CHAPTER 5

TECHNOLOGY ADOPTION USING MULTIPLE CRITERIA DECISION-MAKING (MCDM)
5.1 INTRODUCTION

This chapter illustrates the process of model development of technology adoption using the multiple criteria decision-making (MCDM) technique. The model is aimed to develop to evaluate the most preferred technology. The five most preferred technologies chosen on the basis of primary information observed during interviews and formal chatting with bank officials concerned were considered for further evaluations. These technologies assist the banks to fulfill their mission. The five most preferred technologies were first subjected to be evaluated on the intuition-based methodologies followed by using Multi Criteria Decision-Making tools. The model thus designed was used to analyze the answers for the second research question, what is a requisite group model of IT adoption of the bank? In terms of most preferred technologies and various factors related to this. The result thus obtained through intuition and MCDM shall are vetted.

Making decisions in the fast changing areas of information technology is a difficult process. Initially, the decision-makers are confronted with constraints such as time and resources. Additionally, the problem is more complicated because it involves many dimensions the technological problem itself, but also in other areas such as, the environment, social, economic and political dimensions, Decision-makers, therefore, have to deal with multiple alternatives and criteria in an uncertain environment. Finally, it involves many stakeholders. That is, decision-making is a collective process rather than purely individual. Group decision-making is far more difficult because each decision-maker has his/her own perceptions, attitudes, motivations and personality. It is difficult to find an optimal solution whereby all affected parties are satisfied.

When an organizational environment or a problem becomes more complex, more competitive and subject to fluctuations, subjective decision-making techniques contingent upon experience, judgments and intuition cannot achieve all of the aims of
the organization. Hence, appropriate, objective decision-making paradigms are attractive. We discussed in earlier chapters and on the basis of certain aspects finalised MCDM for this study. In this chapter we discusses the process of using MCDM to assist decision-makers in selecting the best technology by prioritizing technological alternatives in the operation of the State Bank of India. The model development will provide the answer for the second research question, "what is a requisite group model of IT adoption?" MCDM is also employed for the purpose of narrowing the scope of the research. Instead of elaborating each technology, only preferred technologies are scrutinized and elaborated by the system dynamics model to capture the interrelationships among variables and their dynamic aspects.

Three aspects of study has been explained in this chapter, i.e. the first part deals with decision-making based on intuitive judgment, whereby respondents identified Anywhere Banking (Core Banking/CDC) as the preferred technology. The second part highlights decision-making based on MCDM analyses including model building and model analysis using real scales and local scales. As per analytical results based on MCDM, Internet banking was the most preferable technology to fulfil bank objectives. To The third part, therefore, discusses the reasons for this divergence and offers some recommendations to bridge the gap.

5.2 DATA COLLECTION TECHNIQUES

In this study questionnaire and interviews were used to collect data. Questionnaires were derived from previous studies (Mohammed Quaddus n Arunee-2002). This study employed both open-ended and closed questionnaires. Open-ended questionnaires were used to gain understanding and capture the points of view of respondents without predetermining those points of view through prior selection of questionnaire categories. On the other hand, closed questionnaires were used to facilitate respondents understanding of topics of concern, remind them of the points that they may not think about, and involve many respondents within a limited time.

Also, key executives responsible for technologies were interviewed during various visits and over video conferencing sessions. Specific Information was sought through interviews and basic questionnaire about available or promising technologies, as well as criteria for decision-making. The bank deploys many progressive technologies in different shapes under different products and projects such as Plastic Money (ATM Cards/Credit-Debit Cards/Smart Cards), Anywhere Banking/Core
Banking (Core Data Center), Cheque Truncation System/ Electronic Fund Transfer Products (EFTs), Internet banking and Mobile Banking to fulfill their objective. The "Employed Technologies & Technical problems", questionnaires were shared with 200 bank executive staff senior executives and middle managers, responsible for technical decisions of the bank employed at various technical Departments at CDC, Belapur and ITS Department at Local Head Offices.

The "Evaluation of Banking Technologies" was shared with same level of respondents as the previous questionnaires to evaluate technology alternatives based on the specified criteria (Appendix I- Questionnaire 2). The data from these questionnaires were used to evaluate technological choices based on MCDM analyses and compare decision-making using intuition with that facilitated by computer software.

