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# The Effect of Activators on Non-banking Financial Service Receiving Behavior in Developing Countries: An Application of Artificial Neural Network

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**Abstract:** Aim of this paper is to measure the prediction of consumers' response level at each selected factor using the artificial neural network, and to provide proper evidence to financial managers and executive readers for evaluating and using these variables to develop non-banking finances in developing countries. Sample size of the study was 207 respondents, and 41 variables under 8 factors were used to examine whether they respond to 5-point scale with strong relationship between input neurons, hidden neurons and output neurons throughout the artificial neural network. The results showed that Comparative Capital Benefits, Cost Benefits, Branch Service Coverage, Self-efficacy and Service Quality were positively related with Service Intention, and Risk was negatively related with Service Intention towards non-banking financial services. Finally, consumers' attitude towards non-banking financial services positively influenced Service Behavior.

**Keywords:** Backpropagation equation, benefit and risk, non-banking finance, artificial neural network, Bangladesh.

## INTRODUCTION

Non-bank financial intermediation is chief leading elements of a sound, stable financial system. Financial products are not only available in banks but also in insurance, leasing, factoring, and venture capital companies, mutual funds or pension funds. Over the last decade, there has been a growing interest in the field of consumer services marketing and in the non-banking financial services sector in particular. Most of the existing studies have focused on either banking sector development or stock market development. These two sectors of the financial system have been used in the finance-growth nexus literature as a

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proxy for financial development. The emergence of Non-bank financial institute as one of the important sub-sectors in the financial system development and its relationship with economic activity is largely ignored. In Bangladesh, the financial market is extremely competitive with 49 Banks and 29 Non-Banking Financial Institutions (NBFIs).

The competitive environment for NBFIs is even more challenging as they have to compete with banks, which have low cost even zero cost funds. In this seemingly adverse environment, the NBFIs of Bangladesh continue to grow robustly due to prudent fund management, strong credit management policies, innovative products, prompt service, and better transparency thus providing greater value to their consumer. Leasing is an important new method of financing and dates back from the time since the Second World War. Leasing involves a contractual relationship in which the owner (lessor) of an asset or property grants to an organization or a person (lessee) the use of the asset services for a specified period of time, usually for an agreed sum of rent. Leasing, therefore, enables a firm to avail the services of a plant or equipment without making the investment or incurring debt obligation. The firms can use the asset by paying a series of periodic amounts called “lease payments” or “lease rentals” to the owner of the asset at the predetermined rate and generally in advance. The lessee regularly pays the fixed lease, rent over a period of time at the beginning or at the end of a month; 3 months, 6 months or a year. Lease contract has two parties, namely, lessor and lessee. A lessor may be a leasing company, a manufacturer, a subsidiary or an associate of a large business organization, including the trading firms looking for avenues to invest the surplus to avail of the tax benefits, through a subsidiary. A lessee may be a company, a cooperative society, a partnership firm, an individual, government or its agencies.

Bangladesh Bank Order 1972 defined Non-Banking Financial Institutions and incorporated the regulatory powers of the Central Bank in relation to these institutions. The concept of non-banking, however, owed its origin to the Reserve Bank of India Act 1934, which was the mother act of all central banking institutions in the sub-continent. The State Bank of Pakistan Act was based on this mother act, so also was the Bangladesh Banks Order 1972. NBFIs represent one of the most important segments of the financial system and play a very important role in mobilizing and channelling resources in Bangladesh. Currently out of 29 NBFIs, 22 specialize in lease and long term financing and 2 in house financing. So far, leasing companies are involved in lease finance only. As per the Bangladesh Bank annual report, total investment by the NBFIs up to June 2014 was BDT 17,373.432 million, which is 11.329% higher than that of the previous year (BDT 15,605.486 million as of June 2013) [24]. Objectives of Leasing Business in Bangladesh, Lease financing as organized in Bangladesh, operates with the following objectives: (a) to assist the development and promotion of productive enterprises by providing equipment lease financing and related services; (b) to assist in balancing, modernization, replacement and expansion of existing enterprises; (c) to extend financial support to small and medium scale enterprises; (d) to provide finance for various agriculture equipment and (e) to activate the capital market by operating as managers to the issue, underwriters, or portfolio managers.

Artificial neural network techniques are very important and emerging areas of business research and applications [1]. [2] Showed some review of applications of neural network in market segmentation. These researchers emphasized the Kohonen Self-Organizing Map which is unsupervised Artificial Neural Network (ANN) used in clustering for large and complex data. Self-Organizing Feature Maps (SOM) is “able to project high dimensional input space on a low dimensional topology, allowing one to visually

determine out the number of clusters as [3]and [4]showed clustering. Artificial intelligence-based systems were employed in industrial marketing of different industries in different periods [5]. Forecasting and analysis of marketing was determined based on data using neural networks [6]. [7] proposed that market orientation or marketing intelligence and performance can be measured through the modelling of a neural network. Clustering different variables attributing goodness or badness is potential as few scholars showed in their works on Neural Networks for marketing research data classification [8].

A number of borrowers in bank financial services still suffer for having limited options in financial service mix. The activators that are explored by studying previous literature are influential in non-banking financial services in developing countries. Theory of reasoned action was applied to develop conceptual framework. Aim of this paper is to measure the more accurate prediction of the activators of non-banking financial services through using artificial neural network.

