



# Diffusion of Smart Cards in Indian Banking Sector: An Empirical Investigation

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## ABSTRACT

Plastic cards are the neglected innovation as far its research on diffusion and adoption from bankers' perspective is concerned. The present study tends to fill that gap by analyzing the adoption pattern and diffusion of smart cards in Indian banking Industry. The present study would serve as the roadmap for the regulators to frame polices and guidelines while introducing new technology in the industry which are best suited to customers as well as bankers. While investigating the bank specific variables, the results of the study have capacity to provide authentic and reliable directions to the bankers regarding diffusion and adoption decision. Thus, a comprehensive model has been developed which can assist the bankers to check the rate of success of upcoming innovation within the industry.

**Keywords: Smart Cards, India, Banking, Adoption, Determinants**

**Jel Classification: O33, C32, E42, L25, N75**

## INTRODUCTION

Innovation is the key to transform people's lives. It is widely recognized that innovation plays a crucial role in improving efficiency and productivity. Scientific research and novel technologies deliver real benefits only when innovators appropriately apply them to improve the lives of ordinary people (Melnick and Melnick, 2007). Thus, the objective of innovation in the financial market can be diverse as it can be understood as something new which is supposed to reduce costs, risk, or provide improved product, service, that better meets needs of demand of financial market's participants. Hence, in financial sector main entities participating in

creation, implementation and taking advantage of innovation are financial institutions, customers, regulating institutions, technology suppliers and society as a whole.

The dynamics of innovation in service firms are of particular interest for the overall discussion around the adoption of new technology as most of people believe that we are now in a new economy where the rapid diffusion of IT has dramatically altered the economic landscape we live in (Khan, 2004).

Banking in India too is undergoing rapid transformation. Prime factors ushering these changes are increased competition, more demand for productivity and efficiency of operations, reduced operating margins, better asset/liability management, anytime and anywhere banking. Exploiting the benefits of technology holds the key for enabling the financial system to manage the forces of change. A major force behind these developments is information technology (Kamesam, 2005). By using IT, a bank not only can reach out to maximum customers to provide them general information about its services but also get the opportunity of performing interactive retail banking transactions. Since 1990s, they have continuously introduced technology oriented products and services, such as multifunctional automatic teller machine (ATM), electronic share application, telephone banking, electronic transfers, plastic cards and internet based banking (Balkrishnan, 2006). The demanding environment has exposed banks to various challenges like customer service, branch banking, competition, technology and risk management system (Leeladhar, 2005). Hence, it becomes necessary for the banks to meet the required standards and challenges which in turn have made it necessary for the banks to introduce innovative products through e-banking and e-payment system. It can be regarded as one of the ways for the banks to survive in this environment by launching the electronic products in the market viz. Internet Banking, Plastic Cards, Electronic Fund Transfer, Mobile Banking etc. which are known for its unique features like more speed to conduct transactions, universal applicability, lesser financial cost etc. However, the adoption of these products should be made by taking into consideration the customers' needs, preferences, societal perceptions, supplier convenience and need of an hour.

However, in spite of the striking potential benefits, many banks still hesitate to adopt, or fail to implement plastic cards successfully. According to Frame and White (2004) banks generally do not have a reputation for rapid adoption of innovative technologies. Nevertheless, new technologies eventually enter the banking sector, as banking firms are profit maximizers. Smart cards can be considered as one of the contemporary services being provided by the banks these days. The present study aims to describe the various determinants which tend to affect the adoption and diffusion of smart cards in banks.

## REVIEW OF LITERATURE

The rapidity with which an innovation is adopted across an industry is an interesting question. Thus rate at which innovations are adopted by firms constitutes an important part of process of technological change. An investigation of the firm specific and market specific characteristics, which influence decision to adopt innovation, has long been recognized as an important area of the study (Hannan and Mcdowell, 1983).

Investing in new technology is a major decision for top management. However in spite of its rising importance, relatively little is known about the adoption process and factors that affect the adoption. Diffusion theory research has helped to identify and understand the various factors and has provided substantial insight into the determinants of the adoption decision (Fichman, 1992). These factors may well have divergent impacts on the various stages of the innovation decision process (Karhanna *et al.*, 2000)

Hence, the voluminous studies and research has been conducted on the financial innovation services. However, the maximum emphasis has been given on the adoption and diffusion of internet banking services. Thus, the factors influencing the banks' decision to adopt new technology is an interesting area to explore. The present study tends to fill that gap by analyzing the adoption pattern and diffusion of plastic cards in Indian banking Industry.

## DATABASE AND RESEARCH METHODOLOGY

### *Objective of the Study*

In present study, the main objective is to explore the factors which may have helped to drive the diffusion and adoption of smart cards in Indian banking sector.

