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## Customer's Choice amongst Self Service Technology (SST) Channels in Retail Banking: A Study Using Analytical Hierarchy Process (AHP)

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## Abstract

In the retail banking context, convergence of technologies has given birth to different channels of distribution like Automatic Teller machines (ATM), internet banking, and mobile banking. This enables the customer to avail the banking services at any time and any where. These technological interfaces are known as self service technologies (SSTs). Customers availing banking services through these SSTs get more benefits in terms of time, cost and energy. Despite these benefits the customer trial, adoption and repeat usage of SSTs vary among banking customers. Although the kinds of service one can avail from these SST are similar, the patronage among the SSTs differs. The SST channel choice could be attributed to various factors viz., Nature of service to be availed or purpose, Perceived risk, Requirements and Benefits. When it comes to predicting customer priority among alternatives, Analytical hierarchy process (AHP) has been proved as an effective technique. This paper explores the factors influencing customer choice of SSTs by employing AHP technique.

**Keywords: Retail banking, self service technologies (SSTs), Channel choice, Analytical hierarchy process (AHP),**

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## INTRODUCTION

In the last two decades, service industry has witnessed tremendous changes in the way business is conducted Comparing to the previous era. Convergence of technologies has made the distribution of services more convenient than ever before. Automatic Teller Machines, bill payment kiosks, internet based services and phone based services (both voice and text), automated hotel check out, automated check-in for flights, automated food ordering system in restaurants, vending machines, Interactive voice response systems are examples of technology based service delivery channels. These technology enabled service delivery mediums are known as self service technologies (SSTs). In case of retail banking the customers receive the services through technology enabled mediums such as Automatic Teller Machines (ATM), Internet and Mobile phone. SSTs are defined as technological interfaces that aid users generating service with out direct involvement from the service company employee (Meuter et al., 2000).The banks adoption of this technology enabled mediums swiftly changed the way the consumers received the services.

These SSTs provide advantages for service providers and customers alike (Bitner et al., 2002; Meuter et al, 2000; Bitner et al., 2000; Brown, 1997; Dabholkar, 1991, 1996). When customers of retail banking avail the services through these SSTs, they get more benefits in terms of time, cost and energy; the service providers reduce their personnel costs and gain closer access to the customer. Further in order to project them as tech savvy bank and to have a point of parity, almost all the leading nationalized and private banks in India are offering their services through the every available technology enabled mediums. This leads to a situation in which the customer is confronting with myriad of options to avail the banking service. Not all the services offered through one particular SST are being utilized by the customer. The utilization level varies due to various factors. We theorize that customer will evaluate the different SST options for carrying out specific task and finally settles with the option that will best serve the purpose. Since

various factors determines the selection of a specific SST for a specific purpose. The objective of this research is to identify the factors influencing usage of SSTs in general and to identify the priority for the different SST channels in a retail banking environment

## CONCEPTUAL BACKGROUND

In response to the increasing role of technology in services researchers have begun to explore customer perceptions and usage of service delivery technologies. The outcome of these research has shown that adoption of technology-enabled services is impacted by number of factors viz., perceived ease of use and perceived usefulness (Davis, 1989), comparative benefits and advantages offered (Davis, 1993; Agarwal and Karahanna, 2000; Meuter et al., 2000, 2003), perceived risk (Walker et al., 2002, 2006; Meuter et al., 2005), locus of control (Oyedele et al., 2007), self efficacy (Dabolkar and Baggiozzi., 2002; Badura,1977), technology reliability (Walker et al., 2002), security (Bitner, 2001; Tero pikkarainen et al., 2004), technology readiness (Liljander et al., 2006) and technology anxiety (Meuter et al.,2005; Oyedele et al., 2007). The existing research on customer adoption of SSTs focuses only a specific SST and few specific factors at a point of time. Most of the research available in the retail banking context deals with adoption of internet banking only. When a customer is confronted with more service delivery channels, then choosing among the alternative delivery channels was studied between personal and technology enabled services (Walker et al., 2002; Dabholkar and Baggiozzi, 2002) but not amongst SSTs. The role of purpose and system requirements on the choice of SST in a multiple choice environment has not been studied before.