## LITERATURE REVIEW

### Non-banking finances

There is universal agreement that a well be functioning financial system is necessary for a thriving modern economy [9]. The Bank Holding Company Act of 1956 defines a bank as any depository financial institution that accepts checking accounts (checks) or makes commercial loans, and its deposits are insured by a federal deposit insurance agency. In china, it's interesting that those four banks and especially the four state-owned banks are known for their prudence in granting loans to small private companies [10]. As a comparison, most of non-bank institution loans have been extended to the non-state-owned sector [11]. The impact of bank loans was found in these two types of financial institutions on the provincial real per capita GDP growth, using a dataset covering 27 provinces over the period 1995-2003. Findings highlight that the size of bank loans shows a significantly positive impact on local growth, both statistically and economically. As a comparison, non-bank financial institutions, while granting most of their loans to the non-state-owned sector, seem to be less important for local growth. Recent studies, such as [12], [13], [14], and [15] examined the relationship between finance and growth in the context of innovation-based background. For instance, [15] showed why the existence of technology transfers is not sufficient to put all countries on parallel long-run growth rate paths. They find that it is not just financial constraints that make some countries poor but rather that financial constraints inhibit a technological transfer and thus lead to an ever-increasing technology gap. Following [12], it showed as an illustration briefly how financial development affects technology innovation and hence possibly influence the long-run growth rate. Their endogenous growth model focuses on the connections between finance, entrepreneurship and economic growth. Financial institutions in this model play an important role in both monitoring and financing potential entrepreneurs in the initiation of innovative activities and launching of new products to the market. In financial services transactions a set of promises is essentially being exchanged between the buyer and the seller. From the buyer's point of view, it must depend on what exactly is being promised and the likelihood of such promises being delivered [16]. In the case of long-term savings plans, for example, its often difficult for consumers to evaluate these promises that are given in the absence of full information. Decisions on whether to purchase such services are more likely to be based on experience and credence qualities. As there are fewer searching qualities. Before any financial resources change hands consumers must have confidence and trust not only in the financial

institution concerned but also in its personnel. A part from relying more on information from personal sources, consumers are likely to consider factors such as the size, longevity and image of the financial services organizations indicators of whether any promises made are sound and likely to be fulfilled. Interest rate swap is an arrangement by which one set of fixed interest payment is exchanged for variable one and vice versa [17]. Interest rate is the price a borrower pays for the use of money they borrow from a lender/financial institutions or fee paid on borrowed assets [18]. The difference between the gross costs of borrowing and the net return on lending defines the intermediary costs (information costs), transaction costs (administration and default costs and operational costs) [19]. It is interesting to note that the growth in the non-bank financial services industry in many countries has been more rapid than the deposit / lending activities of commercial banks. As a result, banking institutions have sought to diversify away from the traditional commercial banking business i.e., accepting deposits and providing loans to non-traditional banking activities, viz., investment banking, IPO financing and other capital market related activities besides the lease finance etc.

### **Artificial neural network**

In the last years, the literature has produced several studies about the application of artificial intelligence systems for consumer benefit and risk perception. The studies on the application of artificial intelligence systems within the classification and discrimination of economic phenomena, with particular attention to the consumer benefit and risk perception, we can mention [20], [3], and [21]. The paper of [22] introduces a neural network approach to perform discriminant analysis in business research. Using customer service data, the neural approach is compared with linear classifier. Empirical results show that neural model is a promising method of evaluating bank conditions in terms of predictive accuracy, adaptability and robustness. The objective of the paper written by [3] is to explore the performance of credit scoring by integrating the back propagation neural networks with traditional discriminant analysis approach. To demonstrate the inclusion of the credit scoring result from discriminant analysis would simplify the network structure and improve the credit scoring accuracy of the designed neural network model, credit scoring tasks are performed on one bank credit card data set. As the results reveal, the proposed hybrid approach converges much faster than the conventional neural networks model. Moreover, the credit scoring accuracies increase in terms of the proposed methodology and outperform traditional discriminant analysis and logistic regression approaches. Extracting rules from a neural network are different. Over the last few years, connectionism or neural networks (NN) have successfully been applied to a wide range of areas and have demonstrated their capabilities in solving difficult problems. Current indications show that these techniques are very important and rapidly developing areas of research and applications, particularly, in the area of data mining for knowledge discovery.

### **Conceptual framework**

#### ***Hypotheses***

- H1: Comparative Capital Benefits, Cost Benefits, Branch Service Coverage, Service Quality and Self-Efficacy are positively related with service intention.
- H2: Risk is negatively related with service intention towards non-banking financial services.
- H3: Consumers' Attitude towards non-banking financial services influences service behavior.

