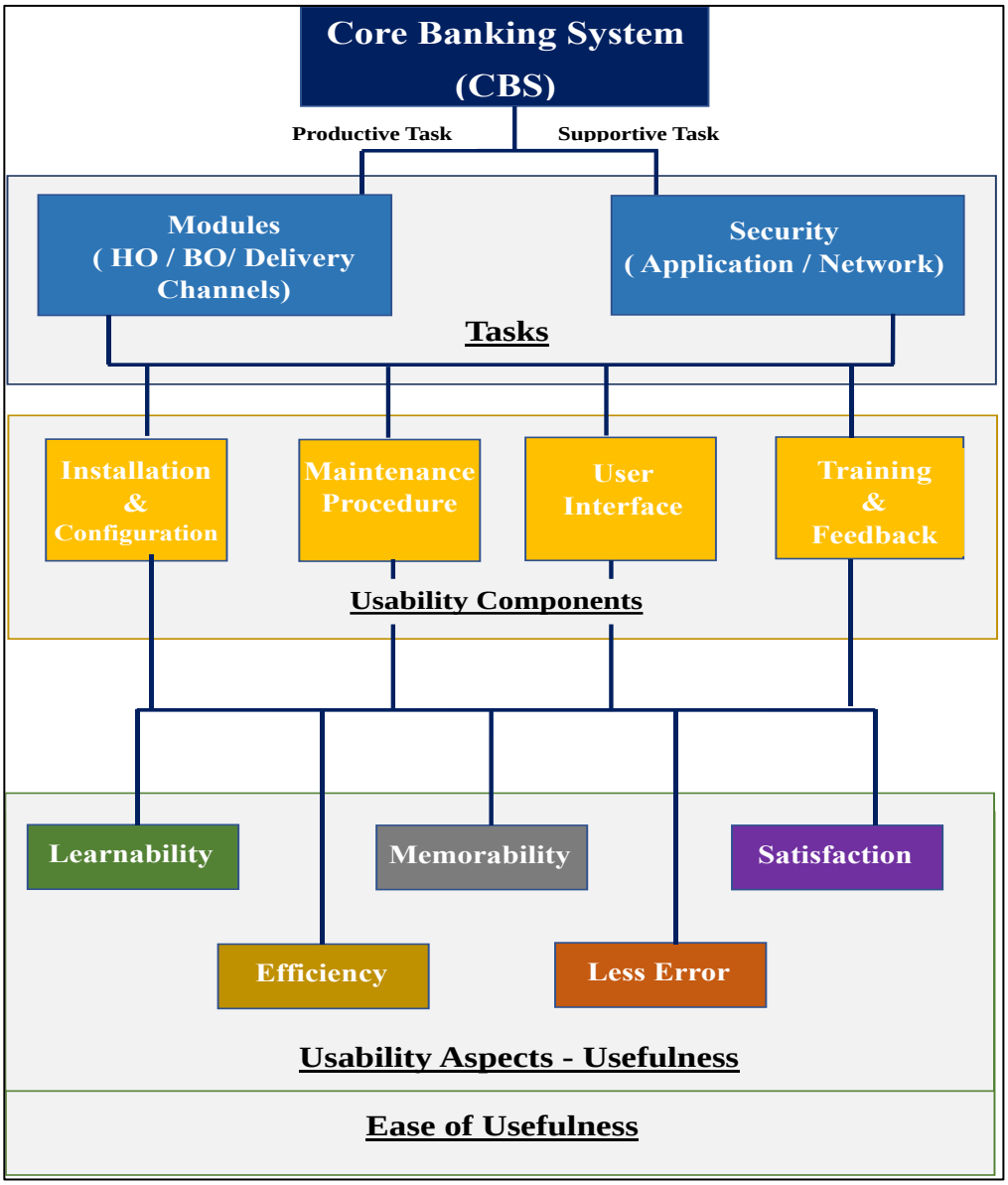
In this model, the researcher has identified CBS modules such as the Head Office module, Branch office module, and delivery channels as productive tasks which need to be designed along with security as a supportive task. Each and every module of the CBS can be designed considering it's usability components listed below,

- Installation & Configuration
- Maintenance procedure
- Interface
- Training and Feedback

Developers should design the working of these components considering their security perspective(CIA) (Figure 3.8). Further, all these usability components should be mapped to the five usability and usable security aspects, listed below

- Learnability
- Efficiency – in terms of speed
- Memorability
- Less Errors
- Satisfaction.

Figure 5.3 depicts the proposed CBS-Framework Model



(Source: Compiled by the Researcher)

5.4. Concluding Remarks – SWOC Analysis

The study determines that a variety of direct and indirect factors influenced the implementation of Core Banking Solutions in cooperative banks. Statistics reveal banks and vendors did not address usability concerns when creating or deploying CBS. Despite the fact that cooperative banks have adopted and implemented CBS, the study depicts that it is not being used to its full potential due to a lack of IT proficiency and a failure to appreciate the technical knowledge of the CBS implementation.

The researcher would like to conclude the study by presenting the SWOC (Strengths-Weaknesses-Opportunities-Challenges) analysis of the research study under discussion, **'Study of Usability Aspects with Reference to CBS in Cooperative Banks in Pune District.'**, based on the data investigation.

Strength –

1. Enhanced Productivity- CBS streamlines and automates various banking processes, leading to increased productivity.
2. Centralized Banking - CBS provides a centralized system for managing all banking operations, including accounts, loans, deposits, transactions, etc., making it easier for cooperative banks to handle their operations.
3. Real-Time Processing - A well-designed CBS facilitates real-time processing of transactions, enabling cooperative banks to provide quick and efficient services to their customers.
4. Scalability – CBS enables Cooperative Banks to handle increased volumes of transactions and customers.
5. Enhanced Customer Service – CBS offers anytime, anywhere banking to their customers with a variety of delivery channels.
6. Integration of Channels - CBS integrates various channels, such as internet banking, mobile banking, ATM, and branch operations, which can provide a consistent and unified experience, improving user satisfaction.
7. Familiarity with Banking Concepts – The cooperative bank staff already possess a basic understanding of banking concepts and can leverage their existing knowledge to recall and apply relevant concepts when using CBS.

Weakness –

1. Implementation Challenges - Integrating a CBS into existing cooperative bank systems is complex and time-consuming, requiring significant investment and technical expertise.
2. Limited Training Resources & Learning Curve - Some CBS vendors are not providing sufficient training resources or ongoing support, making it more difficult for cooperative banks to train their staff effectively. Inadequate training or lack of awareness among cooperative bank staff regarding system functionalities and procedures can contribute to errors in CBS usage. Also, transitioning to a new system requires cooperative bank staff to undergo training and adapt to new processes, leading to a temporary decrease in productivity during the transition phase.
3. Third-Party Risks – Primary data suggest that, cooperative banks rely on external vendors or service providers for their CBS, there may be security risks associated with those third-party systems.
4. Dependence on Technology - The cooperative banks must have reliable IT infrastructure and technical support to ensure the smooth functioning of the CBS. Any technological failures or disruptions can significantly impact operations.
5. Resistance to Change – Employees resist learning and adopting new technologies, including CBS. Overcoming resistance to change may require effective changes in management strategies and clear communication about the benefits of the system.
6. Vulnerability to Cyber Threats - CBS platforms is susceptible to cyberattacks, including hacking, malware, phishing, and social engineering. Any weaknesses in the system's security infrastructure can be exploited.
7. Human Error - Security breaches can occur due to human error, such as improper handling of customer data, sharing of sensitive information, or falling for social engineering scams. Adequate training and awareness programs are necessary to mitigate this risk.
8. System Downtime – The primary data suggest that, CBS systems experiences downtime or slowdowns due to technical issues, network interruptions, or maintenance activities, affecting the speed and effectiveness of cooperative bank operations.