The purpose of SST usage can be classified as customer service, transactions and self-help (Meuter et al., 2000).In the banking context customer service denotes getting information about the account balance available, getting statement of accounts, ordering for check books, applying for loans etc. Transaction involves making payments through SSTs like paying electricity bills, Telephone bills, booking tickets for travel and entertainments, third party transactions. Self-help includes knowing about the banks activities, location of branches, interest rates, procedures related to availing different services extended by banks etc

Perceived risk (PR) is commonly thought of as felt uncertainty regarding possible negative consequences of using a product or service. Perceived risk was defined by Bauer (1960) to have a two-dimensional structure; namely, adverse consequences, and uncertainty It has formally been defined as “a combination of uncertainty plus seriousness of outcome involved” (Bauer, 1967),‘Consequence’ is the degree of importance and/or danger of the outcomes derived from any consumer decision; ‘uncertainty’ is the subjective possibility of these outcome.

Cunningham (1967) identified two major categories of perceived risk (a) performance and (b) psychosocial. Further he classified the performance component into three types (i) economic, (ii) temporal, (iii) effort; and classified psychosocial into two types—(i) psychological and (ii) social. Cunningham (1967) further typified perceived risk as having six dimensions—(1) performance, (2) financial, (3) opportunity/time, (4) safety, (5) social and (6) psychological loss.

Table: 1 Description and definition of perceived risk facets

Perceived Risk Facet	Description—Definition
1. Performance risk	The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore failing to deliver the desired benefits.(Grewal et al., 1994)
2. Financial risk	The potential monetary outlay associated with the initial purchase price as well as the subsequent maintenance cost of the product (Grewal et al., 1994). The current financial services research context expands this facet to include the recurring potential for financial loss due to fraud
3. Time risk	Consumers may lose time when making a bad purchasing decision by wasting time researching and making the purchase, learning how to use a product or service only to have to replace it if it does not perform to expectations
4. Psychological risk	The risk that the selection or performance of the producer will have a negative effect on the consumer's peace of mind or self-perception (Mitchell, 1992). Potential loss of self-esteem (ego loss) from the frustration of not achieving a buying goal.
5. Social risk	Potential loss of status in one's social group as a result of adopting a product or service, looking foolish or untrendy.
6. Privacy risk	Potential loss of control over personal information, such as when information about you is used without your knowledge or permission. The extreme case is where a consumer is "spoofed" meaning a criminal uses their identity to perform fraudulent transactions

Source: Featherman and Pavlou (2003)

Many researchers have used the six basic dimensions in their studies (for example, Cheron and Ritchie, 1982; Mitra, Reiss, and Capella, 1999; Stone and Gronhaug 1993; Kim and Prabhakar 2002, Featherman and Pavlou 2003) Kim and Prabhakar (2002) explained the effect of perceived risk on accepting technology such as Internet banking by demonstrating that the more perceived risk one has, the less likely he will accept new technology. Many researchers evaluated the role of perceived risk on adoption of SSTs in the banking context (for example Lee 2009, Kuisma *et al.*, 2007, Featherman and Pavlou 2003)

Whilst risk is present in every choice situation, it would seem self-evident that these risk dimensions will be present in varying proportions depending on the product or service category under consideration. Services are seen to be riskier than goods, particularly in terms of social risk, physical risk and psychological risk (Murray and Schlacrer, 1990).

When customers of retail banking avail the services through these SSTs, they get more benefits in terms of time, money, less physical efforts besides 24 x 7 access to banking (Bitner et al., 2002; Meuter et al, 2000; Bitner et al., 2000; Brown, 1997; Dabholkar,

1991, 1996).Based on the existing literature it can be implied that SST channel choice is influenced by Purpose, Perceived risk, Benefits and Equipments & skill requirement.