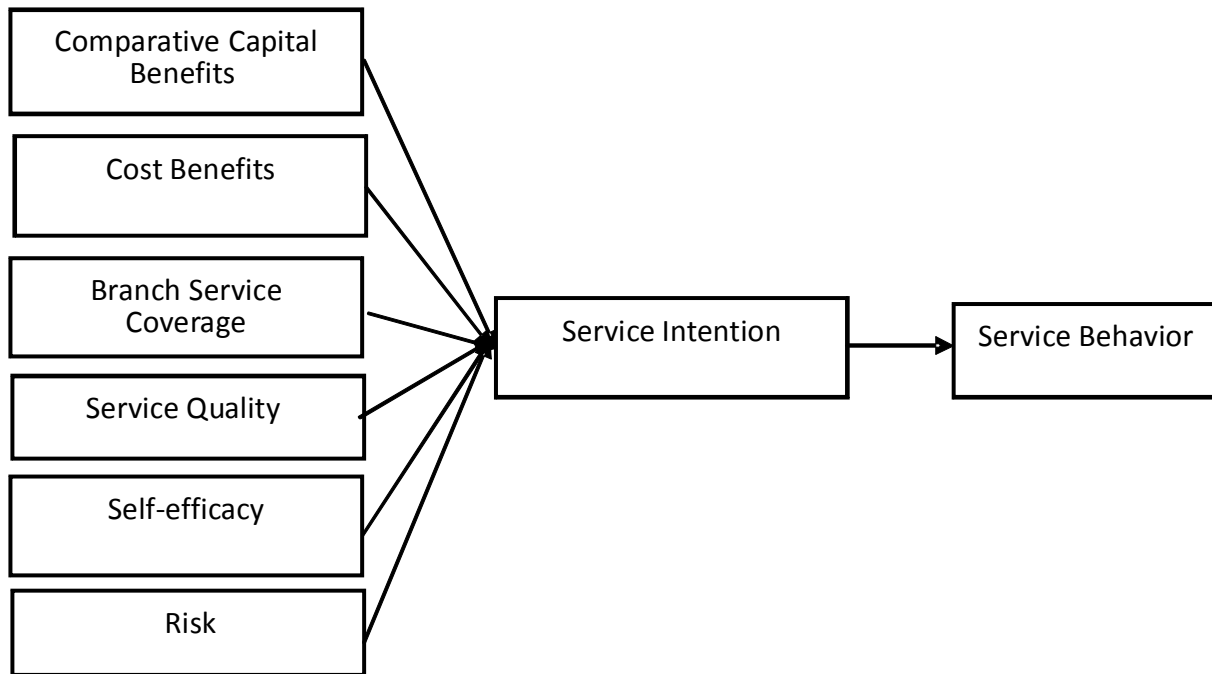


Figure 1: Conceptual Model

## METHODOLOGY

### Survey method

Quantitative research approach is employed. To collect primary data, convenient simple random sampling method is employed, and sample size was 207 respondents who were receiving non-banking financial services. 41 variables under 8 factors were developed to examine whether they respond to 5-point scale with strong relationship between input neurons, hidden neurons and output neurons using artificial neural network technique. These factors are SB (service behavior), SI (service intention), CCB (comparative capital benefits), CB (cost benefits), BSC(branch service coverage), SQ (service quality), SE (self-efficacy), and RI (Risk).

### Instrument and Data collection

To collect primary data, self-administered 5-point Likert scale questionnaire was used. The question can secure relevant facts or opinions from informed and interested respondents included in the sample survey. The self-administered questionnaire on 5-point Likert scale was developed in between strongly disagree and strongly agree to measure the selected variables; but, consumer perceived value has been measured on a scale of value 1-5 on which respondents were asked to rate cognitively by comparing the benefits and risk of non-banking financial offers. Most of the interviews were personal and some e-mail interviews were required to obtain data from those; and for this, trained field force employed with careful monitoring. It was claimed for causal and associative hypotheses in psychology drawing different examples from eyewitness testimony research in psychology and showing the ground why both types of hypotheses can put forth [23].

### Model algorithm

In this paper, the well-known back propagation neural network model is used to predict the non-banking consumer benefit and risk perception. Its advantage at solving high dimensional nonlinear classification and regression, mean, cost error, correctness problems. One of its inherent practical limitations is the lack of comprehensibility of the model. In order to solve this issue, extensive research has been conducted on how to extract well defined decision rules from trained neural networks. Algorithms for rule extraction can be largely divided into two categories: decomposition and pedagogical algorithms. The first class of algorithms focuses on heuristically searching and extracting rules in neurons of neural networks individually. The second class of algorithms aims to extract rules that map inputs directly into outputs. In this paper, Binarized Input-Output Rule Extraction (BIO-RE), which is a technique belonging to the pedagogical algorithm category, was employed in order to extract binary rules from neural networks trained with “binary” inputs, based on its input-output mapping.

### Basic concepts of artificial neural network

In this research can estimate the consumer benefit and risk and helps to make the right decision toward granting of Non-banking financial service to customers. ANN model is used in this research to achieve the above-mentioned objectives. In our proposed neural network we use 2 hidden layers and one output. 1<sup>st</sup> hidden layer we use 10 hidden node and 2<sup>nd</sup> hidden layer we use 5 hidden nodes with learning rate 0.05 and we simulate our neural network 1,000,000 times. The ANN models use the same input and output parameters as in the linear mode. In this models have three primary components: the input layer, the hidden layer(s) and the output measure(s) layer. Every layer contains nodes, and these nodes are connected to nodes at adjacent layer(s). The hidden layer(s) contain two processes: the weighted summation functions and the transformation function. Both of these functions relate the values from the input data to the output measures. The weighted summation function is typically used in a feedforward/back propagation neural network model and also uses the back propagation equation. Figure 2 demonstrates a simplified model.

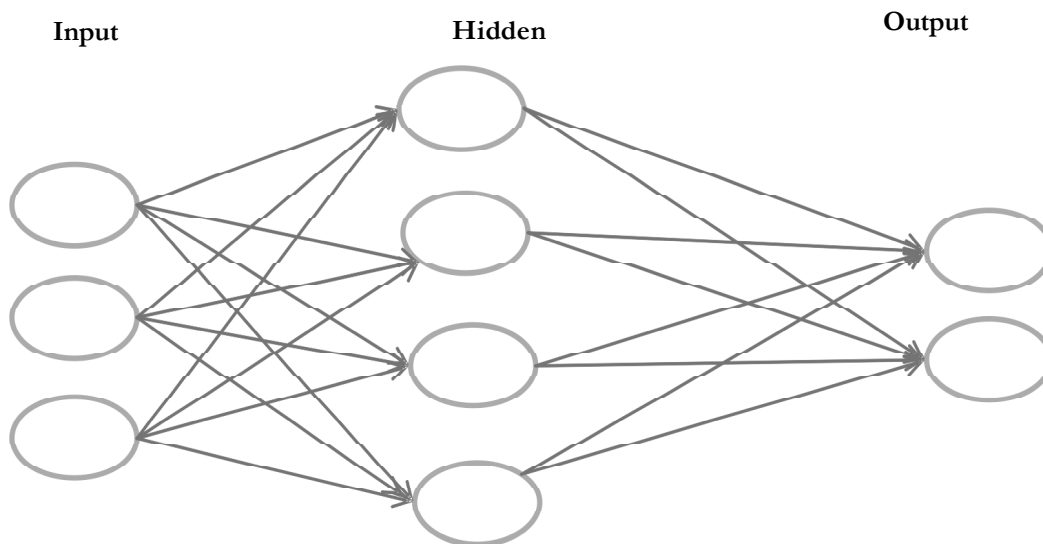


Figure 2: ANN Model

Backpropagation Equation

$$net_{j1} = w_{11}x_1 + w_{21}x_2$$

$$net_{j2} = w_{12}x_1 + w_{22}x_2$$

$$y_{j1} = \frac{1}{(1 + e^{-net_{j1}})}$$

$$y_{j2} = \frac{1}{(1 + e^{-net_{j2}})}$$

$$net_k = w_3y_{j1} + w_4y_{j2}$$

$$y_k = \frac{1}{(1 + e^{-net_k})}$$

$$\text{Error, } Er = \frac{1}{2}(t_k - y_k)^2$$

Backpropagation from output to hidden

$$\frac{\partial Er}{\partial y_k} = -(t_k - y_k)$$

$$\frac{\partial Er}{\partial net_k} = \frac{\partial Er}{\partial y_k} \frac{\partial y_k}{\partial net_k}$$