5.3 INTUITION BASED PERFORMANCE

The respondents from Sate Bank of India, which were taken separately as a case study through "Employed Technologies & Technical problems", were asked to rate the technology on a scale of 1 to 5 depending upon the importance of technology to Banks mission on the basis of their own intuitive perception. Bank officers revealed that the State bank of India has the mission “We will imbibe state of the art technology to drive excellence”. The highest weight 5 indicated the most important technological alternative and less important was rated by lowest weight 1. The weighted results for initial 200 respondents, presented in Table 5.1 and Figure 5.1 revealed that the bank staff felt that preferable technologies were Anywhere/Core Banking (3.8) and Plastic Money (3.5), closely followed by Internet Banking.

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Level of importance (Average weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anywhere/Core Banking</td>
<td>3.8</td>
</tr>
<tr>
<td>Plastic Money</td>
<td>3.5</td>
</tr>
<tr>
<td>CTS/EFTs</td>
<td>3.1</td>
</tr>
<tr>
<td>Internet Banking</td>
<td>3.4</td>
</tr>
<tr>
<td>Mobile Banking</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Source: Data derived from "Employed Technologies & Technical problems" questionnaire on a scale of 1 to 5
However, since this work was done about three years back a fresh mandate was obtained from approximately 100 new respondents (list enclosed at annexure-3, This change in result is contributed to the penetration of Mobile access across country. At the same time it is proved that choice of technology is dynamic and as such it’s a subject matter to be followed precisely.

5.4 DECISION-MAKING BASED ON MCDM

In this study of Multi-Criteria Decision Making (MCDM) approach by Utkarsh Yadav, Department of Mechanical Engineering, National Institute of Technology, Rourkela has stated steps for Multi-Criteria Decision Making (MCDM) analysis of any problem which is influenced by multiple performance criteria/attributes. According to him building the MCDM model required three fundamental stages, Problem structuring, eliciting information and values, and evaluation.

5.4.1 Problem Structuring - To start with, a problem to be solved is well defined and understood, followed by evaluation of all possible solutions under set of criteria. In this study the technological alternatives that would fulfill its mission at this stage were similar to those previously identified for intuitive judgment. The technological alternatives have been evaluated under the same criteria. Arunee Intraparirot In earlier

![Figure 5.1 (Intuition Based Preference)](image)
study for developing the MCDM model of technology adoption, as explained in Chapter 3, have used following criteria for the evaluations of technological alternatives:

- Perceived advantages
- Technological features
- Internal environment
- Customer acceptance
- External environment

Apart from these five criteria, following two more criteria were observed mainly on the basis of researcher's experience in this field and found worth adding to this research work:

- Qualification of deciding Authority
- Universal utility of adopted technology

These variables or criteria, which increase the rate of technology adoption, are explained below in brief.

5.4.1.1 Qualification of Deciding Authority - The research by Suzanne Beaumaster suggests that there are three primary fundamentals aspects to assist in IT implementation. First strategic planning for IT, secondly, it is shown that interdepartmental coordination has proven to be a major factor in effective IT implementation. And finally, the expertise levels of executives with regard to IT have proven to be a contributing factor to effectiveness of the IT development and deployment process. We conclude that many factors affect the rate of adoption including innovation’s characteristics and various economical, sociological, organisational and psychological variables. Some time the choice of technology to be adopted is governed by individual perception or influenced by vendors’ projections. It has been experienced that having a basic knowledge of technology is important so that one can take understand and verify the genuinity of technical specification along with result projected by vendors. However it has been seen that in Banking industry there is hardly any technical expertise at senior level. Though, technical officials have been recruited by various banks but not at the decision taking position. Researchers experience while working in State Bank of India as an IT official realized the same. Some of the decisions including high investment project “Focal Point Processing Centre” launched by State Bank of India at various cities, including two
branches at Chandigarh can be one such example. Probably Bank also realized the need of technical expertise and subsequently appointed few prominent personalities from respective field as technical advisers to the Bank’s board for taking major decisions.

5.4.1.2 Universal utility of Technology adopted - It has been observed that many projects are implemented universally (PAN India). However the investment in doing so is not justified. As such opportunity cost fundamentals were found worth to be considered while dealing with such products. Many products/Projects were found to be implemented just to counter competition irrespective of justifying its usage at that particular area. This issues become more critical when we take case of a large bank like State Bank of India, which has spread of branches across Country even remote isolated village of eastern India, Leh or tribal belt of Kinnaur, Lahaul Spiti valley etc. Most of Bank’s products will never be used or required at these Branches Still Bank has implemented a universal technical platform whereby all products are made available.