## **ANALYTICAL HIERARCHY PROCESS METHODOLOGY**

The AHP is a mathematical method used to determine the priorities of different decision alternatives via pair wise comparisons of decision elements with respect to a common criterion. It provides an objective way for reaching an optimal decision for both individual and group decision makers. It is the widely adopted method in the cases where the decision of the selection among the given alternatives and their ranking is based on several attributes. The AHP technique is extensively used in modeling the human judgment process (Lee et al 1995). This method is based on the problem decomposition into a hierarchy structure which consists of the elements such as: the goal, the criteria (sub-criteria) and the alternatives. The output of this method is a prioritized ranking, indicating the overall preference for each of the decision alternative.AHP has three major steps (Saaty 1994)

**(i) Problem decomposition:** A complex problem is decomposed into levels consisting of a few manageable elements; each element is also, in turn, decomposed hierarchically in lower decision levels. The hierarchy model of the decision problem is developed in such a way that the goal is positioned at the top, with criteria and sub-criteria on lower levels and finally alternatives at the bottom of the model.

**(ii)Comparative analysis:** On each hierarchy structure level the pair wise comparisons should be done by all possible pairs of the elements of this level. The decision maker's preferences are expressed by verbally described intensities and the corresponding numeric values on 1-3-5-7-9 scale (Saaty, 1980). The detailed scale is given in table 1

**(iii)Synthesis of priorities:** On the basis of the pair wise comparisons relative significance (weights) of elements of the hierarchy structure (criteria, sub-criteria and alternatives) are calculated, which are eventually synthesized into an overall alternatives priority list. The priority weights of each element will be calculated based on Eigen vector.

Table 2 Pair wise comparison scale

Intensity	Definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Moderate importance of one over another	Experience and judgment favor one factor over another
5	Essential or strong importance	Experience and judgment strongly Favor one factor over another
7	Very strong importance	An factor is strongly favored and its dominance demonstrated in practice
9	Extreme importance	The evidence of favoring one factor over another is of the highest possible order of affirmation
2, 4, 6, 8 Intermediate values when compromise is needed		

The computational process of the priorities is detailed in this section. Let there be  $n$  criteria and their actual relative priorities are  $w_1, w_2, \dots, w_n$ . Further, let  $\mathbf{A}$  be an  $n \times n$  matrix of pair wise comparison, whose elements are assigned from Table 1. These elements,  $a_{ij}$  may be regarded as an estimate of the ratio  $w_i/w_j$ .

$$\mathbf{A} = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \dots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \dots & w_2/w_n \\ \vdots & \vdots & \dots & \vdots \\ w_n/w_1 & w_n/w_2 & \dots & w_n/w_n \end{bmatrix} \tag{1}$$

We suppose that  $a_{ij} > 0$  and  $a_{ij} = a_{ji}^{-1}$ . If the relative significance ratios  $a_{ij}$  are used to form the matrix  $\mathbf{A}$ , and in the case of consistent evaluations where  $a_{ij} = a_{ik} a_{kj}$  the equation  $\mathbf{A}w = \lambda_{\max}w$  is satisfied. The analytical solution of Equation (2) then provides the relative weights for each decision element. According to the eigenvalue method, the normalized right eigenvector ( $\mathbf{W} = \{w_1, w_2, \dots, w_n\}^T$ ) associated with the largest eigenvalue ( $\lambda_{\max}$ ) of the square matrix  $\mathbf{A}$  provides the weighting values for all decision elements. The largest eigenvalue ( $\lambda_{\max}$ ) can be computed by using Equation (3)

$$AW = \lambda_{\max} W \quad (2)$$

$$\lambda_{\max} = \sum_{i=1}^n \left[ \left( \sum_{j=1}^n a_{ij} \right) \times W_j \right] \quad (3)$$