Opportunities –

1. Enhanced Member Services - CBS can enable cooperative banks to offer a broader range of services to their members, such as Internet banking, mobile banking, and self-service options.
2. Embracing Advanced Technologies - Cooperative banks can explore the adoption of emerging security technologies, such as artificial intelligence (AI)-based threat detection, behavior analytics, or blockchain, to enhance the security of their CBS. Adopting cloud-based CBS solutions can offer scalability, flexibility, and faster processing speeds by leveraging the capabilities of cloud infrastructure and distributed computing.
3. Regulatory Compliance Enhancements - As regulations evolve, cooperative banks can leverage CBS solutions to stay up to date with compliance requirements and improve security practices accordingly.
4. Collaborative Learning - Creating a supportive learning environment where cooperative bank staff can collaborate, share knowledge, and learn from each other's experiences can enhance the learnability of the CBS.
5. Feedback and Iterative Improvements - Continuous feedback from cooperative bank staff regarding the usability and learnability of the CBS can help identify areas for improvement and guide the development of user-friendly interfaces and learning materials.

Challenges –

1. Cost Considerations - Implementing and maintaining a CBS can involve significant financial investments, including software licensing, hardware upgrades, and ongoing maintenance costs, and implementing & maintaining robust security measures can require significant financial and human resources. Cooperative banks may face challenges in allocating the necessary budget and skilled personnel for security initiatives.

2. Vendor Selection - Choosing the right CBS vendor that aligns with the specific needs of cooperative banks can be a complex decision, requiring a thorough evaluation of features, support, and long-term viability. Some cooperative banks may rely on

legacy CBS systems that are difficult to upgrade or replace, limiting their ability to achieve optimal speed and effectiveness.

3. Robust IT department – Establishing a robust IT department with an expert technical team along with security experts is the biggest challenge in front of the cooperative banks.

4. Resistance to Change - Employees and members of cooperative banks may resist adopting new technologies and processes, requiring effective change management strategies.

5. Data Volume and Scalability - As cooperative banks grow and handle larger volumes of data and transactions; the CBS must be scalable to maintain fast processing speeds. Managing increasing data loads can be a challenge for both hardware and software.

6. Data Privacy and Security - With increased digitalization, cooperative banks must ensure robust cybersecurity measures to protect sensitive customer information and guard against potential cyber threats. Security is an ongoing battle, as cyber threats continuously evolve. Cooperative banks must stay vigilant and regularly update their security measures to address emerging risks effectively.

7. Balancing Security and User Experience - Implementing stringent security measures may sometimes introduce friction for users, affecting the overall user experience. Striking the right balance between user satisfaction and maintaining robust security and privacy measures is a big challenge for cooperative banks.

8. Skill Gaps & Retention of Knowledge - Some cooperative bank staff may lack the necessary technical skills or experience to quickly adapt to a new CBS. Providing adequate training and support to bridge these skill gaps is crucial. Learning a new system involves the retention of knowledge over time. Cooperative banks should consider implementing reinforcement techniques, such as regular training refreshers or knowledge-sharing sessions, to ensure long-term retention.

9. Time Constraints - Cooperative banks operate within strict timelines and deadlines. Allocating sufficient time for staff to learn the CBS while managing day-to-day banking operations can be challenging.

10. Staff Turnover - Cooperative banks may experience staff turnover, resulting in new employees having to learn the CBS from scratch. This constant onboarding can pose challenges in maintaining system memorability.

11. Diverse User Needs - Cooperative banks serve a diverse range of customers and have employees with different roles and responsibilities. Meeting the varied needs and expectations of these users can be challenging.

5.5 Scope for further research

1. This research is confined to studying the usability aspect of CBS implemented in the cooperative banks based in Pune District, one can extend the study by expanding the geographical area.
2. The study mainly focuses on the usability aspect of CBS, there is a scope for the other researcher to study the complete technological aspect of CBS implementation.
3. The tradeoff between usability and security of the system can be studied in more depth since this study focuses on the usability aspect in depth, from which security is considered as one of the parameters.
4. There is a scope of research work that will focus on implementing and designing the products, based customization of security.
5. The study and implementation possibilities of Wearable IoT devices for customization of security in banking should be checked and accordingly designing can be proposed.

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Questionnaire

Dear Respondent,

I, Mrs. Arati Sameer Nimgaonkar am, pursuing my Ph.D. from the Department of Computer Science, Tilak Maharashtra Vidyapeeth, Pune. My research topic is **'Study of usability aspects with reference to CBS in cooperative banks in Pune district'**.

As a part of my research, for data gathering purposes, I am carrying out this survey. All responses given by you during this survey will be strictly kept confidential and will be used only for study purposes.

I would like to appreciate the efforts & time that you have taken to complete the following survey.

If you have any questions, queries, or concerns, kindly feel free to contact me.

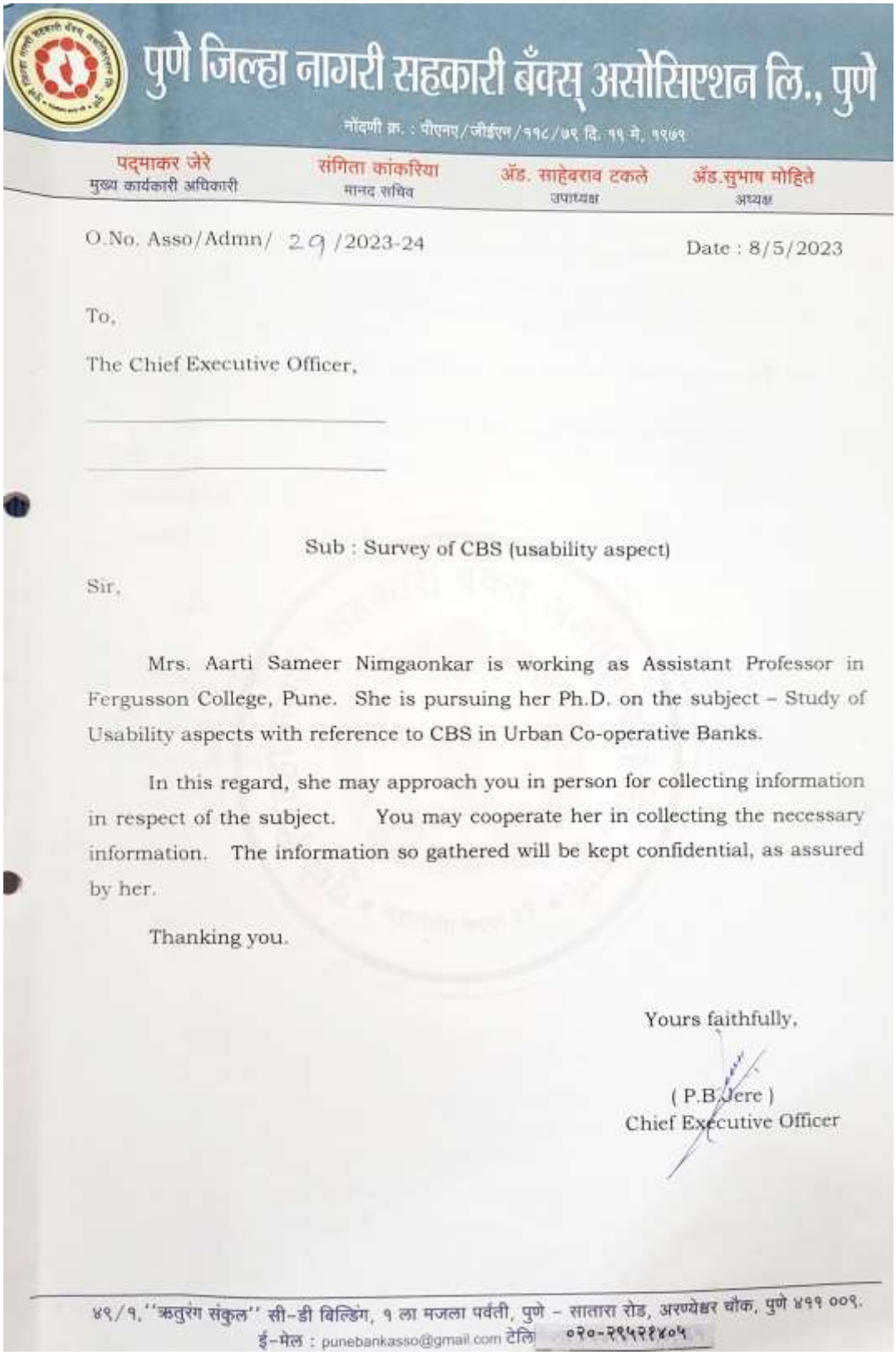
Mail-id – arati.nimgaonkar@fergusson.edu