5.4.1.3 Perceived advantages - Organization adopts new technology assuming associated relative advantage with it. Relative advantages are benefits from technology that may be different based on its properties. Generally it is expected that advantages from technology use include increased sales, extended market share, increased competitive advantages, improved efficiency, more accurate and timely information, better image, reduced costs, and effective decision-making. (Arunee Intraparirot)

5.4.1.4 Features of Technology - The features associated with technology impact directly on new technology adoption. Technological criteria consist of complexity, reliability, risk, and compatibility with existing systems, trial ability, observability, and standardization/customization. Banking being a dynamic business whereby customer requirement varies from area to area and business to business so flexibility of technology becomes important rather critical.

5.4.1.5 Internal Environment - As a universal rule internal environment should be positive with high acceptability for accommodating new technology and take advantages from technology usage. Organizational issues comprise adequate facilities, Management support, and staff acceptance, the open communication and tech-savvy attitude of staff.
5.4.1.6 **Customer Acceptance** - Since most of technologies implemented are for customers its always imperative that they are accepted by customer. Initially customer acceptance and satisfaction is the main concern for any technology which subsequently can be a source of revenue for Banks as customer can be charged for the same.

5.4.1.7 **External Environment** - Economic condition of any country directly influences the growth of every organization in that country particularly the financial sector. Usually during positive economy (having substantial growth rate) huge investments are made by companies and as a part of that many types of promising technologies are acquired and easily accepted. On the other hand, during negative growth either no heavy investments are made or organizations are more careful to select only promising necessary technology.

Most of these variables were used as the potential criteria of technology adoption and later on variables that interested the people in the bank were selected and used as technological criteria for the “Employed Technologies & Technical problems” (Appendix 1 - Questionnaire 1)

As explained above the main criteria consist of many sub criteria having their own effects on technology adoption. For example, relative advantages were further elaborated as increased sales, increased market share, more accurate and timely information and improved decision-making, etc.

Meanwhile, the two new criteria i.e. i) **Qualification of Deciding Authority** and ii) **Universal utility of adopted technology**, were also explored for their sub criteria. However, it was observed that certain findings were not suitable for documentation. Moreover, researcher being a part of organisation (working at senior level in IT Department) will not be permitted for publication of such observations. As far as other criteria is concerned i.e. “universal utility of adopted technology” it was observed that bank has launched a universal platform of technology all facilities/features in terms of projects/products are available at all branches PAN India. This issue was found to be debatable as Bank has 60% branches in rural India and most of tech savvy products may not be required thereat. However, Bank justifies this step in terms of RBI Stipulations of lead bankers and having no discrimination policy among customers. However, it is observed that cost of implementing technology universally, cannot be justified if we consider the concept of Opportunity cost.
2.5 Compatibility
2.7 Trial ability
2.8 Observability
3. Reliability
2.4 Security
2.1 Costs of technology

4. Easy for customers to use
4.2 Customer acceptance
4.1 Customer satisfaction
4.3 Easy for customer to use

5. Economic situation

The SBI
Relative advantage
1. Increased sales
1.2 Increased market share
1.3 Increased competitive advantage
1.4 Increased performance efficiency
1.5 Providing more accurate and timely information
1.6 Increased image
1.7 Reduced costs
1.8 Improve decision-making

3. Availability facilities
3.2 Executive support
3.5 Experience technology

2.2 Easy for staff to learn/use
2.6 Level of required skill
3.3 Staff acceptance
3.4 Level of actual skills in organisation and staff

2.1 Costs of technologies
2.3 Reliability
2.4 Security
2.5 Compatibility
2.7 Trial ability
2.8 Observability

Staff

External Environments

Customers
All these factors which affect the rate of technology adoption can be categorized into four systems:

- organization itself
- external environment
- staff
- customers.