The weights are normalized by constraint  $\sum w_i = 1$ . Due to this matrix features the  $\lambda_{\max} \geq 1$  is valid, whereas the difference  $\lambda_{\max} - n$  is used for measuring the assessment consistency. By means of consistency indices given by equation (4)

$$CI = (\lambda_{\max} - n) / (n-1) \quad (4)$$

The consistency ratio  $CR = CI/RI$  can be computed, where RI is the random index (consistency index for matrices with random generated pair wise comparisons). The table 2 with the RI values computed by simulation is used for the calculation of the CR. Generally, a CR of 0.10 or less (for  $n \geq 5$ ); 0.09 or less (for  $n = 4$ ); 0.05 or less (for  $n = 3$ ), is considered acceptable. Otherwise the relative importance for each objective will be revised to improve the judgmental consistency. Then the priorities are pulled together through the hierarchic composition to provide the overall assessment of the available alternatives.

## APPLICATION OF THE AHP TECHNIQUE IN CHOICE OF SST

Consumer's choice criteria for SSTs: Consumers' choice criteria were determined based on the existing literature (Walker et al., 2002, 2006; Meuter et al., 2005, Davis, 1993; Agarwal and Karahanna, 2000; Meuter et al., 2000, 2003 Lee et al 2009, Kuisma et al., 2007, Featherman and Pavlou 2003). Figure 1 shows the structuring of the hierarchy of consumers' choice problem, which includes four levels. The top level of the hierarchy represents the ultimate goal of the problem, while the second level of the hierarchy consists of four main channel selection criteria, which are namely Purpose, Perceived risk, Benefits, Requirements. At the third level, these criteria are decomposed into various sub-criteria that may affect the consumer's choice for a particular channel. Finally, the bottom level of the hierarchy represents the alternative SST channels. Based on the criteria and sub criteria considered, a detailed instrument was developed for capturing the customer preference.

Calculation of the weights of the criteria: First the degree of preference between and within the criteria at each level of the hierarchy in a pair wise form using Saaty's scales ranging from 1 – equally preferred to 9 – extremely preferred. The data was obtained from 40 customers of a reputed, nationalized bank located in the technological university where the author's are affiliated. Next step involves the weight calculation of each level to obtain the overall score of each SST channel with respect to all 17 sub-criteria and pair wise comparisons of the main selection criteria. Table 2 presents the local weights of each SST channel with respect to main channel selection criteria and the synthesized priority score for each SST channel. The detailed calculation of the local weights using AHP methodology is given in the Appendix-A.