$$\frac{\partial Er}{\partial net_k} = -(t_k - y_k)y_k(1 - y_k)$$

$$\frac{\partial Er}{\partial w_3} = -(t_k - y_k)y_k(1 - y_k)y_{j1} = \Delta w_3 \quad [y_k(1 - y_k) = \delta k]$$

$$\Delta w_3 = -(t_k - y_k)\delta k \cdot y_{j1}$$

Weight updating

$$\Delta w_{3[n+1]} = w_{3(n)} + \eta \Delta w_3$$

From hidden to input

$$\frac{\partial Er}{\partial y_{j1}} = \frac{\partial Er}{\partial y_k} \frac{\partial y_k}{\partial net_k} \frac{\partial net_k}{\partial y_{j1}}$$

$$\frac{\partial Er}{\partial y_{j1}} = -(t_k - y_k) \delta k w_3$$

Similarly

$$\frac{\partial Er}{\partial y_{j2}} = \frac{\partial Er}{\partial y_k} \frac{\partial y_k}{\partial net_k} \frac{\partial net_k}{\partial y_{j2}}$$

$$\frac{\partial Er}{\partial y_{j2}} = -(t_k - y_k) \delta k w_4$$

$$\frac{\partial Er}{\partial net_j} = \frac{\partial Er}{\partial y_k} \frac{\partial y_k}{\partial net_k} \frac{\partial net_k}{\partial y_{j1}} \frac{\partial y_{j1}}{\partial net_{j1}}$$

$$\frac{\partial Er}{\partial net_j} = -(t_k - y_k) \delta k . w_3 . (1 - y_{j1}) . y_{j1} \quad [\delta k . w_3 . (1 - y_{j1}) . y_{j1} = \delta j_1]$$

$$\frac{\partial Er}{\partial w_{11}} = \frac{\partial Er}{\partial y_k} \frac{\partial y_k}{\partial net_k} \frac{\partial net_k}{\partial y_{j1}} \frac{\partial y_{j1}}{\partial net_{j1}} \frac{\partial net_{j1}}{\partial w_{11}}$$

$$\frac{\partial Er}{\partial w_{11}} = -(t_k - y_k) \delta j_1 x_1 = \Delta w_{11}$$

Weight updating

$$\Delta w_{11[n+1]} = w_{11(n)} + \eta \Delta w_{11}$$

### *An Illustration of Artificial Neural Network*

To define ‘good’ survey question or ‘bad’ question, we should know in advance what the purpose of the survey is (target). For different targets, then the assemble of the good question may differ a lot. Like the following survey containing 4 questions.

- Q 1. Does NBFi offer loan at lower rates for your business?
- Q 2. Does NBFi process file quickly?
- Q 3. Do you want to borrow money from any financial institution?
- Q 4. What would you prefer either Bank or NBFi to borrow money?

However, if the purpose we concern is:

Purpose 1 : Is he looking for comparative benefits?

Purpose 2: Is he likely to start a business?



Then for Purpose 1, Q1 and Q3 are likely to be good question. And for Purpose 2, Q2 and Q4 might be better. So, the selection of a good question is dependent on the target. Also to find out good questions by neural network method, we should have some training data (including input and output). Input data is the survey question, and the output data is the purpose we concern. The following are the data of 6 people:

<i>Respondents</i>	<i>Comparative benefits?</i>	<i>Lower rates?</i>	<i>Financial institution?</i>	<i>Borrow money?</i>	<i>Start a business?</i>
A	5	2	5	1	5
B	1	2	1	2	2
C	3	1	4	5	1
D	5	1	4	2	4
E	1	4	2	1	1
F	2	4	1	5	1

The question are good means we can predict the purpose with input survey questions. The higher prediction accuracy, then the questions are better. Then we may select Q1 and Q3 to be good question. Later we ask new person without output data, we are likely to predict whether he will buy or not based on these 2 survey question.

<i>Comparative benefits?</i>	<i>Like sports?</i>	<i>Like Exercise?</i>	<i>Start a business?</i>
G	4	5	4.5
H	2	1	1.2

### **ANALYSIS AND DISCUSSION**

NBFI analysis mainly shows which category is the best category, such as service quality or loyalty. In table 1, it was found that the value of Comparative Capital Benefits correctness was 0.8647. In addition, effects of Benefits in Interests, Branch Service Coverage, Service Quality, Self-Efficacy, Risk on Service Intention were 0.8357, 0.6715, 0.6039, 0.7343, -0.7005 respectively, and the impact of non-banking financial service intentional activator on service behavior was 0.9179. Figure 3, 4, 5, 6, 7, 8, and 9 of those factors or categories portray that when iteration increases the value of errors decreases, i.e. correctness increases. From that table, it can also be determined that all category values were not identical. So, SB category has very good prediction since it already knew the results. The output is contained in SB. In conclusion, SI category is the best set of question based on current analysis.

A survey is conducted to collect data from individuals to find out their behaviors, needs and opinions towards a specific area of interest. It is increasingly important to develop powerful means for analyzing such data and to extract knowledge that could help in decision-making. When we do a survey and collect information from a certain group of people, we generally want to extraction knowledge from survey data which may help our future decision-making process.