Mobile – 9730084639

Thanking you for your cooperation.

Mrs. Arati Nimgaonkar
(Research Scholar)

Dr. R. D. Kumbhar
(Research Guide)



पुणे जिल्हा नागरी सहकारी बँक्स् असोसिएशन लि., पुणे

नोंदणी क्र. : पीएनए/जीईएन/११८/७९ दि. १९ मे, १९७९

पद्माकर जेरे	संगिता कांकरिया	ॲड. साहेबराव टकले	ॲड.सुभाष मोहिते
मुख्य कार्यकारी अधिकारी	मानद सचिव	उपाध्यक्ष	अध्यक्ष

O.No. Asso/Admn/ 29 /2023-24 Date : 8/5/2023

To,

The Chief Executive Officer,

_____

_____

Sub : Survey of CBS (usability aspect)

Sir,

Mrs. Aarti Sameer Nimgaonkar is working as Assistant Professor in Fergusson College, Pune. She is pursuing her Ph.D. on the subject – Study of Usability aspects with reference to CBS in Urban Co-operative Banks.

In this regard, she may approach you in person for collecting information in respect of the subject. You may cooperate her in collecting the necessary information. The information so gathered will be kept confidential, as assured by her.

Thanking you.

Yours faithfully,

(P.B. Jere)
Chief Executive Officer

४९/१, "ऋतुरंग संकुल" सी-डी बिल्डिंग, १ ला मजला पर्वती, पुणे – सातारा रोड, अरण्येश्वर चौक, पुणे ४११ ००९.
ई-मेल : punebankasso@gmail.com टेलि. ०२०-२९५२१४०५

Usability Survey with Respect to CBS in the Cooperative Banks

(Management Level)

Management level people who take the decisions related to which CBS to be purchased based on budgetary provision, training for staff and customers, Infrastructural decisions, etc. Questions from the Questionnaire are divided as,

- Personal Details
- Bank Details
- CBS Implementation
- Finalizing and Exploring the CBS at the time of Purchase
- Preparedness for implementation of the CBS
- Usability and Security Aspects

Usability Survey with Respect to CBS in the Cooperative Banks

(Management Level)

This survey has been carried out as a part of my PhD research work. Information will be kept confidential.

I. Personal Details

1. Name (Optional) _____

2. Your Gender *

◯ Female ◯ Male ◯ Transgender

3. Your Age *

◯ Between 21 - 30 ◯ Between 31 - 40

◯ Between 41 - 5 ◯ 51 and above

4. Educational Qualification *

◯ Diploma ◯ UnderGraduate

◯ Post Graduate ◯ Doctorate

5. Mention your Band/Grade/Level. *

◯ Management Representative (CEO, CGM, GM, DGM, AGM Etc.) /Managers

◯ Technical Staff

◯ Bank officer, Clerk/Clerical Staff

6. Designation *_____

II. Bank Details

7. Bank Name (Optional)_____

8. Year of Establishment of bank *_____

9. Number of Branches of bank *_____

10. Bank Category *

Tier -I Tier -II Tier -III

III. CBS Implementation

11. Does your bank use CBS(CORE Banking Solution) system?

Yes No

12. Is it readymade CBS software that you purchased and then changes are made to that as your requirement? Or Software company has designed completely new CBS software.

Changes are made to the existing

Designed completely new software as per requirements.

Other: _____

13. How long CBS has been implemented in your bank? *

Yet to implement less than 3 years

More than 3 and less than 6 More than 6 and less than 9

More than 9 years

Other: _____

14. Weather it is implemented fully or partially? *

Fully Partially

15. Does CBS system in your bank follows ISO standard *

Yes No

16. Name of the vendor of CBS system implemented at your your bank *

Finacle (Infosys)	Genius	Nelito	Finserv
SAP	Omni -(infrasoft)	SIL	Finacus
Fineserv	FIS	Oracle	Polaris
JJIT	Temenos	Other	

17. Have you used any other CBS system before Current CBS system which you are using?

Yes No No idea

18. If the answer to the previous question is yes, then mention the reason to change the previous system, else write NA in the answer.

_____

19. Which of the following Delivery Channels are supported by your CBS system *
Check all that apply.

ATM Telephone (SMS) Banking Net Banking Mobile Banking

RTGS NEFT IMPS POS UPI Other:

20. Are these channels working as per the requirement? *

Partially working Fully working

IV. Finalizing and exploring the CBS at the time of purchase.

21. Does Top level management support finance to purchase good/required CBS system?

Need to convenience a lot Easily get the convenience.

22. Did the vendor development team ask your requirement before implementing the CBS system?

Yes No

23. Has the vendor made changes according to your requirement or was the CBS system implemented as it is?

All changes are made according to the requirements.

Partial changes are done as per the requirement.

No changes are made to the system.

24. Has the vendor development team consulted about the **User Interface (UI)** of your CBS system before implementation?

- ◯ Yes, they asked for UI specifications but did not make any changes to the existing system.
- ◯ Yes, they asked for UI specifications, and partial changes are incorporated into the existing system.
- ◯ Yes, they asked for UI specifications and all changes are incorporated into theexisting system.
- ◯ No consultation was done for UI implementation.

25. Has the vendor development team consulted about the **Security Features** of your CBS system before implementation?

- ◯ Yes, they asked for Security specifications but did not make any changes in the existing system.
- ◯ Yes, they asked for Security specifications and partial changes are incorporatedin the existing system.
- ◯ Yes, they asked for Security specifications and all changes are incorporated inthe existing system.
- ◯ No consultation was done for Security implementation.