Organization adopts technology because of two main reasons to manage the competitors move and to take lead or take advantage of situation by being innovative. As such anticipation for increased relative advantages from that particular technology (e.g. increased market share, more accurate and timely information, and increased image). Soundness of technological features (e.g. reliability, security and compatibility) impacts technology adoption positively. Furthermore, readiness of organizational environments (e.g. available facilities, management support, and experience in technology) increases the rate of technology adoption. Second, many issues related to staff acceptance of technology like ease of use, trainings to patch up the level of required and actual skill, and staff acceptance have to be taken into consideration. Third, if technology is employed to serve customers directly, factors such as customer satisfaction/acceptance and ease of use along with confidence in technology impact on the rate of technology adoption. Fourth, variables such as the economic situation of the country, which comes from the external environment, can impact positively or negatively on technology adoption. All these criteria were summarized in two categories: high and low level criteria. High-level criteria involved the main issues that are taken into account whenever the bank adopts new technology. On the other hand, low-level criteria as a sub set of high level criteria included specific issues detailed from the high level main criteria as illustrated in Figure 5.3.
Figure 5.3 High and Low Level Criteria

- E. Purse/ Plastic Money
- Core banking/CDC
- EFTs
- Internet Banking
- Mobile Banking

Source: Adopted from earlier research work.
5.4.2 Eliciting Information and Values - The high level and low level criteria were evaluated by respondents on a scale of 1 to 5. At this stage the "relative importance" of the specified criteria (i.e. weighting) and the performance of alternatives against the specified criteria (i.e. scoring) were determined (table 5.2).

<table>
<thead>
<tr>
<th>High level criteria</th>
<th>Level of Importance</th>
<th>Low level criteria</th>
<th>Level of Importance (Average Weight-1 low and 5 high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantages</td>
<td>4.12</td>
<td>1.1 Increased sales</td>
<td>4.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2 Increased market share</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 Increased competitive advantage</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.4 Increased performance efficiency</td>
<td>4.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 Providing more accurate and timely information</td>
<td>4.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.6 Increased image</td>
<td>4.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.7 Reduced costs (e.g. labour costs, operational costs, paper work, rework)</td>
<td>3.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8 Improved decision-making</td>
<td>4.38</td>
</tr>
<tr>
<td>Features of technology</td>
<td>4.07</td>
<td>2.1 Costs of technologies</td>
<td>3.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2 Easy for staff to learn/use</td>
<td>3.73</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.3 Reliability (fewer breakdown)</td>
<td>4.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4 Security (less openness to abuse)</td>
<td>4.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 Compatibility with existing systems</td>
<td>3.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.6 Level of required skills for staff to use technology</td>
<td>3.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7 Trial ability (ability to test it)</td>
<td>3.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8 Observability (ability to see if it works)</td>
<td>3.12</td>
</tr>
<tr>
<td>Bank environments</td>
<td>3.44</td>
<td>3.1 Available facilities</td>
<td>3.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2 Executive support</td>
<td>3.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 Staff acceptance</td>
<td>3.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.4 Level of actual skills in organization and staff</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5 Experience in technology</td>
<td>3.3</td>
</tr>
<tr>
<td>Customer behavior</td>
<td>3.91</td>
<td>4.1 Customer satisfaction</td>
<td>4.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.2 Customer acceptance</td>
<td>4.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.3 Easy for customers to use</td>
<td>4.42</td>
</tr>
<tr>
<td>Economic situation of the country</td>
<td>3.59</td>
<td>5. Economic prosperity, recession</td>
<td>3.71</td>
</tr>
</tbody>
</table>

Source: Data derived from “Employed Technologies & Technical problems Questionnaire”
5.4.2.1 **Weighting and scoring** - After the bank respondents gave weights ranging from 1 to 5 on both the high and low level criteria in order to indicate the level of importance of each criterion. The weights were averaged as a group weight. The level of importance of each high and low level criterion is indicated in Table 5.3. It can be observed that all the high level criteria are Important for the bank staff to take into consideration whenever new technologies are adopted. The importance weights as obtained from the “Employed Technologies & Technical problems” Questionnaire were used in this study.