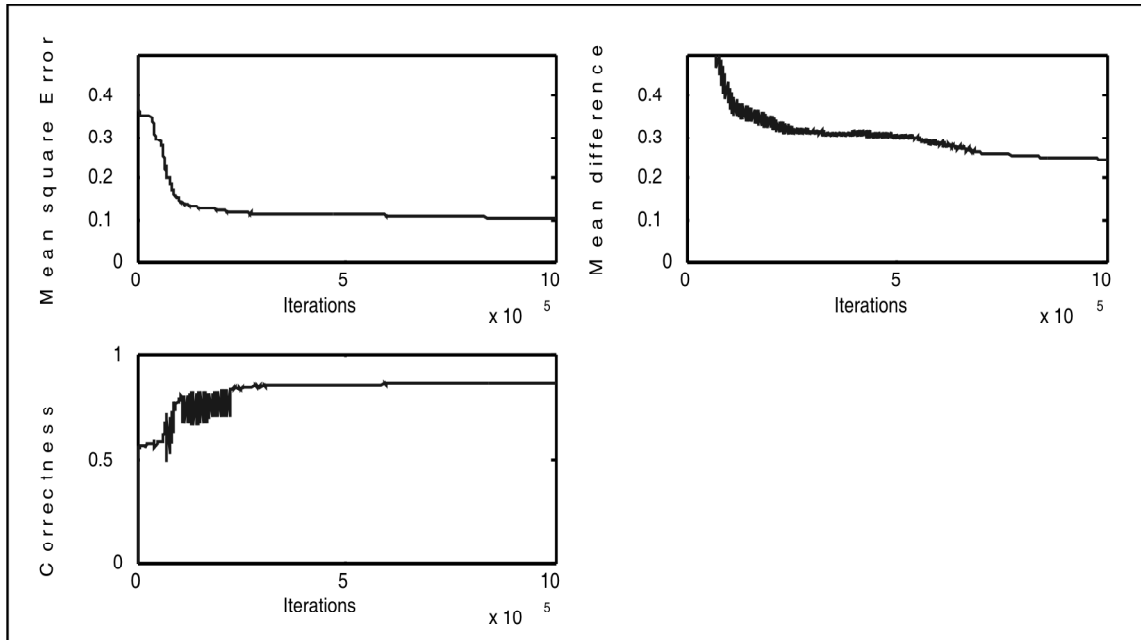


Figure 3: ANN for CCB Factor

Table 1  
Regression Coefficients through ANN

<i>Factors</i>	<i>Cost</i>	<i>Mean_error</i>	<i>Regression</i>
CCB-SI	0.1082	0.2423	0.8647
CB-SI	0.0838	0.2288	0.8357
BSC-SI	0.281	0.5064	0.6715
SQ-SI	0.2691	0.5147	0.6039
RI-SI	0.1852	0.3836	0.7005
SE-SI	0.1744	0.3774	0.7343
SI-SB	0.0266	0.1133	0.9179

In current survey on this study, it includes 41 questions and they are categorized into 8 groups such as (Comparative Capital Benefits, Cost Benefits, Branch Service Coverage, Service Quality, Risk, Self-Efficacy, Service Intention, Service Behavior). Each questions is rated with a value 1-5, indicating strongly disagree to strongly agree. When doing a survey, they should indicate a typical purpose and we want to infer from the other survey questions. Assume that the question we are interested is ‘Will you recommend others to continue capitalization really?’ this is the target feature in our neural network training and all the other questions are input feature. For good survey questions related to the purpose, we are likely get good predictions from these questions.

To find out which of the 8 groups of data is most informative of our target purpose, neural network method is applied. It contains 2 hidden layers, with 10 neurons on the first hidden layer and 5 on the second. The input is the values of a certain group of question, and the output is the target question