26. Do you have Annual Maintenance Contract with the vendor from whom you have purchased CORE Banking software?

◯ Yes ◯ No

V. Preparedness for implementation of the CBS

27. Do you have a separate IT department? *

Yes No

28. If yes, then tick the members who are all part of IT department *

IT manager Security Admin

Hardware Admin Software Admin

Network Admin Other:

_____

29. Do you have IT security policy? *

Yes No

30. Year of Implementation of the IT policy

_____

31. Have you given any separate training to technical support staff? *

Yes No

32. Have you conducted a **Security training program/ workshop on** for your employees?

Yes No

33. Have you taken the **Employee Satisfaction Survey** on CBS system that they are currently using? *

Yes No

34. Have you forwarded the feedback received from the **Employee Satisfaction Survey** to the development team for the enhancement in the CBS system?

Yes No

35. Do you provide online or offline training to your customers regarding **USE** of Internet Banking/ Mobile banking Software? (Apart from Guided tour/ FAQ from your internet banking/mobile banking web site)

Yes No

36. Have you conducted **Online/offline Security Awareness Program** on Internet Banking/Mobile Banking for your customers? (Apart from flashing messageson the website)

Yes No

37. Have you taken the **Customer Satisfaction Survey** about their experience of Internet Banking/ Mobile banking Software that your bank is currently using?

Yes No

38. Have you forwarded the feedback received from the **Customer Satisfaction Survey** to the development team for the enhancement in the Internet Banking/ Mobile banking Software?

Yes No

VI. Usability and Security Aspect of CBS

39. Do you find CBS useful?

Yes No

40. Do you find CBS transactions secure?

Yes No

41. Do the Security measures implement by the current CBS system overburdening to you? (You feel sometimes Multiple passwords, 2 step authentication, OTPs, CAPTCH are unnecessary or more than what the requirement)

Never Sometimes Always

42. Does your current CORE Banking Software asks you many questions to provide you secure environment?

Yes No

43. Is the User Interface (UI) provided by the Current CBS Software by your bank customizable as per your needs?

Yes No

44. Does your Internet Banking/ Mobile banking software provide additional facilities in terms of **User Interface (UI) to Senior Citizen Customers?**

Yes No

45. Does your Internet Banking/ Mobile banking software provide additional facilities in terms of **User Interface (UI) to Visually Impaired Customers (Blind)**?

Yes No

Usability Survey with Respect to CBS in the Cooperative Banks

(Front office staff – Officer/ Clerical)

Front office staff or Branch staff - officers, clerks, heads of different sections, etc. These are the actual people who use different CBS modules, may be Head-office Module or Branch Module Day to day for banking transactions, report generations, etc. Questions from the Questionnaire are divided as,

- Personal Details
- Bank Details
- CBS Implementation
- Usability and Security Aspects
- Suggestions on and Training of CBS
- Availability of Infrastructure
- Rating on Usability
- Problems Faces during using CBS

Usability Survey with Respect to CBS in the Cooperative Banks

(Bank office staff – Officer/ Clerical)

This survey has been carried out as a part of my PhD research work. Information will be kept confidential.

I. Personal Details

1. Name (Optional) _____

2. Your Gender *

Female Male Transgender

3. Your Age *

Between 21 - 30 Between 31 - 40

Between 41 - 5 51 and above

4. Educational Qualification *

Diploma UnderGraduate

Post Graduate Doctorate

5. Mention your Band/Grade/Level. *

Management Representative (CEO, CGM, GM, DGM, AGM Etc.) /Managers

Technical Staff

Bank officer, Clerk/Clerical Staff

6. Designation *_____

II. Bank Details

7. Bank Name (Optional)_____

8. Year of Establishment of bank *_____

9. Number of Branches of bank *_____

10. Bank Category *

Tier -I Tier -II Tier -III

III. CBS Implementation

11. Does your bank use CBS(CORE Banking Solution) system?

Yes No

12. Is it readymade CBS software that you purchased and then changes are made to that as your requirement? Or Software company has designed completely new CBS software.

Changes are made to the existing

Designed completely new software as per requirements.

Other: _____

13. How long CBS has been implemented in your bank? *

Yet to implement less than 3 years

More than 3 and less than 6 More than 6 and less than 9

More than 9 years

Other: _____

14. Weather it is implemented fully or partially? *

Fully Partially

15. Does CBS system in your bank follows ISO standard *

Yes No

16. Name of the vendor of CBS system implemented at your your bank *

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Fineserv	FIS	Oracle	Polaris
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Yes No No idea

18. If the answer to the previous question is yes, then mention the reason to change the previous system, else write NA in the answer.

_____

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Check all that apply.

ATM Telephone (SMS) Banking Net Banking Mobile Banking

RTGS NEFT IMPS POS UPI Other:

20. Are these channels working as per the requirement? *

Partially working Fully working

IV. Usability and Security Aspect of CBS

21. Do you find CBS useful?

Yes No

22. Do you find CBS transactions secure?

Yes No

23. Do the Security measures implement by the current CBS system overburdening to you? (You feel sometimes Multiple passwords, 2 step authentication, OTPs, CAPTCH are unnecessary or more than what the requirement)

Never Sometimes Always

24. Does your current CORE Banking Software asks you many questions to provide you secure environment?

Yes No

25. Is the User Interface (UI) provided by the Current CBS Software by your bank customizable as per your needs?

Yes No

26. Does your Internet Banking/ Mobile banking software provide additional facilities in terms of **User Interface (UI) to Senior Citizen Customers?**

Yes No

27. Does your Internet Banking/ Mobile banking software provide additional facilities in terms of **User Interface (UI) to Visually Impaired Customers (Blind)**?

Yes No

V. Suggestions on & Training of CBS

28. While developing CBS, have your management asked for your suggestions/requirements? *

Yes No

29. If you have given any suggestions, have it been incorporated in the software?

Yes No

30. Have you received any training from before using/implementing the current CBS System? *

Yes No

31. Rate the training you have received., If not received any training tick NA *

Poor Satisfactory Good Excellent

Not Received any training

32. Is the evaluation of the training done?

Yes No

33. Evaluation after training will improve performance.

Strongly Disagree Disagree Neutral

Agree Strongly Agree

VI Availability of Infrastructure

34. Do you have the complete infrastructure required for executing the CBS system?

Yes No

35. Have you implemented subsystems of the Head Office Module? (For e.g. account & general ledger, shares, branch consolidation, transaction reconciliation – inter-branch or bank, HRM, HRIS etc)

Yes No

36. Have you implemented subsystems of the Branch Office Module? (For e.g. account opening, deposit, advances, Bills, Delivery channels, and many more)

Yes No

VII Usability aspect of CBS

37. Rate the following in case of CBS system as per its Usability or Usefulness. *

	Poor	Satisfactory	Moderate	Good	Excellent
a) Ease in carrying out Functionalities.					
b) Use Interface (Graphical User Interface)					
c) Usability of security Features					
d) Ease in report Generation					
e) Navigation through the CBS software					

f) Understandability of the errors

g) Increase in the speed of work

VIII. Problems faced during using CBS

38. Frequency of Problems faced by Bank Staff

		Always	Frequently	Rarely	Never
a)	Application runs slowly.				
b)	Changes are implemented without prior information.				
c)	Data loss due to system updation				
d)	External threats like virus, worm, phishing, trojan horse etc.)				
e)	Network connection issue				
f)	Employee IT Illiteracy				

g)	Customer IT Illiteracy	⬭	⬭	⬭	⬭
h)	Breakdown of ATMs	⬭	⬭	⬭	⬭
i)	Errors in Delivery channels	⬭	⬭	⬭	⬭
j)	Vendor Support	⬭	⬭	⬭	⬭
k)	Server down / Data accessibility issue	⬭	⬭	⬭	⬭

Usability Survey with Respect to CBS in the Cooperative Banks

(Bank Technical Staff)

Technocrats, technical staff, or IT Department people who take care of CBS implementation, Infrastructure requirement and maintenance, handling CBS-related or hardware, and software queries of staff, and customers. Questions from the Questionnaire are divided as,

- Personal Details
- Bank Details
- CBS Implementation
- Usability and Security Aspects
- IT Infrastructure
- Involvement During CBS implementation
- Technical and Security Training
- Rating on Usability
- Network Aspect Handled
- Security Aspect Handled
- Authentication & Security for Customers
- Problems faced during using CBS

Usability Survey with Respect to CBS in the Cooperative Banks

(Bank Technical Staff)

This survey has been carried out as a part of my PhD research work. Information will be kept confidential.