After the weights of both high and low level criteria had been determined; all the alternatives were scored against the specified criteria by using the "Evaluation of Banking Technologies" (questionnaire 5.2). The scores were entered on a 0 to 100 scale, where a higher value represented a more preferred outcome. For example, Internet banking as the technology which does best on a particular criterion (e.g. increased sales) was assigned a score of 100. On the other hand, Mobile Banking, which does least well, was assigned a score of 0. All other alternatives were given intermediate scores, which reflect their performance relative to these two end points (Table 5.3).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Technologies</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Preferred</td>
</tr>
<tr>
<td></td>
<td></td>
<td>outcome</td>
</tr>
<tr>
<td>Increased sales</td>
<td>Any/Core Banking</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Plastic Money</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>CTS/EFTs</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Internet Banking</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Mobile Banking</td>
<td>55</td>
</tr>
</tbody>
</table>

5.4.3 **Evaluation and Analysis** - The "Evaluation of Banking Technologies" questionnaire explained how to score technological alternatives based on the concept of local scale - the best equals 100 whereas the worst equals 0 - quite a few respondents scored technological alternatives based on real scales. As submitted by Arunee Intrapariri in her earlier study the results were not suitable for comparison directly. Probably may be because it was not found to be suitable to rate two competitive aspects in such a fashion by putting 0 for one alternative and 100 for the other. Although this may have happened because the concept of local scale and
respondents' perception contradict each other. They may have felt that if two technological alternatives provide proximate outcomes, it is incorrect to put 0 for one alternative and 100 for the other. Therefore, they were inclined to rate scores based on the numbers that they perceived as a real scale for each technology. As a consequence, the technological evaluations were undertaken using both real scales provided by each respondent and local ones transformed from the real scales.

5.4.3.1 MCDM Analysis Based on Real Scale - The real scales provided by the respondents were averaged to find the group scores. Then, the V.I.S.A. software was used to determine the final weighted scores. The results of the technological evaluation are indicated in Table 5.4 and Figure 5.4. Various screen shots (Figure 5.4 a to 5.4 e) explains the application process of V.I.S.A software.

Table 5.4 results of the technological evaluation

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Technologies</th>
<th>The Best Technology Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic Money</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>Anywhere/Core Banking</td>
<td>72</td>
</tr>
<tr>
<td>3</td>
<td>CTS/EFTs</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>Internet Banking</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>Mobile Banking</td>
<td>56</td>
</tr>
</tbody>
</table>

Source: Result obtained using V.I.S.A on data Derived using from Employed Technologies & Technical problems Questionnaire (August 2008)

Figure 5.4 Best Technology

Source: Result obtained using V.I.S.A on data Derived using from "Employed Technologies & Technical problems Questionnaire."

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According to Figure 5.4, the best technology is Internet banking with a score of 78 and the second choice is a Core Banking (CDC) with a score of 72. Internet banking was judged superior to a Core Banking (CDC) in every criterion shown in table 5.5 and figure 5.5 (e.g. perceived advantages, customer acceptance, external environment, technology feature and internal environments).

If we consider the fresh data collected through questionnaires we get different result. Surprisingly Mobile Banking was found to be first choice followed by Anywhere/Core banking. This act again can be explained in terms of mobile penetration and ease of mobile banking.
Table 5.5 Revised results of the technological evaluation

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Technologies</th>
<th>The Best Technology Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plastic Money</td>
<td>62</td>
</tr>
<tr>
<td>2</td>
<td>Anywhere/Core Banking</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>CTS/EFTs</td>
<td>68</td>
</tr>
<tr>
<td>4</td>
<td>Internet Banking</td>
<td>72</td>
</tr>
<tr>
<td>5</td>
<td>Mobile Banking</td>
<td>82</td>
</tr>
</tbody>
</table>

Source: Result obtained using V.I.S.A on fresh data Derived using from Employed Technologies & Technical problems Questionnaire. (May 2012)

Figure: 5.5 Best Technology (Revised)

Table 5.6 Best Technology

<table>
<thead>
<tr>
<th>Preferred Technology through MCDM</th>
<th>Plastic Money</th>
<th>Anywhere/Core Banking</th>
<th>Cheque Trun. Sys/EFTs</th>
<th>Internet Banking</th>
<th>Mobile Banking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Advantage</td>
<td>64</td>
<td>78</td>
<td>58</td>
<td>80</td>
<td>62</td>
</tr>
<tr>
<td>Customer acceptance</td>
<td>70</td>
<td>66</td>
<td>64</td>
<td>84</td>
<td>60</td>
</tr>
<tr>
<td>External Environment</td>
<td>60</td>
<td>66</td>
<td>58</td>
<td>76</td>
<td>50</td>
</tr>
<tr>
<td>Technological feature</td>
<td>64</td>
<td>68</td>
<td>56</td>
<td>74</td>
<td>52</td>
</tr>
<tr>
<td>Internal Environment</td>
<td>62</td>
<td>64</td>
<td>64</td>
<td>80</td>
<td>56</td>
</tr>
</tbody>
</table>