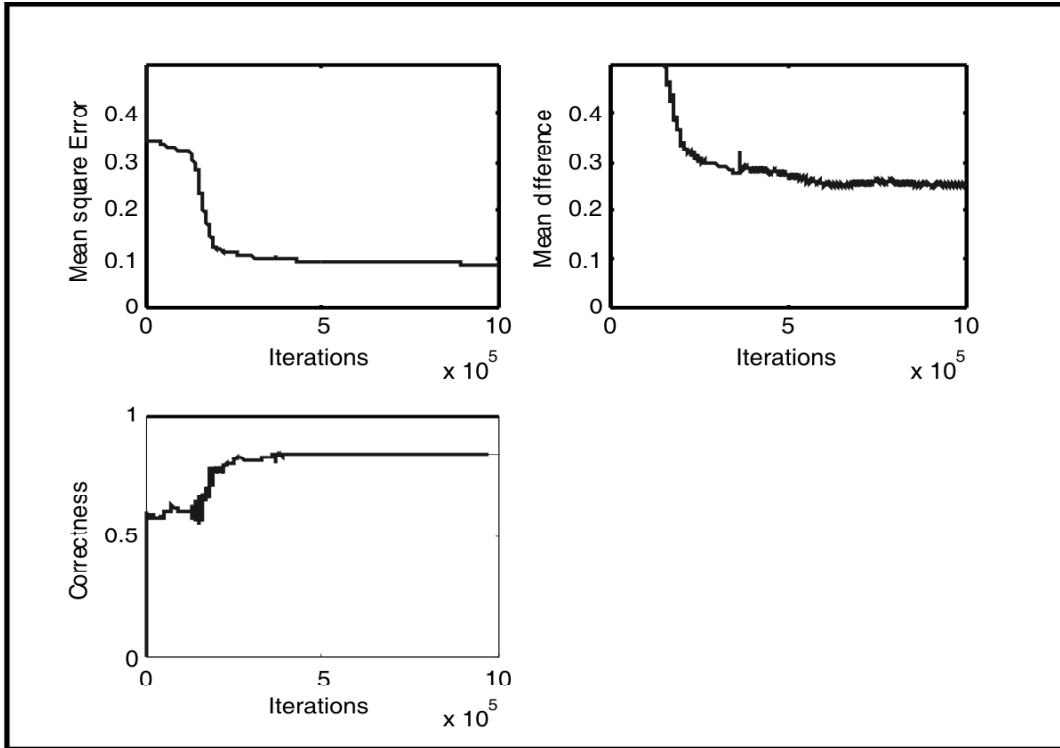


Figure 4: ANN for CB

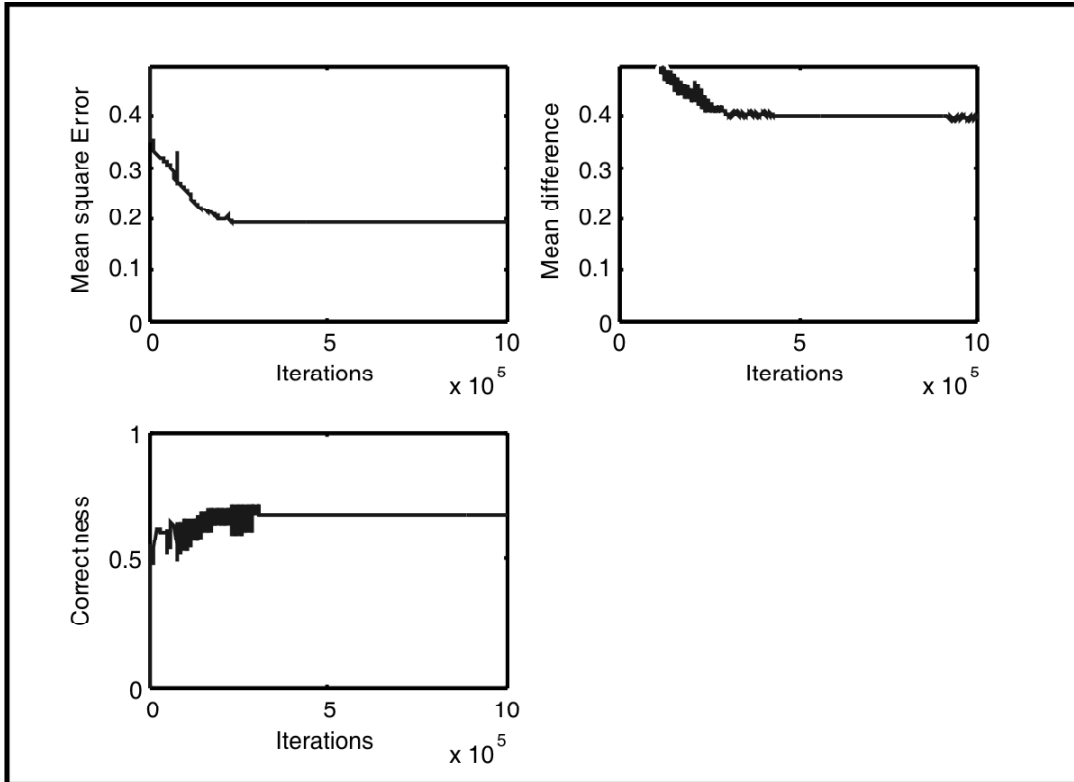


Figure 5: ANN for BSC

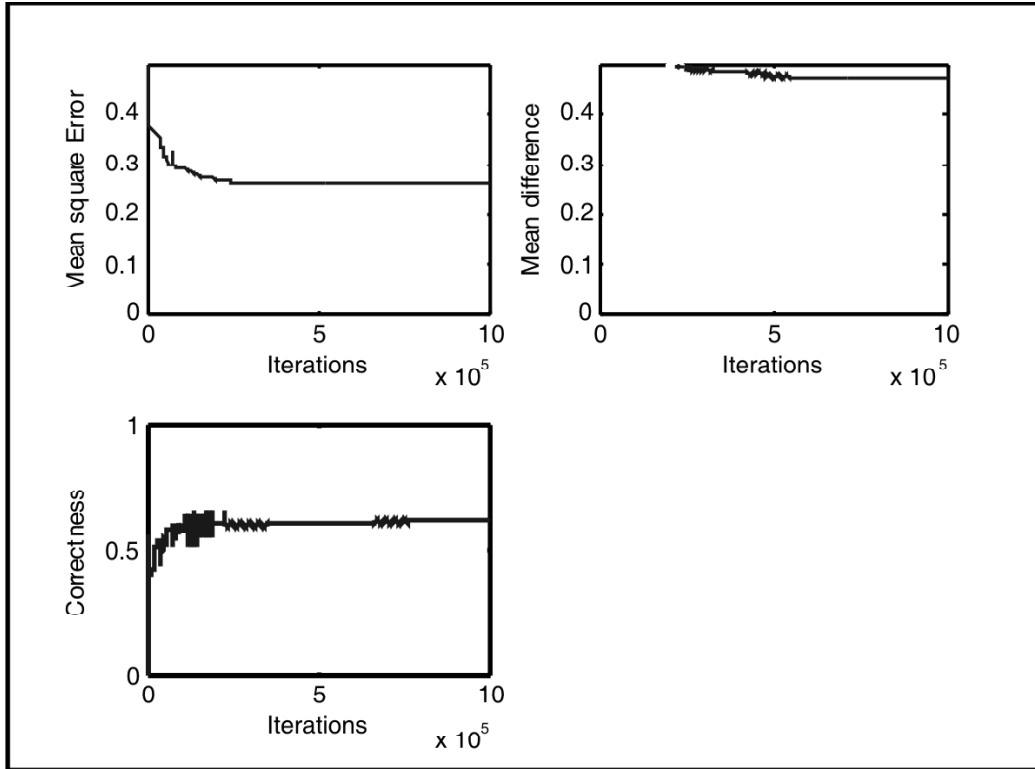


Figure 6: ANN for SQ

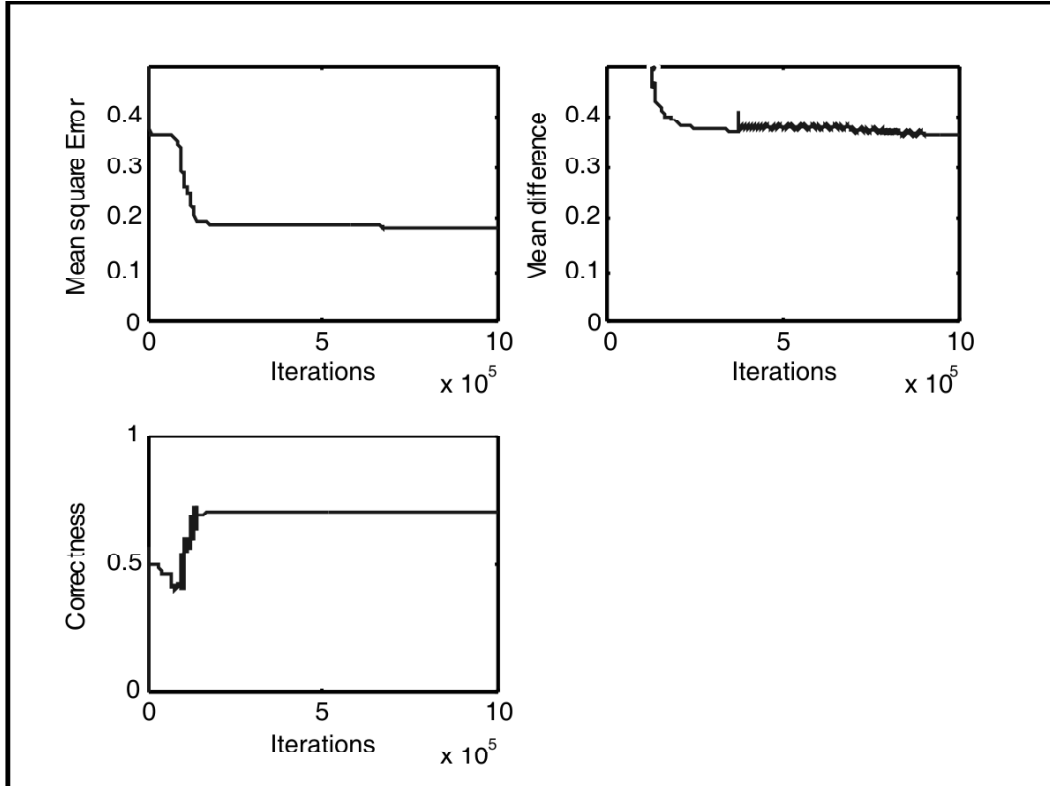


Figure 7: ANN for SE

value. In the training process of the neural network, it requires feed forward calculation to obtain the predicted output value, and using backward propagation algorithm to compute the gradient for the neural network, and therefore updates the weight between the neural nodes. The neural weights are calculated and updated during the training process to satisfy that the minimum error is obtained when using the input data to predict the output data.

The average error is defined as the average error between the real output value and predicted ones:

$$error = \frac{1}{N} \sum_{i=1}^N |p_i - y_i|,$$

and the mean correctness is to find out the percentage that we can get the correct category 1-5 after rounding the predict value. (If predicted value is 3.4, then the rounding is 3; If the predicted value is 3.9, then the rounding is 4.) Since the current output question is contained in the ‘SB’ category, it is not strange that SB category has very good prediction. From the results list below, SI category is the best set of question based on current analysis.