I. Personal Details

1. Name (Optional) _____

2. Your Gender *

Female Male Transgender

3. Your Age *

Between 21 - 30 Between 31 - 40

Between 41 - 5 51 and above

4. Educational Qualification *

Diploma Undergraduate

Post Graduate Doctorate

5. Mention your Band/Grade/Level. *

Management Representative (CEO, CGM, GM, DGM, AGM Etc.) /Managers

Technical Staff

Bank officer, Clerk/Clerical Staff

6. Designation *_____

II. Bank Details

7. Bank Name (Optional)_____

8. Year of Establishment of bank *_____

9. Number of Branches of bank *_____

10. Bank Category *

Tier -I Tier -II Tier -III

III. CBS Implementation

11. Does your bank use CBS(CORE Banking Solution) system?

Yes No

12. Is it readymade CBS software that you purchased and then changes are made to that as your requirement? Or Software company has designed completely new CBS software.

Changes are made to the existing

Designed completely new software as per requirements.

Other: _____

13. How long CBS has been implemented in your bank? *

Yet to implement less than 3 years

More than 3 and less than 6 More than 6 and less than 9

More than 9 years

Other: _____

14. Weather it is implemented fully or partially? *

Fully Partially

15. Does CBS system in your bank follows ISO standard *

Yes No

16. Name of the vendor of CBS system implemented at your your bank *

Finacle (Infosys)	Genius	Nelito	Finserv
SAP	Omni -(infrasoft)	SIL	Finacus
Fineserv	FIS	Oracle	Polaris
JJIT	Temenos	Other	

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18. If the answer to the previous question is yes, then mention the reason to change the previous system, else write NA in the answer.

_____

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22. Do you find CBS transactions secure?

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Never Sometimes Always

24. Does your current CORE Banking Software asks you many questions to provide you secure environment?

Yes No

25. Is the User Interface (UI) provided by the Current CBS Software by your bank customizable as per your needs?

Yes No

26. Does your Internet Banking/ Mobile banking software provide additional facilities in terms of **User Interface (UI) to Senior Citizen Customers?**

Yes No

27. Does your Internet Banking/ Mobile banking software provide additional facilities in terms of **User Interface (UI) to Visually Impaired Customers (Blind)**?

Yes No

V IT Infrastructure

28. Do you have an IT department?
    Yes ◯ No ◯
29. Do you have the complete IT infrastructure in the banks?
    Yes ◯ No ◯

VI. Involvement during Implementation of CBS

30. In the development / implementation stage has your management involved you in the discussion with the development team?

    ◯ Yes ◯ No

31. Has the vendor development team of your CBS asked your input/feedback on the design of User Interface (UI)?

    ◯ Yes ◯ No

32. If you have suggested any changes, have those changes related to User Interface (UI) been incorporated in the software?

    ◯ Yes ◯ No

33. Has the vendor development team of your CBS asked your input/feedback on the CBS Security?

    ◯ Yes ◯ No

34. If you have suggested any changes, have those changes related to CBS security Measures been incorporated in the software?

    ◯ Yes ◯ No

VII. Technical and Security Training of CBS

35. Have you received any technical training for using/implementing the current CBS System? *

Yes No

36. Rate the training you have received., If not received any training tick NA *

Poor Satisfactory Good

Excellent

Not Received any training

37. Is the evaluation of the training done?

Yes No

38. Do you think - Evaluation after training will improve performance.

Strongly Disagree Disagree Neutral

Agree Strongly Agree

VIII. Usability aspect of CBS

39. Rate the following in case of CBS system as per its Usability or Usefulness. *

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a) Ease in carrying out Functionalities .					
b) Use Interface (Graphical User Interface)					
c) Usability of security Features					

d) Ease in report Generation					
e) Navigation through the CBS software					
f) Understandabilit y of the errors					
g) Increase in the speed of work					

IX. Network Aspect Handled

39. Tick the network aspects handled by Network administrator. * *Check all that apply*

- ⬭ Network monitoring for violation
- ⬭ Intrusion Detection System (IDS) deployment for real time traffic analysis
- ⬭ Firewall deployment
- ⬭ Vulnerability assessment at periodical levels
- ⬭ Restriction on Secondary Device Connect
- ⬭ No access to bank WiFi
- Other: _____

X. Security Aspect Handled

40. Tick the network aspects handled by Network administrator. * *Check all that apply*

- ⬭ Netted IP address is used
- ⬭ Change in default password.
- ⬭ Licensed OS
- ⬭ Security Patch Update in OS
- ⬭ Maintenance and Review of logs
- ⬭ Authentication and Access Control
- Other: _____

XI. Authentication & Security for Customers

41. Tick the authentication you are providing to the customers.

- ⬭ Login password
- ⬭ Transaction password.
- ⬭ ATM Pin
- ⬭ Mobile Banking Pin
- ⬭ SMS- OTP
- ⬭ E-Mail OTP

XII. Problems faced during using CBS

42. Frequency of Problems faced by Bank Staff

		Always	Frequently	Rarely	Never
a)	Application runs slowly.	⬭	⬭	⬭	⬭
b)	Changes are implemented without prior information.	⬭	⬭	⬭	⬭
c)	Data loss due to system updation	⬭	⬭	⬭	⬭
d)	External threats like virus, worm, phishing, trojan horse etc.)	⬭	⬭	⬭	⬭
e)	Network connection issue	⬭	⬭	⬭	⬭
f)	Employee IT Illiteracy	⬭	⬭	⬭	⬭

g)	Customer IT Illiteracy	⬭	⬭	⬭	⬭
h)	Breakdown of ATMs	⬭	⬭	⬭	⬭
i)	Errors in Delivery channels	⬭	⬭	⬭	⬭
j)	Vendor Support	⬭	⬭	⬭	⬭
k)	Server down / Data accessibility issue	⬭	⬭	⬭	⬭

Usability Survey with Respect to CBS in the Cooperative Banks

(Customer)

To study the customer experience with the usability of E-banking, the researcher has considered customers from the banks that provide ATM, internet banking, and mobile banking facilities to their customers. Questions from the Questionnaire are divided as,

- Personal Details
- Rating on Implemented Usability and Security

Usability Survey with Respect to CBS in the Cooperative Banks

(Customer)

This survey has been carried out as a part of my PhD research work. Information will be kept confidential.