Source: Result obtained using V.I.S.A on data Derived using from Employed Technologies & Technical problems Questionnaire.
5.4.3.2 MCDM Analysis Based on Local Scale

As explained the scale chosen was not found to be suitable and accordingly need was felt to convert in to local scale. The real scales were adjusted to local scales by using Buchanan (1997) formula given below and setting the highest score at 100 and the lowest one at zero.

Local score = \( \frac{(X-L) \times 100}{(U-L)} \)

Where
- \( X \) = Present Score
- \( L \) = Lower Score
- \( U \) = Upper Score

The real score of Any Where / Core Banking (CDC) is 72 and this was modified to the local score using the formula below.

The local scale of a Core Banking (CDC) = \( \frac{(X-L) \times 100}{(U-L)} \)

Where
- \( X \) = Present Score = 72
- \( L \) = Lower Score = 56
- \( U \) = Upper Score = 78

\[
\begin{align*}
\text{Score} & = \frac{72-56 \times 100}{78-56} \\
& = \frac{72-56}{78-56} \times 100 \\
& = (12/22) \times 100 \\
& = 54
\end{align*}
\]

Source: Result obtained using V.I.S.A on data Derived using from “Employed Technologies & Technical problems” Questionnaire.
Using the above formula the real scale of a Core Banking (CDC) of 72 is converted to local scale of 54. The other real scales of each technology were similarly converted using the same formula as indicated in the example and are shown in Table 5.7.

**Table 5.7 Conversion of Real Scales to Local Scales**

<table>
<thead>
<tr>
<th>Increased sales</th>
<th>Real Scale</th>
<th>Local Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Money</td>
<td>64</td>
<td>36</td>
</tr>
<tr>
<td>Anywhere/ Core Banking</td>
<td>72</td>
<td>54</td>
</tr>
<tr>
<td>CT Sys/EFTs</td>
<td>60</td>
<td>23</td>
</tr>
<tr>
<td>Internet Banking</td>
<td>78</td>
<td>100</td>
</tr>
<tr>
<td>Mobile Banking</td>
<td>56</td>
<td>0</td>
</tr>
</tbody>
</table>

**Source:** Data Derived from “Employed Technologies & Technical problems” Questionnaire, January 2008

The obtained local scales were then evaluated using V.I.S.A. software. The final results are illustrated in Figure 5.6.

**Figure 5.7 Best Technology on different scales**

According to Figure 5.6, the best technology is Internet banking with the score of 100 and the second choice is a Core Banking (CDC) with the score of 54. The graph indicates that Internet banking was also superior to a Core Banking (CDC)
on every criterion. However if we consider the latest data collected the results are likely to change as mobile banking has been found to be very popular.

5.5 COMPARISON OF INTUITION VERSUS MCDM ANALYSIS

While comparing various technologies ranked on the basis of intuition and MCDM based methodology, it is observed that technological alternatives based on the MCDM analysis either using real or local scales revealed that Internet banking was the best technology that can fulfill the bank’s mission and Core Banking (CDC) was the second best alternative followed closely by Plastic Money presented in Table 5.8. However, the results differed when compared with ranking on the basis of intuitive perceptions of the respondents; almost all of who considered that Core Banking was superior to Plastic Money and Internet banking.

Table 5.8. Technology Rank on different scales

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Intuition</th>
<th>MCDM (Real scale)</th>
<th>MCDM (Local scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anywhere/Core Banking</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Plastic Money</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CTS/EFTs</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Internet Banking</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mobile Banking</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Data from "Existing Banking Technologies & Technological Issues Questionnaire" and "Evaluation of Banking Technologies" Questionnaire

5.5.1 Observations discussion - The difference in preferred technology when compared the results of MCDM analysis and intuitive perception of the respondents can be contributed to various reasons discussed.