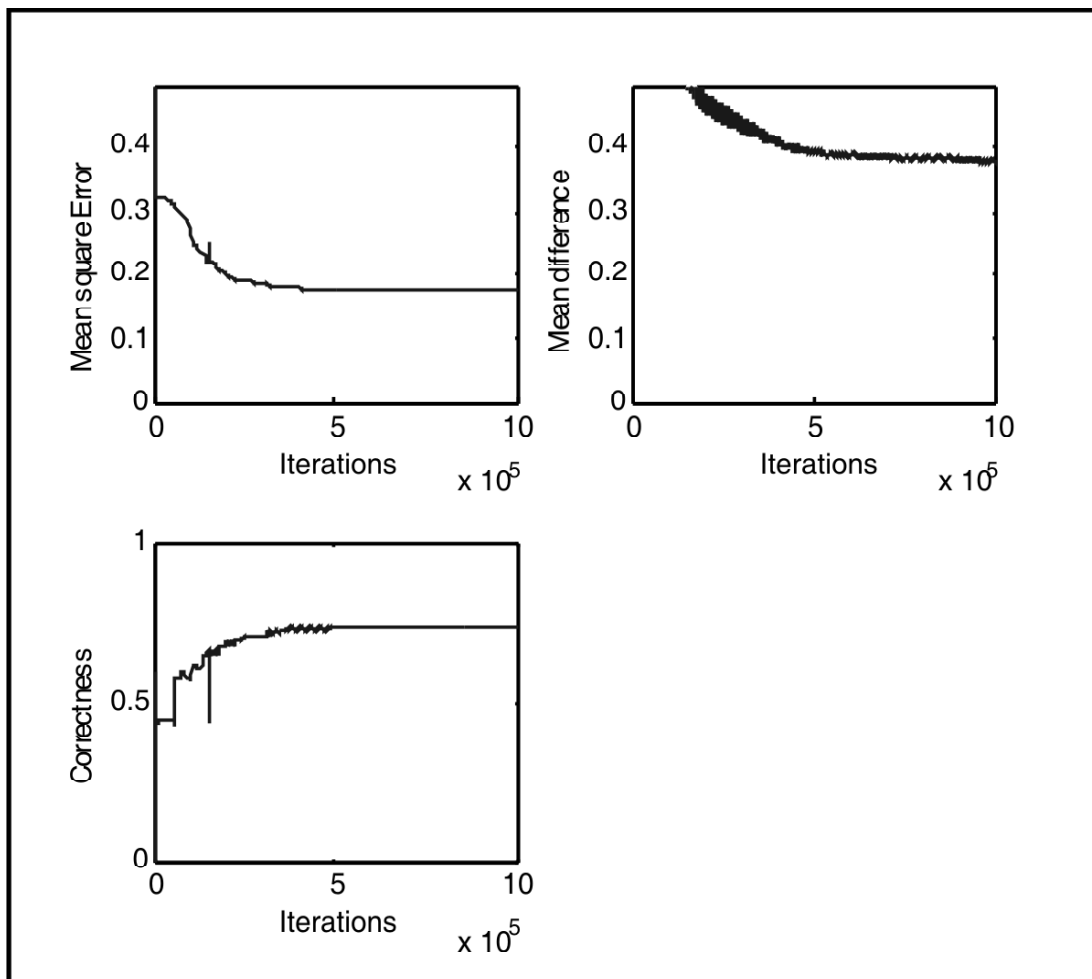
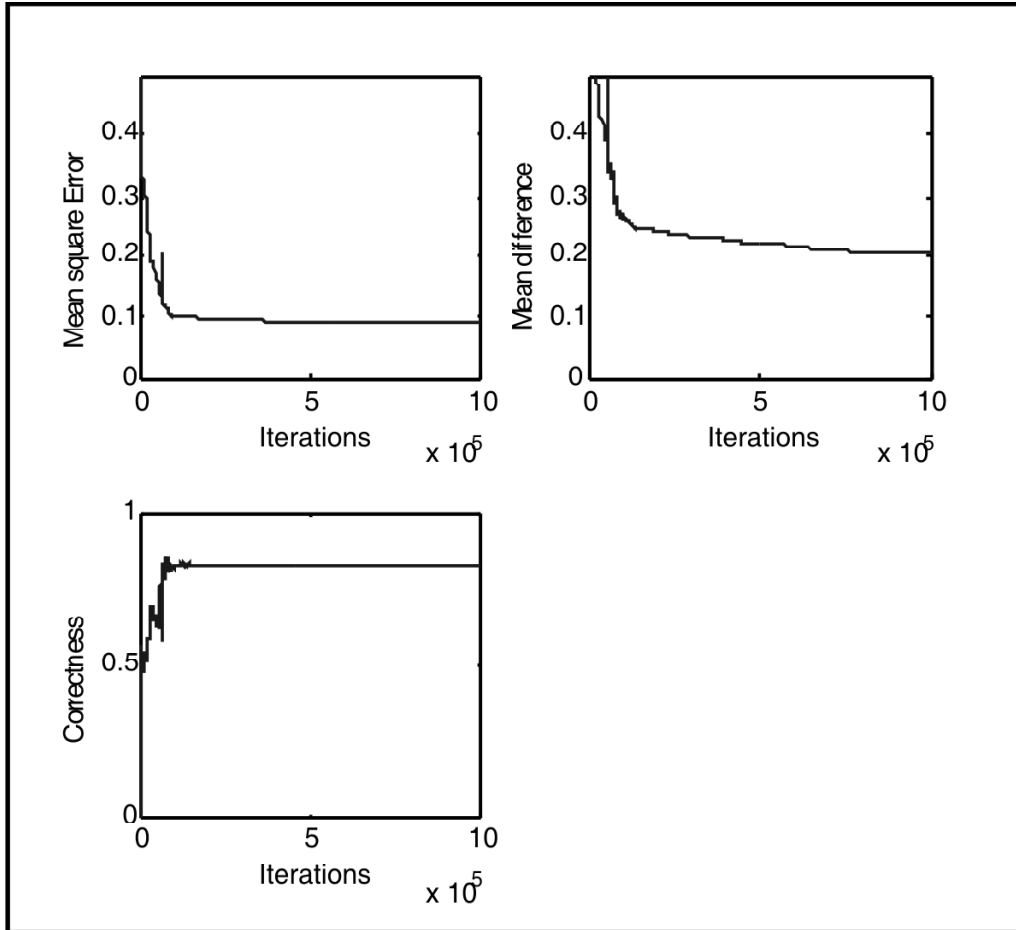


Figure 8: ANN for RI



**Figure 9: ANN for SI**

### **Managerial Implication**

To provide proper evidence to financial managers and executive readers is inevitable through producing empirical research outputs. Nonbank organizations in developing countries could develop financial businesses gradually relying on a wide range of financial products developed based on information of both financial needs of households and bank businesses, resulting in economic development in developing countries. Branch services and customers' satisfaction are important factors for NBFIs in the developing countries. According to our findings from this study we can say that, if any companies (NBFIs) increase the number of branches into its operating areas, it will increase customers' intention to purchase and sales with large number of new customers. Branches are crucial factor for NBFIs because it is the source of customer and solve their problems with satisfaction. It needs to increase its service quality for the better customers' satisfaction. NBFIs should emphasize self-efficiency and standard behavior at the time of providing services to create more positive customers' intention and sales towards NBFIs business organizations. These organizations also require to put weight other factors for improving customers' benefits compared to Bank in the financial market. Overall, theory of reasoned action is clearly functional on the conceptual framework as the strong relationships between hypothesized constructs were yielded.

## CONCLUSION

In this paper, we have presented an application of artificial neural network to measure the effects of risk and benefit on intention and purchasing behavior towards non-banking financial services. We discussed the importance and necessity of non-banking customers' risk and benefit measurement and explained the architecture of ANN models. After determining required variables, we feed the data into the model to produce regression outputs. Results of this study show that mean, cost error, correctness problems and identifying of willingness towards purchasing non-banking financial offers in developing countries. It also shows that SB category has very good prediction power, and SI category appears to have a strong relationship with service purchasing behavior.

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