### *Sample Description*

The sample consists of all the commercial banks prevailing in India during 2020 i.e. 79 in number out of which 29 are foreign banks, 23 are private sector banks and 27 are public sector banks. The time period of the study is 20 years i.e. from 2000 to 2020. The data relating to sampled banks' characteristics have been collected from database of Reserve Bank of India.

### *The Model*

This section seeks to identify the important/significant factors which can influence the propensity to implement a certain innovation namely smart card in Indian banking industry. The study considers the dependent variable i.e. adoption of smart cards as dichotomous variable, whether or not a bank renders the smart card services,

denoting 1 if the bank has adopted smart card otherwise 0. The logistic regression has thus been applied to get the valid and reliable results.

## THE EMPIRICAL RESULTS

Firstly, to find out the significant determinants of diffusion of smart cards, pair wise correlation of all independent variables and dependent variable were calculated. The Table 1 reveals that several statistically significant correlations exist among dependent and independent variables. It reveals that the probability to adopt smart card is positively related with size of the bank, branch intensity, age, non-interest income, deposits and market share. The smart card adoption decision is found to be negatively related with the profitability and non-performing assets of the banks. The correlation between different independent variables is also found to be less than 0.6 in all the cases, which eliminates affect of multicollinearity in the final model.

The results of the logistic regression have been shown in Table 1. -2 log likelihood of the model is found to be significant which depicts that the observed model is better than the null model. McFadden  $R^2$  is calculated to measure the strength of association which is found to be strong enough (31%). A likelihood Ratio (LR) test was conducted to examine the joint explanation power of independent variables. The estimated logit model applied on the sample had significant LR test and satisfactory  $R^2$  which suggest that the model adequately fits the data.

Table 2 demonstrates the effect of various explanatory variables on the probability to adopt credit cards by banks in India. The variable size was found to have positive coefficient i.e. 0.991 and highly significant too. Large the size of the bank, more will be the chances of adoption of new technology by banks (Hannan and McDowell, 1983; Pennings and Harianto, 1992; Gourlay and Pentecost, 2005; Murrilo, 2010 and Sullivan and Wang, 2013). The results support the priori condition too as the size of the bank increases, the banks tend to become more innovative and technological savvy. Thus it can be concluded that the large banks in India adopt smart cards easily.

The present study has rejected significant impact of profitability on the banks' adoption decision regarding the smart cards. This finding is similar to the findings of Hannan and McDowell, 1985; Corrocher, 2006 and Deyoung *et al.*, 2006. Moreover, the results of fixed cost ( $b = 0.093$ ,  $p = 0.208$ ) and branch intensity ( $b = 0.167$ ,  $p = 0.1402$ ) are found to be insignificant and thus confirmed its least impact on the adoption decision of the banks regarding smart cards. Also, the insignificant coefficient of non-performing assets ( $b = 0.025$ ,  $p = 0.3143$ ) signifies that the probability to adopt smart cards by banks in India is not affected by it. These findings of the study coincide with the finding of Hannan and McDowell, 1983; Hannan and McDowell, 1984; Bughin, 1999; Gourlay and Pentecost, 2005, Hester *et al.*, 2001 and Malhotra and Singh, 2007.

According to the empirical results, deposits have positive and significant coefficient having the value i.e. 3.949 which depicts that with the increase in deposit, the chances of adoption of smart cards also increases. It may be due to the fact that those banks who already have higher deposits try to retain their market by offering new competitive product and services. The findings of the study are similar to the findings of Hannan and McDowell, 1984; Sharma, 1993; Bughin, 1999; Gurthrie, 1999; Andriy, 2001; and Malhotra and Singh, 2007.



**Table 1: Pearson Correlation Matrix of Variables Influencing the Adoption of Smart Cards in Indian Banking Sector**

Variables	Size	Profitability	Fixed Cost	Branch Intensity	Age	Non Interest Income	Non Performing Assets	Deposits	Market Share	Private Sector Banks	Public Sector Banks	Smart card
Size	1.000											
Profitability	-0.075	1.000										
Fixed Cost	-0.058	-0.020	1.000									
Branch Intensity	0.178	-0.136	-0.065	1.000								
Age	0.459	-0.049	-0.027	0.434	1.000							
Non Interest Income	-0.271	0.516	-0.033	-0.163	-0.194	1.000						
Non Performing Assets	-0.245	-0.298	0.035	0.054	-0.157	-0.070	1.000					
Deposits	0.553	-0.251	-0.105	0.619	0.410	-0.360	-0.024	1.000				
Market Share	0.563	-0.039	-0.030	0.044	0.098	-0.106	-0.061	0.188	1.000			
Private Sector Banks	-0.009	0.083	-0.025	-0.242	0.035	0.144	0.019	-0.320	0.111	1.000		
Public Sector Banks	-0.409	0.116	0.057	-0.391	-0.389	0.238	0.086	-0.489	-0.399	-0.493	1.000	
Smart Cards (Y <sub>1</sub> )	0.896	-0.367	0.114	0.557	0.714	0.654	-0.059	0.536	0.612	0.736	0.648	1.000