5.5.1.1 Criterion used - The main factor contributing this difference seems to be criteria used to evaluate the terminology. We have discussed earlier that Anywhere Banking/Core banking is one of the most preferred technology from bank’s prospective being MIS tool. The general perception is that it’s a technology for banks
not for the customer. Further, apparently for any customer visiting the branch it hardly makes any difference that counter is operating on manual system or back office computerization or may be full CBS platform.

At the same Internet Banking allows any customer to do banking from his/her premises may be office, home or while on move i.e. using mobile (using GPRS). Certainly, a user/customer friendly technology whereby user can feel the convenience of technology. This technology no doubt is based on anywhere/core banking platform and every individual customer can use it as such chosen by customer. Where as in case of core banking the benefit of technology can be felt only by customers who happens to use banking across cities

Therefore, if customer benefits (i.e. customer satisfaction, acceptance and ease of use) are taken into account, a anywhere/core banking is inferior to Internet banking. The lower scores of anywhere/core banking under this criterion result in lower scores for the whole evaluation. As can be seen the more weight on customer behaviour, the more Internet banking is superior to a Core Banking (CDC). Therefore, it can be concluded that one of the shortcomings of MCDM analysis is to use a specific criterion to evaluate two different alternatives where one alternative towers above the other. If other criteria are used, it may affect the results of the whole evaluation.

5.5.1.2 Data Interpretation - We have earlier explained the difference between qualitative and qualitative methods. In quantitative methods we do not capture all information but only the data being used, whereas intuitive judgmental methods allow people to use inside information or knowledge with selective bias, inconsistency, and emotional (optimistic or pessimistic) information. When the respondents select the best technology based on their own thinking and experience, they may consider other criteria (e.g. personal or political considerations). Whereas such things are not defined in case of any quantitative method which works only on the basis of pre-programmed parameters and same is applied to our methodology.

5.5.1.3 Conscious awareness - It is the quality or state of being aware of an external object or something within oneself. It has been defined as: subjectivity, awareness, the ability to experience or to feel, wakefulness, having a sense of selfhood, and the executive control system of the mind. Despite the difficulty in definition, many
philosophers believe that there is a broadly shared underlying intuition about what consciousness is. As such conscious awareness for intuition is low but it is high for rational analysis. In terms of intuition, Plastic Money gains more general approval than Internet banking because of its ease of operation. Similarly, in case of Core banking it is intuitively believed by bank officials that with this technology, the bank can prepare itself for present competition and also prepare a platform for future. Respondents may also be aware that Core Banking (CDC) projects in many organizations failed even before full implementation due to massive resource consumption without significant economic returns. On the other hand, Internet banking is a small project with completed implementation-through it the bank obtains customers and gains benefits from subscription fees, transfer fees and other advantages. Therefore, when comparing these technologies based on objective analysis, Internet banking becomes superior to Core Banking (CDC) and Plastic Money.

5.6 REQUISITE GROUP MODEL OF IT ADOPTION:

RESEARCH QUESTION 2

In this chapter we illustrated the process required to develop the requisite model of IT adoption to provide an answer to second research question, "what is a requisite group model of IT adoption?". The exercise to develop model was divided in to three stages :-

- Structuring a problem
- Eliciting information and values
- Evaluation

At first stage we identify that the bank tries to manage its operation in such a way that it can become the best bank of India and can compete with international banks apart from achieving its mission. Accordingly, bank introduces various technologies, from both prospective i.e. Bank’s prospective and customer point of view. We summarized all these technologies and finally used technology alternative which were found to be most popular from customer’s prospective namely Plastic Money, Anywhere/Core Banking, Internet banking, Mobile Banking and Cheque
Truncation System/E.F.Ts. In continuation to earlier study done by Arunee, two more criteria were added to the list of five such alternatives finalized by her. However the study was carried on earlier used five high level criteria and the associated low level criteria. Since the findings of the two new criteria could not be incorporated. The evaluation stage was to evaluate the specified alternatives and conduct sensitivity analysis using the V.I.S.A. software. The model analysis revealed that the preferred technology were Internet banking and Anywhere/core banking technology, respectively.

The requisite model can be defined as a model which uses a dynamic process, includes all relevant actors and significantly includes them in process and develops a deeper understanding of it over the time. The model considers the sensitivity factors and can be used in a group environment. Because of these properties/qualities the model was justified as a requisite model.