I. Personal Details

1. Name (Optional) _____

2. Your Gender *

○ Female ○ Male ○ Transgender

3. Your Age *

○ Below 30 ○ Between 30 - 40

○ Between 40 - 50 ○ Above 50

4. Educational Qualification *

○ Diploma ○ UnderGraduate

○ Post Graduate ○ Doctorate

Usability Survey with Respect to CBS in the Cooperative Banks

(Customer)

To study the customer experience with the usability of E-banking, the researcher has considered customers from the banks that provide ATM, internet banking, and mobile banking facilities to their customers. Questions from the Questionnaire are divided as,

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Usability Survey with Respect to CBS in the Cooperative Banks

(Customer)

This survey has been carried out as a part of my PhD research work. Information will be kept confidential.

16. Personal Details

1. Name (Optional) _____
2. Your Gender *

   ◯ Female ◯ Male ◯ Transgender

3. Your Age *

   ◯ Below 30 ◯ Between 30 - 40

   ◯ Between 40 - 50 ◯ Above 50

4. Educational Qualification *

   ◯ Diploma ◯ UnderGraduate

   ◯ Post Graduate ◯ Doctorate

II Usability and Security aspect of CBS

5. Rate the following in case of CBS system as per its Usability or Usefulness. *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Remembering e-banking user name or mobile banking user name along with account number requires extra efforts	◯	◯	◯	◯	◯
Remembering various passwords is difficult	◯	◯	◯	◯	◯
Password policies enforced by the banks are demanding	◯	◯	◯	◯	◯

Changing is password/pin is challenging since it depends upon other authentication techniques					
Login process of my e-banking is difficult.					
OTP generation does not happen withing given time limit.					
Not able to finish work before session time out.					
Navigation through the website/ App/ interface is complex.					
Error messages are not understandable.					
It's difficulty to deal with different interfaces for different bank's ATM center.					
I know security is important but Security Measures Implemented are overburdening.					
Banks should provide various sets of security options for authentication, from which customers will choose his/her options. (Security Customization)					

STUDY OF USABILITY ASPECTS WITH REFERENCE TO CBS IN COOPERATIVE BANKS IN PUNE DISTRICT

A THESIS

SUBMITTEDTOTHE
TILAKMAHARASHTRAVIDYAPEETHPUNE

FORTHEDEGREEOF

DOCTOROFPHILOSOPHY

INCOMPUTER SCIENCE

UNDER THE BOARD OF MODERN SCIENCES & PROFESSIONAL SKILLS

BY

MRS. ARATI SAMEER NIMGAONKAR
(25315007657)

UNDER THE GUIDANCE OF

Dr. RAJENDRA D. KUMBHAR
Head, Department of Computer,
KBPIMSR, Satara

SEPTEMBER-2023

80_Recommendations

According to a study conducted by researchers on the Usability of CBS implementation in cooperative banks with reference to the Pune district, there is a lot that can be done to improve cooperative banks. Data has been collected from the management level, technical heads, officers/clerks, and customers of a sample cooperative bank by the researcher through one-on-one interactions with the respondents. The mandate of use of CBS and of course coping with this changing digital world, cooperative banks have adopted CBS. The adoption of CBS has been seen to face several obstacles, which banks have already overcome to some extent. Banks have understood and accepted the usefulness of CBS but still, they are struggling with the ease of using CBS. Since banks have crossed the one milestone of computerization, the adoption of CBS, now the next milestone is to make it easy to use.

The researcher has made the following suggestion considering the research findings.

From planning through implementation, top management all the way down to the branch level must observe and be aware of the overall intentions of the CBS implementation.

- **Budget**

  Even though the sample cooperative bank's existing budget is mostly devoted to IT maintenance, a separate budget should be set aside for the adoption of IT and related technologies, and training of employees and customers. For e.g. adoption of Open-source technologies like Linux can be beneficial to cooperative banks since it is cost-effective and secure.

- **Selection of CBS**–

  Although there are numerous CBS vendors throughout the world, not all of them are qualified to provide you with the best service. These are some things cooperative banks should think about in addition to the budget while selecting CBS.

  - When choosing a new CBS, the cooperative bank should consider both current and upcoming demands.

- Most importantly, top-level management should involve technical people while finalizing the CBS. Also, requirements from staff members should also be considered while choosing CBS.

- When picking a core banking system, technological considerations are crucial. The ideal core banking system is scalable and adaptable to new technologies, making it simple to grow as needed.

- In addition to being technologically sound, core banking software must provide you with the most functionality and ease of use. This would entail using a system that makes daily tasks simple to complete.

- Select a core banking system that automates the majority of operations so you may concentrate on other important banking tasks.

- After support is an important thing in any purchase. So cooperative banks should go for Service Level Agreement with the CBS vendors.

- **Training and Feedback**

  The key to making any system acceptable and usable is training and feedback. *'Using CBS and effectively using CBS'*, this gap can be bridged by the robust training program. For that,

  - Analyzed data shows that technical staff are more competent than clerical staff in using CBS and that is obvious also. So, the cooperative banks have to work more towards clerical staff to make them more competent. For that, they should involve the representatives of these staff members from the start.

  - As the technical requirements of clerical staff and technical staff are different, the banks shouldtrain them as per their needs. Clerical staff training should focus on how to use the CBS, and how and which security measures should be used while using the system. Whereas technical staff should get training from more technical and security perspective. Such as configurations of Network Infrastructure, Firewall, IDS deployments, Vulnerability assessment tools, Software & Hardware etc.

- Not only CBS, but training related to small hardware or software troubleshooting and cyber security is recommended so that bank employees can easily handle it, resulting in saving time and cost.

- This will minimize the vendor dependency and increase the system throughput.

- Also, it is important to get feedback on the conducted training.Their feedback needs to be verified and forwarded to the vendors for the appropriate changes in CBS.

- Here, the researcher would like to recommend that all training should be evaluated through some kind of test. So that employees will attend these training more seriously and evaluation will definitely help them to boost their confidence while using the system also management will be able to judge the competency of the employees.

- Most of the cooperative banks provide e-banking guidelines and security guidelines on their websites but the cooperative banks should also provide frequent training regarding *'Effective and secure e-banking'* to customers to improve their competency and strengthen their confidence. Training should involve effective use of e-banking delivery channels along with what security precautions customers should follow while doing the e-banking.

- Although it is difficult for banks to arrange such training for customers in person, banks can have different strategies like can take a customer survey and arrange it for those who require that or can conduct online training. But this will help customers in using e-banking. And the one who is afraid to use e-banking can think of using it.

- **Usability and Security Customization –**

  Security is of paramount importance in e-banking.When it comes to online banking, it's important to choose strong authentication mechanisms which are alsoeasyto use.The researcher analyzed the data received from banking staff and customers related to the implemented security. Both are of the opinion that they agree on the importance of

security, but they are overburdened with security measures implemented by the bank. For example, if the bank provides different authentication methods such as SMS-based OTP, hardware tokens, or biometric authentication, the user may be allowed to choose the mechanism they want from the options supplied by the bank. Finally, the availability of user-customizable security techniques and the amount to which a bank may accept such options are determined by the bank's specific policies, technological capabilities, and regulatory limits. However, this will undoubtedly improve the user's banking experience.

Also, customization of the Session timeout timer can help non-technical people or elderly people to perform their transactions at their pace.