Figure1: Hierarchy of decision criteria

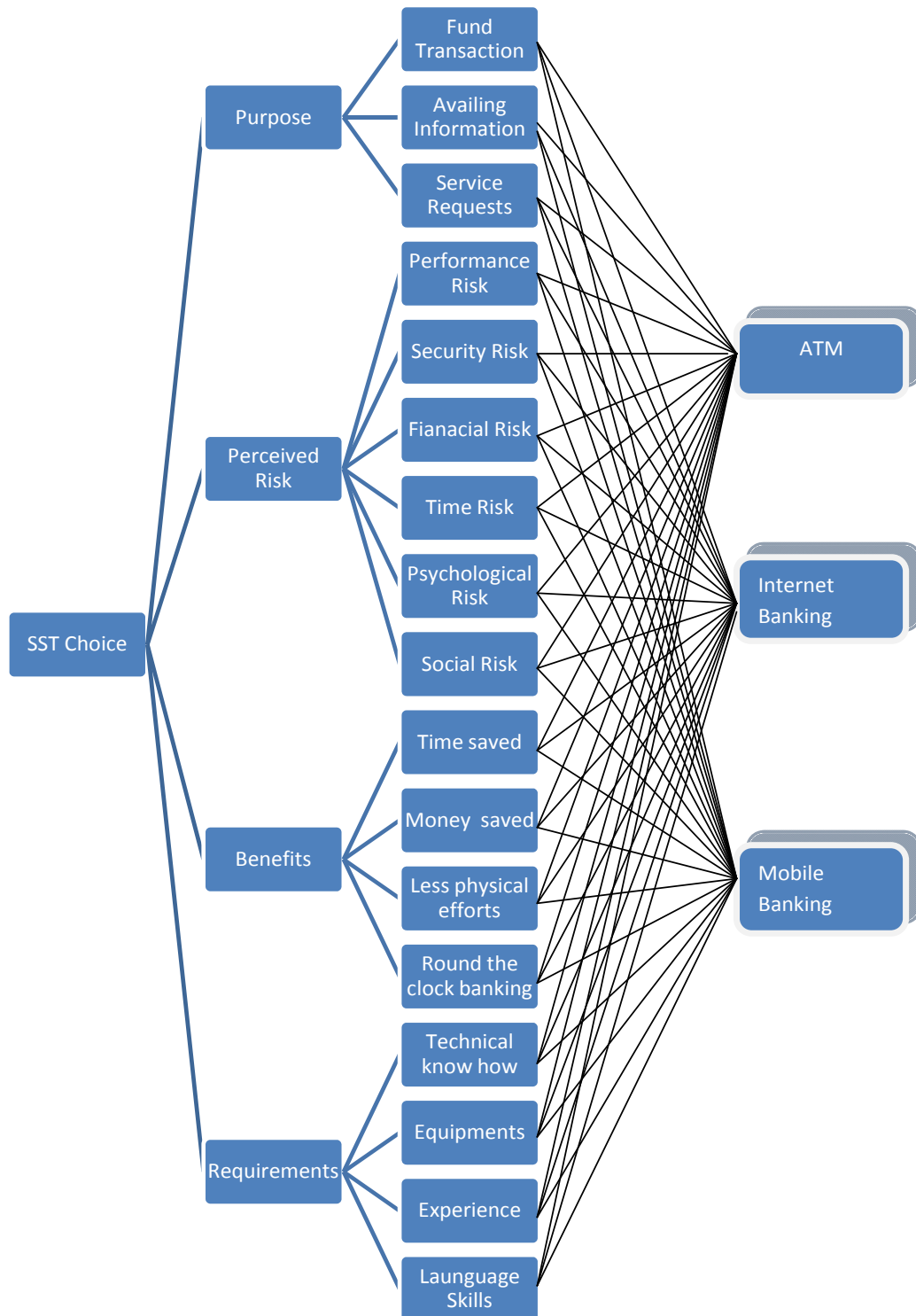


Table: 3 Each Channel's local weight related to the respective selection criterion

	Purpose (.098)	Perceived risk (.259)	Benefits (.592)	Requirements (.049)	Overall Priorities
ATM	0.198	0.662	0.313	0.66	0.408
Internet banking	0.508	0.178	0.327	0.16	0.297
Mobile banking	0.291	0.14	0.355	0.172	0.283

The over all priority is arrived by multiplying the local weights with the weights of the respective criterion and summing it up. For example the priority for ATM is computed as follows  $0.198*0.098+0.662*.259+0.313*0.592+0.66*0.049=0.408$