The Problems are resolved in a dynamic way by first defining the mission the Bank and taking appropriate steps to achieve by defining the policy frame work for the year including implementation of IT projects. All the potential alternatives and criteria used for evaluation were identified and then evaluated using the user-friendly software that allows decision-makers to compare the results with their intuition in order to confirm their perception or further investigate the causes behind the different outcomes. Using this model the policy makers can conduct sensitivity analysis or make changes so that the model fit with their requirement.

Further, the model gives opportunity to have in depth analysis and understanding of various criteria the model creates a deeper understanding for decision-making. Normally, since banks don’t have technical people at decision making level the in charge decision-makers may take decision with a narrow view i.e. may consider only a few variables known to them or commonly observed, such as customer behaviour, the economic situation of the nation, and features of technology. However, from our experience and information from the literature review reveals some more variables that should be taken into account. This model being a dynamic model has options to add new variables in both the categories i.e. High Level and Low level categories. In the present case we could find two more high level criteria namely Qualification of deciding authority and opportunity cost of implantation of particular technology and have been explained in detail. However, being part of the
system itself researcher could not explore them further and research was carried out on the basis of earlier used criteria by Arunee. In this model we studied all possible variables in detail and subsequently choose the variables relevant to respondents. As such it helps the decision maker to have better understanding of existing system and allows them study and adds other variables that may impact the technology adoption process.

Also the results obtained from model were analog or say analytical which differed from the one achieved by summarizing the institution based database of respondents. The model provided options to analyze this difference to further resolve the issue by using other application software. This model was developed in a group environment since its not possible to have all concerned people together for every small issue. So interviews and questionnaires were used to gather information.

In this model we can analyze the information and design the model being a dynamic model and further can compare the outcomes. As such we can say that the Model developed by using MCDM technique is the requisite model of technology adoption. This model helps in understanding organization problems, considers relevant variables/factors and provides analytical solutions, can compare the result with the one got from intuition based data collection. Also there are option and provisioning to compare both results. The criteria chosen can be changed depending upon the circumstances as such we find the model highly flexible and dynamic.

5.7 SUMMARY

In this chapter we illustrated the various technologies used by bank from Customer’s prospective and MIS view point. We developed a model using MCDM technology which helps Bank to adopt the most preferred technology which in turn is a part of Bank’s policy to achieve Bank’s Mission. After analyzing various factors five technologies from Customers point of view were chosen to be studied further and find out most preferred technology on the basis of respondents intuition and MCDM technology. The technology’s covered were Anywhere/Core Banking, Mobile Banking, Internet Banking, Plastic Money and Cheque Truncation System/EFTs.

The model analyses provided the answers for the second research question, what is a requisite group model of IT adoption of the bank? According to the MCDM analysis, Internet banking was preferred technology, which help the bank achieve the mission.

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However, this result was contradicted with respondents' intuitive perception i.e. Anywhere/Core Banking was a more preferable choice. Sometime the decision based on intuition is criticized by decision analyst.

Indian banking industry after made open to private participation has posed big challenges for Public Sector Banks. Their management has to adopt latest technologies just to be at par with private Banks and foreign Banks apart from helping them in MIS activities. As such the management or decision makers has to have the ability to combine their business experience with a sense of "computer intuition" to visualize which information technologies could help bank in getting competitive advantage. As such we understand that while choice of technology is important but equally important is to bridge the gap and detect the reasons for that so that experience can be matched or paired with technology to yield best results.

To summarize we can say that the model using MCDM is simple and analytical but it’s a useful tool for management. It helps in increasing understanding of subject matter and supports the results with statistical factors. In this model decision-makers may change a set of criteria, adjust weighting and scoring, and subsequently carry out sensitivity analysis to verify the findings. That would lead to improve their decision-making after examining the results. We can priorities the choices of technologies using MCDM technique and as such can narrow down the scope of analysis. Intuition theory also helps in similar fashion but MCDM is an analytical tool.

However, both these theories have discrepancies in terms of inter relationship of variables and limitations of each variable. Results may be time frame is not fixed or nonlinear parameters are not adjusted to right scale.

We find that anywhere/Core banking and internet banking are two most popular technologies which can help in fulfilling Bank’s mission. These technologies are having multiple benefits and have impact on every aspect of banking. Therefore it is proposed to elaborate these technologies further using a system Dynamic analysis next chapter in order to explore more advantage from these technologies.
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