- **Security – Authentication techniques for Senior Citizens**
  Along with traditional authentication mechanisms, banks should start thinking of giving other mechanisms, especially for senior citizens such as physical tokens.It's important to provide clear instructions and support to senior citizens when setting up and using these authentication mechanisms.

  Tokens for physical security are small devices that produce one-time passwords. Senior citizens can be given these tokens, which allow them to produce secure codes for authentication during online banking transactions. Because most senior persons properly store their stuff, keeping physical tokens secure will not be a problem for them. They will also be able to distinguish between other messages or OTPs received on mobile devices and bank OTP. Because physical tokens will only get bank OTPs.

- **Security – Authentication techniques for the Visually Impaired –**
  The way physical token-based authentication can help senior citizens authenticate, same can be used for visually impaired persons, but in this case, this physical token should be designed in Braille. Braille is a tactile writing system that uses raised dots to represent letters, numbers, and other symbols. By incorporating Braille into physical tokens, visually impaired individuals can use them as an authentication method.

  While designing, physical token-based authentication in braille, one should consider the compact and portable design with proper embossing of braille characters on it,

instructions, and training to familiarize with the token and authentication process, and compatibility with other assistive technologies used by visually impaired persons. By designing physical tokens that incorporate Braille, visually impaired individuals can independently authenticate themselves during online banking transactions, enhancing their security and accessibility in the digital banking realm.

It's important for banks and device manufacturers to collaborate and ensure that physical token-based authentication in braille devices meets the necessary security standards, has robust authentication mechanisms, and offers seamless integration with e-banking systems.

- **IT Department Organizational Structure–**

  The researcher would like to propose that the properformation of an IT Department is a must for the sample cooperative banks.Refer to Figure 5.1 for the same.This will help in increasing the overall usability and utility of the system. Members of thebank management team, IT industry specialists and Security specialist must be a part of this. In the sample banks, separate IT departments with personnel who are sufficiently technically skilled are required. The specific structure may vary depending on the size, complexity, and regulatory requirements of the cooperative bank. However, after considering the research findings the researcher would like to suggest a general **IT DepartmentalStructure** that can be adopted by the cooperative banks.

  Mostcooperative bankshave IT departments. But along with that, they must establish a dedicated Cyber Securitydivision. This will help to monitor and improve cyber security needs continuously.If small-scale banks find it financially difficult, such banks can take help from professional agencies as per RBI guidelines.

  This will increase customer and staff confidence in the bank. Another crucial point is that IT staff shouldn't participate in other banking clerical duties.Cooperative banks must customize their IT governance architecture to meet their specific requirements while guaranteeing adherence to all applicable laws and industry best practices.

  Since security should not be an afterthought, so many of these technical activities and security activities carried out by the technical team members of the IT department should

work hand-on-hand. Such as, Admin – IT policy should work with Admin – IT Security Audit, Admin – Network & System can work with Admin -Security Architect and so on. Security.

- **Analyze the Usability aspect of Core Banking System**

  As per RBI guidelines and Primary data collected from the sample cooperative banks suggest that all banks have implemented and are using core banking system software. Now the next step is for better throughput and working, banks should analyze the implemented core banking system software using usability components such as learnability, memorability, efficiency, error tolerance and satisfaction. For that they can conduct the employee as well as customer satisfaction survey based on these parameters and can make the necessary changes to the core banking system software through venders.

- **Proposed Working Modelof Implementation of Core Banking System (CBS)**

  The Researcher has analyzed the current working model and proposed the revised working model of implementation of Core Banking System. The cooperative banks should request the Central Regulatory Body of Banking about implementation of the same.

  The very first step in this is, Central Regulatory Body of Banking such as Reserve Bank of India, should analyze the core banking system software implemented by the cooperative banks considering usability aspect. This can be done by conducting CBS audit of cooperative banks which will perform the assessment of learnability, memorability, efficiency, error tolerance and satisfaction components of usability. Based on which suggestions should be given to the banks for further improvement.

  Currently,wheneverRBI finds vulnerability or requires any changes to be made in the system or delivery channels, such directives are sent to cooperative banks. Also, in case of any other updations in the banking rules, such asinterest rates, ATM transactions, Internet banking, and mobile banking, are sent to cooperative banks. The RBI orders normally include a last date for execution, and cooperative banks who are unable to comply with the deadline must have to pay the fine.

After receiving RBI directives, the cooperative banks consult with their individual CBS providers and make the changesin the specified module of the CBS. The findings indicate that one of the important problems faced by the banks is, Vendor Support. (Table 4.10) As a result of this, banks are unable to deliver the adjustments before the deadline.

In such situations, two things canhappen –

1. Bank employees must manually do calculations, report generations or other such tasks which have been impacted due to the change in the RBI directives.
2. And Sometimes banks may have to pay the fine to RBI.

The authorities of cooperative banks can follow below mentioned steps and insist the Central Regulatory body about the same. This will help to establish effective coordination between the Central Regulatory body, cooperative banks, and CBS providers.

1. Regulatory body/bodies should give thought to implementing the uniform framework for Core Banking Solution(CBS) Software based on functionalities, efficiency, security, usability, and performance. For this they can form a separate committee, Regulatory Committee for CBS Framework (RCCF) which should include Representatives of concerned regional offices, Experts from the banking industry, IT professionals (Auditors), Security Architects, and representatives from the cooperative banks.
2. This committee may have the Regional – RCCF committee which will take care of CBS implementation issues of the respective region.
3. CBS vendors must design their CBS product based on the framework suggested by the Regulatory Committee for CBS Framework (RCCF).
4. Designed CBS products need to acquire an Indian Core Banking License (ICBL) from Regulatory Committee from the CBS Framework (RCCF). RCCF will perform the scrutiny of the product and licensing can be done.
5. Such CBS software which has Indian Core Banking License (ICBL) should be recommended to the cooperative banks. The cooperative banks can tailor their CBS software to suit their unique needs, size, complexity, and regulatory requirements.
6. As these ICBL – CBS software are registered under the Regulatory body, every directive or guideline by RBI which needs changes in the CBS will be informed to the CBS vendors along with the Cooperative Banks.
7. This license will have an expiry date. After every specific duration that needs to be revoked.

- **CBS – Framework – Considering Usable Security Aspect**

After analysing the data received from the cooperative banks staff and customers, the researcher would like to conclude the study by proposing a framework for Core Banking System which is based on the usable security aspect. Figure 5.3 briefly depicts the framework considerations.

The researcher has referred Technology Acceptance Model(TAM), proposed by Davis,(Davis, 1986) which suggests that acceptance of the technology not only depends on its usefulness of it, but also on ease of usefulness. The statistics reveal that users have accepted the usefulness of the CBS (Figure 4.8) but at the same time, the hypothesis proves that users are facing problems while using the system from a usability perspective. TAM can be used in the development stage as well after development.

The researcher has used TAM to measure user satisfaction with Human-Computer Interface (HCI) which defines the good fit between the human, the computer, and the required tasks. The required task can be

1. Productive tasks which aim to accomplish the system objective and generate output.
2. Supportive tasks which are not necessarily used to attain the goal, but it enablesproduction tasks to be completed longer term and more effectively.

In the case of Core Banking System (CBS), accomplishing the banking functionality is a productive task and one of the most important supportive tasks is to provide security which should be designed to support the banking functionalities. For this, a sociotechnical software engineering approach can be used. Figure 5.3 depicts the proposed CBS-Framework Model.

