BINARY LOGISTIC REGRESSION IN MEASURING THE LEVEL OF CUSTOMER SATISFACTION ON ELECTRONIC BANKING

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ABSTRACT
This research work is intended to measure the level of customer satisfaction on electronic banking. The binary logistic regression analysis and descriptive statistics was used to analyze the dependent variable (Satisfaction) on independent variables (security, ease of use, accessibility, information quality, design and features, reliability, and speed.) the descriptive results of the analysis shows that customers are fully satisfied with overall service of the e-banking with a reasonable percentage of 92.59% out of 100%. And also the inferential result i.e. (Binary logistic regression results) shows that 98.7% were correctly classified as satisfied group and 50.0% as not satisfied group. Overall of 95.1% were correctly classified. This is a considerable improvement on the 92.8% correct classification with the constant model hence the model with predictors is a significantly better model.

Keywords: e-Banking, Customer, Logistic Regression.

Introduction
Nowadays, customer is said to be the king who is enjoying the benefits in terms of service that are offered to them as a bunch of marketing strategies that are adopted by the firms to boost up the customer base of the organization. Customer satisfaction is a measure of how products and services supplied by a company meet or surpass customer expectation. It is seen as a key performance indicator within business Fatahi (2012).

Technology is making a tremendous impact upon service companies in general and the financial services sector is no exception. The application of information and communication technology concepts, techniques, policies and

implementation strategies to banking services has become a subject of fundamentals importance and concerns to all banks and indeed a prerequisite for local and global competitiveness in banking industry. As a result of this technological improvement, business environment in financial sector is extremely dynamic and experience rapid changes and demands banks to serve their customer electronically Timothy, (2010).

Before the emergence of modern banking system, banking operation was manually done which lead to a slowdown in settlement of transactions. This manual system involves posting transactions from one ledger to another which human handles. Figures or counting of money which should be done through computers or electronic machine were computed and counted manually which were not 100% accurate thereby resulting to human errors. Most bank then use only one computer in carrying out transactions which improved the sluggish nature of banking transaction Idris (2015).

Today, no organization can be successful without focusing on the needs and demands of its customers' satisfaction. The quality of products and services offered by the company helps organizations to distinguish themselves from other competitors. Most experts believe that the best way to succeed in business is to maintain a good relationship with its customers; this is achieved by providing high quality of products and services Naebzadeh and Fatahi, (2012)

Timothy, (2012) assumes that three or four decades ago, banking was a simple business; where consumers saved their money and received their financial services from. Some customer's open savings account, pass books or withdrawal booklets are issued to them which enable them have access to their accounts; and when it is a current account, cheque books are issued to them for the same purpose. The evolution of e-banking started from the use of Automatic Teller Machine (ATM) and "Finland "is the first country in the world to have taken a lead in e-banking Akinci *et al*, (2004), E-banking has been widely used in developed countries and in developing economies today, the banking industry has transformed in to an era of information technology where specialized software programs called banking applications are used in the banks. Ikechukwu (2000). The recent consolidation exercise in Nigerian banking sector has drawn the attention of many banks to application of various technological devices in promoting/achieving better customer service delivery

that guaranteed customer satisfaction which translates into increase profitability and higher return on investment.

Aim and Objectives of the Study

The main of this study is to investigate the level of customer satisfaction towards e-banking services provided by banking sectors in Nigeria. This study targets to identify the difference in customers' expectations and perceptions towards e-banking services.

The objectives are as follows: -.

1. To enable us to know the level of customer satisfaction on electronic banking.
2. The findings may lead the decision makers of the banks to focus on criteria that are considered important to their customers, so that they can satisfy more customers.
3. This also enables us to know the significant effects of reliability, ease of use, security, speed of delivery, design features and information quality with customer satisfaction level in e-banking services.

Literature Review

Several researches have been conducted to analyze the different aspects of customer satisfaction on e-banking,

Dogarawa, (2005) examined and assessed the impact of e-banking services in customer satisfaction in the Nigerian banking industry. Data analysis was done using descriptive statistics and Chi-square test. It was found that customers enjoying E-banking services are not satisfied with the quality and efficiency of the services. The Study suggested that banks should try to win customers" confidence by providing adequate security and ensuring good connectivity.