## CONCLUSION AND MANAGERIAL IMPLICATIONS

This study explains the customer preferences towards SST channels in a multi channel environment. The real choice criterion which includes the Purpose, Perceived risk, Benefits and Requirements cannot be quantitatively and precisely measured. The application of AHP which enable to capture decision maker's subjective evaluation related to channel selection criteria provide accurate and consistent channel preferences. On a whole ATM is found to be the most preferred channel followed by Internet banking and Mobile banking with more or less equal weights. When it comes to catering various purposes for which SSTs are used, the internet banking is widely used for Service requests, availing information and fund transfer followed by mobile banking and ATM as customers use Internet and mobile for service requests and availing information. For avoiding the perceived risk associated with SSTs, ATM is the most preferred channel followed by Internet banking and Mobile banking. The perceived benefits of the all the three SST channels found to be equal though the patronage is not uniform. Under the system and Skill requirements criteria, ATM is mostly preferred as one need not own any equipment and need little skills to use it. Mobile banking is the next preferred channel under these criteria. The customer need to own hand sets with blue tooth facility and software provided by the bank need to be installed in it so as to carry out fund transfer through mobile phones. Internet banking is the least preferred channel under system skill requirement criteria as the customer need a computer with internet connection. As the benefits perceived equal amongst the SST channels, the patronage for Internet banking and mobile banking can be improved if the risk perception is reduced.

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APPENDIX-A

Table: A1 Local weights for the criteria 'Purpose'

<i>A. Comparison of criteria with respect to Purpose</i>				
Criteria	Fund Transaction	Availing Information	Service requests	AHP –Priority
Fund Transaction	1	2	7	0.562
Availing Information	1/2	1	8	0.374
Service requests	1/7	1/8	1	0.0625
Consistency ratio=.07				
<i>B. Comparison of SST alternatives with respect to Fund transaction</i>				
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority
ATM	1	1/3	5	0.266
Internet banking	3	1	9	0.669
Mobile banking	1/5	1/9	1	0.063
Consistency ratio=.01				
<i>C. Comparison of SST alternatives with respect to Availing Information</i>				
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority
ATM	1	1/3	1/5	0.110
Internet banking	3	1	1/2	0.309
Mobile banking	5	2	1	0.581
Consistency ratio=.00387				
<i>D. Comparison of SST alternatives with respect to Service requests</i>				
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority
ATM	1	1/3	1/4	0.120
Internet banking	3	1	1/3	0.272
Mobile banking	4	3	1	0.608
Consistency ratio=.0767				

Computation of Local weight for ATM, Internet banking, Mobile banking under the criteria purpose is as follows

$$0.562 \times 0.266 + 0.374 \times 0.110 + 0.0625 \times 0.120 = 0.198$$

$$0.562 \times 0.669 + 0.374 \times 0.309 + 0.0625 \times 0.272 = 0.508$$

$$0.562 \times 0.063 + 0.374 \times 0.581 + 0.0625 \times 0.608 = 0.291$$

Table: A2 Local weights for the criteria 'Perceived risk'

<i>A. Comparison of criteria with respect to Perceived risk</i>							
Criteria	Perform. risk	Security risk	Financial risk	Time risk	Psych. risk	Social risk	AHP-Priority
Perform. risk	1	3	1/2	4	6	8	0.272
Security risk	1/3	1	1/3	4	5	6	0.171
Financial risk	2	3	1	5	7	9	0.375
Time risk	1/4	1/4	1/5	1	3	5	0.087
Psych. risk	1/6	1/5	1/7	1/3	1	4	0.0525
Social risk	1/8	1/6	1/9	1/5	1/4	1	0.026
Consistency ratio=0.09							
<i>B. Comparison of SST alternatives with respect to Performance risk</i>							
SST alternative	ATM	Internet banking	Mobile banking				AHP –Priority
ATM	1	4	5				0.665
Internet banking	1/4	1	3				0.231
Mobile banking	1/5	1/3	1				0.104
Consistency ratio=0.0996							
<i>C. Comparison of SST alternatives with respect to Security risk</i>							
SST alternative	ATM	Internet banking	Mobile banking				AHP –Priority
ATM	1	5	3				0.633
Internet banking	1/5	1	3				0.106
Mobile banking	1/3	3	1				0.259
Consistency ratio=0.0378							
<i>D. Comparison of SST alternatives with respect to Financial risk</i>							
SST alternative	ATM	Internet banking	Mobile banking				AHP –Priority
ATM	1	7	9				0.790
Internet banking	1/7	1	2				0.133
Mobile banking	1/9	1/2	1				0.077
Consistency ratio=0.0322							
<i>E. Comparison of SST alternatives with respect to Time risk</i>							
SST alternative	ATM	Internet banking	Mobile banking				AHP –Priority
ATM	1	5	7				0.724
Internet banking	1/5	1	3				0.193
Mobile banking	1/7	1/3	1				0.083
Consistency ratio=0.0844							
<i>F. Comparison of SST alternatives with respect to Psychological risk</i>							
SST alternative	ATM	Internet banking	Mobile banking				AHP –Priority
ATM	1	3	8				0.646
Internet banking	1/3	1	6				0.290
Mobile banking	1/8	1/6	1				0.064
Consistency ratio=0.084							
<i>G. Comparison of SST alternatives with respect to Social risk</i>							
SST alternative	ATM	Internet banking	Mobile banking				AHP –Priority
ATM	1	1	1				0.333
Internet banking	1	1	1				0.333
Mobile banking	1	1	1				0.333
Consistency ratio=0.000							