Source: Calculated through E-views

**Table 2: Factors Affecting of Diffusion and Adoption of Smart Cards in Indian Banking Sector**

Variables	Coefficient	Std. Error	z-Statistic	Prob.
C	-23.93407	4.205079	-5.691705	0.0000***
Age	0.012268	0.004059	3.022241	0.0025**
Branch Intensity	0.167647	0.113654	1.475063	0.1402
Deposits	3.949290	2.359245	1.673963	0.0941*
Fixed Cost	0.093786	0.074622	1.256817	0.2088
Market Share	21.13648	12.06011	1.752594	0.0797*
Non Interest Income	0.257813	0.110687	2.329210	0.0198**
Non Performing Assets	-0.025424	0.025267	1.006181	0.3143
Profitability	-0.192098	0.139245	-1.379564	0.1677
Size	0.991729	0.181912	5.451699	0.0000***
Public Sector Banks	1.685421	0.631191	2.670225	0.0076**
Private Sector Banks	2.962653	0.758832	3.904228	0.0001***
McFadden R-squared	0.310718	Mean dependent var		0.366906
S.D. dependent var	0.482395	S.E. of regression		0.388700
Akaike info criterion	0.963669	Sum squared resid		81.58728
Schwarz criterion	1.088007	Log likelihood		-251.8999
Hannan-Quinn criter.	1.012235	Restr. Log likelihood		-365.4525
LR statistic	227.1052	Avg. log likelihood		-0.453057
Prob(LR statistic)	0.000000			

Source: Calculated through E-views

Note: Here \*\*\*, and \*\* and \* means statistically significant at 1%, 5% and 10 respectively.

As per the findings, the coefficient of age is positive i.e. 0.122 and having significant effect on the probability of adoption of smart cards by banks. Hence, the older and experienced banks in India have greater propensity to adopt smart cards. These results coincide with the findings of Gourlay and Pentecost, 2005.

The larger share of the bank in industry induces it to be more innovative in nature (Hasan, 2002; Corrocher, 2002; Malhotra and Singh, 2007; Murrillo, 2010 and Sullivan and Wang, 2013). The market share in case of smart card adoption decision of the banks found to be the most important determinant of adoption of smart cards by banks in India having the value of coefficient of 21.13. It shows that the industry advantage push the banks to respond quickly for the adoption of new technology.

Non interest income is found to have significant and positive coefficient i.e.  $b = 0.257$ ,  $p = 0.019$ . It indicates that the banks which are already diversified and have large proportion of income generated from fee and other

value based services have more likelihood to adopt smart cards. The similar findings have been reported by Bughin, 1999; Andriy, 2001; Corrocher, 2001; Furst *et al.*, 2002; and Sullivan and Wang, 2013.

Public and private sector banks are found to be more innovative than the foreign sector banks as the results are significant and having positive coefficients i.e. 1.68 and 2.96 respectively. It depicts that public and private sector banks take more initiatives regarding adoption of credit cards than foreign sector banks in India.

To conclude, the empirical findings suggest that the diversified banks having large size, having more market share with less profitability and more deposits have higher probability to adopt smart cards in India.

## SUMMARY AND CONCLUSIONS

The empirical results regarding the determinants of diffusion and adoption of smart cards show that private sector banks are eager to adopt new technology rapidly as compared to public and foreign sector banks. Also, the foreign sector banks are found to be least innovative in case of smart cards in India. The reason behind it is that the foreign sector banks in India are more involved in the wholesale and corporate banking than that of retail banking and payment system.

Hence, size of the bank plays an encouraging and dominant role in the adoption decision. It depicts that the banks which are comparatively larger in size and possess more assets have capacity to innovate at greater pace. Market share as industry advantage too plays a significant role in taking decision regarding the adoption of cards by banks. It positively and significantly affects the diffusion and adoption of smart cards. It can be finally said that banks take advantage of their industrial competence and thus try to be more innovative. Other remarkable results report that the more diversified banks, which earn non interest income fetched by modern services and products, have more propensity to adopt plastic cards.

In case of smart cards adoption, deposits of the bank enhance the likelihood of the banks to adopt plastic cards. Notable results have been observed in case of age of the bank. Older and experienced banks were found to adopt smart cards quickly. No significant impact of NPAs and profitability has been found in the adoption decision regarding smart cards by banks in India.

Apart from it, other variable i.e. fixed cost has the negligible impact on the adoption and diffusion of smart cards. Last but not the least, branch intensity representing geographical network of the banks has not influence the diffusion and adoption of plastic cards. The present study may help the regulators to frame polices and

guidelines while introducing new technology in the industry which is best suited to customers as well as bankers.

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