In this model, the researcher has identified CBS modules such as the Head Office module, Branch office module, and delivery channels as productive tasks which need to be designed along with security as a supportive task. Each and every module of the CBS can be designed considering it's usability components listed below,

- Installation & Configuration
- Maintenance procedure
- Interface
- Training and Feedback

Developers should design the working of these components considering their security perspective(CIA) (Figure 3.8). Further, all these usability components should be mapped to the five usability and usable security aspects, listed below

- Learnability
- Efficiency – in terms of speed
- Memorability
- Less Errors
- Satisfaction.

Concluding Remarks – SWOC Analysis

The study determines that a variety of direct and indirect factors influenced the implementation of Core Banking Solutions in cooperative banks. Statisticsreveal banks and vendors did not address usability concerns when creating or deploying CBS. Despite the fact that cooperative banks have adopted and implemented CBS, the study depicts that it is not being used to its full potential due to a lack of IT proficiency and a failure to appreciate the technical knowledge of the CBS implementation.

The researcher would like to conclude the study by presenting the SWOC (Strengths-Weaknesses-Opportunities-Challenges) analysis ofthe research study under discussion, **'Study of Usability Aspects with Reference to CBS in Cooperative Banks in Pune District.'**, based on the data investigation.

Strength –

1. Enhanced Productivity- CBS streamlines and automates various banking processes, leading to increasedproductivity.
2. Centralized Banking - CBS provides a centralized system for managing all banking operations, including accounts, loans, deposits, transactions, etc., making it easier for cooperative banks to handle their operations.
3. Real-Time Processing - A well-designed CBS facilitates real-time processing of transactions, enabling cooperative banks to provide quick and efficient services to their customers.
4. Scalability –CBS enablesCooperative Banks to handle increased volumes of transactions and customers.
5. Enhanced Customer Service – CBS offers anytime, anywhere banking to their customers with a variety of delivery channels.
6. Integration of Channels - CBS integrates various channels, such as internet banking, mobile banking, ATM, and branch operations, which can provide a consistent and unified experience, improving user satisfaction.
7. Familiarity with Banking Concepts –The cooperative bank staff already possess a basic understanding of banking concepts andcan leverage their existing knowledge to recall and apply relevant concepts when using CBS.

Weakness –

1. Implementation Challenges - Integrating a CBS into existing cooperative bank systems is complex and time-consuming, requiring significant investment and technical expertise.
2. Limited Training Resources & Learning Curve - Some CBS vendors are not providing sufficient training resources or ongoing support, making it more difficult for cooperative banks to train their staff effectively.Inadequate training or lack of awareness among cooperative bank staff regarding system functionalities and procedures can contribute to errors in CBS usage. Also, transitioning to a new system requires cooperative bank staff to undergo training and adapt to new processes, leading to a temporary decrease in productivity during the transition phase.
3. Third-Party Risks – Primary data suggest that, cooperative banks rely on external vendors or service providers for their CBS, there may be security risks associated with those third-party systems.
4. Dependence on Technology -The cooperative banks must have reliable IT infrastructure and technical support to ensure the smooth functioning of the CBS. Any technological failures or disruptions can significantly impact operations.
5. Resistance to Change – Employeesresist learning and adopting new technologies, including CBS. Overcoming resistance to change may require effective changes in management strategies and clear communication about the benefits of the system.
6. Vulnerability to Cyber Threats - CBS platforms is susceptible to cyberattacks, including hacking, malware, phishing, and social engineering. Any weaknesses in the system's security infrastructure can be exploited.
7. Human Error - Security breaches can occur due to human error, such as improper handling of customer data, sharing of sensitive information, or falling for social engineering scams. Adequate training and awareness programs are necessary to mitigate this risk.
8. System Downtime – The primary data suggest that, CBS systemsexperiences downtime or slowdowns due to technical issues, network interruptions, or maintenance activities, affecting the speed and effectiveness of cooperative bank operations.

Opportunities –

1. Enhanced Member Services - CBS can enable cooperative banks to offer a broader range of servicesto their members, such as Internet banking, mobile banking, and self-service options.
2. Embracing AdvancedTechnologies - Cooperative banks can explore the adoption of emerging security technologies, such as artificial intelligence (AI)-based threat detection, behavior analytics, or blockchain, to enhance the security of their CBS. Adopting cloud-based CBS solutions can offer scalability, flexibility, and faster processing speeds by leveraging the capabilities of cloud infrastructure and distributed computing.
3. Regulatory Compliance Enhancements - As regulations evolve, cooperative banks can leverage CBS solutions to stay up to date with compliance requirements and improve security practices accordingly.
4. Collaborative Learning - Creating a supportive learning environment where cooperative bank staff can collaborate, share knowledge, and learn from each other's experiences can enhance the learnability of the CBS.
5. Feedback and Iterative Improvements - Continuous feedback from cooperative bank staff regarding the usability and learnability of the CBS can help identify areas for improvement and guide the development of user-friendly interfaces and learning materials.

Challenges –

1. Cost Considerations - Implementing and maintaining a CBS can involve significant financial investments, including software licensing, hardware upgrades, and ongoing maintenance costs, and implementing &maintaining robust security measures can require significant financial and human resources. Cooperative banks may face challenges in allocating the necessary budget and skilled personnel for security initiatives.

2. Vendor Selection - Choosing the right CBS vendor that aligns with the specific needs of cooperative banks can be a complex decision, requiring a thorough evaluation of features, support, and long-term viability.Some cooperative banks may rely on legacy CBS systems that are difficult to upgrade or replace, limiting their ability to achieve optimal speed and effectiveness.

3. Robust IT department –Establishing a robust IT department with an expert technical team along with security experts is the biggest challenge in front of the cooperative banks.

4. Resistance to Change - Employees and members of cooperative banks may resist adopting new technologies and processes, requiring effective change management strategies.

5. Data Volume and Scalability - As cooperative banks grow and handle larger volumes of data and transactions; the CBS must be scalable to maintain fast processing speeds. Managing increasing data loads can be a challenge for both hardware and software.

6. Data Privacy and Security - With increased digitalization, cooperative banks must ensure robust cybersecurity measures to protect sensitive customer information and guard against potential cyber threats.Security is an ongoing battle, as cyber threats continuously evolve. Cooperative banks must stay vigilant and regularly update their security measures to address emerging risks effectively.

7. Balancing Security and User Experience - Implementing stringent security measures may sometimes introduce friction for users, affecting the overall user experience. Striking the right balance between user satisfaction and maintaining robust security and privacy measures is a big challenge for cooperative banks.

8. Skill Gaps& Retention of Knowledge - Some cooperative bank staff may lack the necessary technical skills or experience to quickly adapt to a new CBS. Providing adequate training and support to bridge these skill gaps is crucial.Learning a new system involves the retention of knowledge over time. Cooperative banks should consider implementing reinforcement techniques, such as regular training refreshers or knowledge-sharing sessions, to ensure long-term retention.

9. Time Constraints - Cooperative banks operate within strict timelines and deadlines. Allocating sufficient time for staff to learn the CBS while managing day-to-day banking operations can be challenging.

10. Staff Turnover - Cooperative banks may experience staff turnover, resulting in new employees having to learn the CBS from scratch. This constant onboarding can pose challenges in maintaining system memorability.

11. Diverse User Needs - Cooperative banks serve a diverse range of customers and have employees with different roles and responsibilities. Meeting the varied needs and expectations of these users can be challenging.