Table: A3 Local weights for the criteria 'Benefits'

<i>A. Comparison of criteria with respect to Benefits</i>					
Criteria	Time saved	Money saved	Less phy. efforts	Rou clock bankg	AHP – Priority
Time saved	1	1/3	1/4	1/6	0.066
Money saved	3	1	1/3	1/4	0.139
Less phy. efforts	4	3	1	1/2	0.296
Rou clock bankg	6	4	2	1	0.496
Consistency ratio=0.03					
<i>B. Comparison of SST alternatives with respect to Time saved</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	¼	5	0.236	
Internet banking	4	1	9	0.701	
Mobile banking	1/5	1/9	1	0.062	
Consistency ratio=0.0893					
<i>C. Comparison of SST alternatives with respect to Money saved</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	5	6	0.723	
Internet banking	1/5	1	2	0.174	
Mobile banking	1/6	1/2	1	0.103	
Consistency ratio=0.0374					
<i>D. Comparison of SST alternatives with respect to less physical efforts</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	1/3	1/5	0.11	
Internet banking	3	1	1/2	0.309	
Mobile banking	5	2	1	0.581	
Consistency ratio=0.0037					
<i>E. Comparison of SST alternatives with respect to Round the clock banking</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	1	1	0.333	
Internet banking	1	1	1	0.333	
Mobile banking	1	1	1	0.333	
Consistency ratio=0.000					

Table: A4 Local weights for the criteria 'Requirements'

<i>A. Comparison of criteria with respect to Requirements</i>					
Criteria	Technical knowhow	Equipments	Prior experience	Language skills	AHP – Priority
Technical knowhow	1	3	1/4	5	0.251
Equipments	1/3	1	1/3	3	0.138
Prior experience	4	3	1	9	0.556
Language skills	1/5	1/3	1/9	1	0.049
Consistency ratio=0.08					
<i>B. Comparison of SST alternatives with respect to Time saved</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	1/4	5	0.236	
Internet banking	4	1	9	0.701	
Mobile banking	1/5	1/9	1	0.062	
Consistency ratio=0.0893					
<i>C. Comparison of SST alternatives with respect to Money saved</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	5	6	0.723	
Internet banking	1/5	1	2	0.174	
Mobile banking	1/6	1/2	1	0.103	
Consistency ratio=0.0374					
<i>D. Comparison of SST alternatives with respect to less physical efforts</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	1/3	1/5	0.11	
Internet banking	3	1	1/2	0.309	
Mobile banking	5	2	1	0.581	
Consistency ratio=0.0037					
<i>E. Comparison of SST alternatives with respect to Round the clock banking</i>					
SST alternative	ATM	Internet banking	Mobile banking	AHP –Priority	
ATM	1	1	1	0.333	
Internet banking	1	1	1	0.333	
Mobile banking	1	1	1	0.333	
Consistency ratio=0.000					