Kwame *et al*, (1993) they wrote a paper to ascertain whether customer's decision to use e-banking is influenced by socioeconomic classifications in which binary logistic regression were used.

Suleiman & Usman, (2016) also made research to investigate an empirical relationship between e-banking products and customers' satisfaction of accessibility using the logistic regression model and best on their analysis and hypothesis tests indicated that the customer satisfaction of accessibility is positively and significantly influenced by e-banking components in the dimension of internet banking, electronic fund transfer, home banking and

mobile banking, but positively and insignificantly influenced by automatic teller machine (ATM) and e-banking. This therefore indicates that the more the level of improvement in the quality service of e-banking components, the more level of satisfaction customer derived from these services.

Abdullah and Rozario (2009) study the influence of service and product quality towards customer satisfaction. 149 respondents from one of the well-known hotel in Kuala Lumpur, Malaysia are selected as a sample. Psychometric testing is conducted to determine the reliability and validity of the questionnaire. The study finds positive significant relationship between place/ambience and service quality with customer satisfaction. Although, relationship between food quality and customer satisfaction is significant, it is in the negative direction. Future researchers can concentrate on determining attributes that influence customer satisfaction when cost/price is not a factor and reasons for place/ambience is currently becoming the leading factor in determining customer satisfaction.

Negative Impact of Electronic Banking in Nigeria

- **Power failure and communication link:** -Constant electric failure leads to deficiencies in infrastructures such as ATMs, computers etc. which slow down the rate of electronic transactions which caused by consistent electronic power supply.
- **Lack of computer back up:** -As a result of lack of computer backup when the bank system is corrupt there will be a loss of information about a customer, and this may lead to misappropriation of customers account, therefore the bank should have a manual backup (ledger) containing all data about the customers.
- **Reduces employment in the country: -**Electronic banking in the country today has reduced the rate of employments in the country whereby most works that should be done by human are done by machines thereby lead to minimum rate of employment and high rate of unemployment in the country.

Positive Impact of Electronic Banking in Nigeria

- **Speedup settlement of transaction: -** Electronic banking speedup settlement of transaction either national or international level where the bank stands as paying bank to the customers for settlement of transaction

or debt and collection bank for the collection of payment on transaction made.

- **Reduces the rate at which customer visit banks: -**The introduction of this system has bridge the gap between customer and his bank, where the customer can easily go any branch bank close to him and withdraw money from the ATM's machine through the help of the interbank-switch and also safes time energy and reduces stress of the customer.
- **Move into a cashless society: -** The introduction of the electronic machine has reduced the use of raw cash thereby moving the country into a cashless economy. As stipulated by Anyawaokoro, (1999) that the settlement of financial obligations is now done by the use of electronic gadgets such as computer, facsimile and telex, instead of currency notes and coins. The perfection of this system is what he described as a move into cashless society.

Research Methodology

Logistic regression is helpful when you want to predict a categorical variable from a set of predictor variables. The binary logistic regression is a special case of generalized linear models McCullough & Nelder, (1989). It is generally used to model binary responses. It was employed in this study to assess whether a customer is satisfied or not on e-banking services this statistical technique was used because of the dichotomous response to customer's satisfaction towards e-banking. Agresti, (2007) defined a binary logistic regression model with multiple explanatory variables as:

$\log it\ \ p(y=1)$

Where is the constant term of the model's denote the regression coefficients of the covariates and *x's* represent a set of covariates or independent variables. The covariates in any regression model can either take the form of categorical, P (Y =1) describes the probability of the customers been satisfied, while 1-P (Y =1) denotes probability of not satisfying the customer. The extension of the binary logistic regression is the multinomial logistic regression.

Binary logistic regression

is similar to linear regression except that it is used when the dependent variable is dichotomous. Multinomial logistic regression is used when the dependent/outcome variable has more than two categories, but that is complex and less common, the multinomial (polytomous) logistic regression model is a simple extension of the Binomial logistic regression model. It is used when the

dependent variable has more than two nominal or unordered categories, in which dummy coding of independent variables is quite common.
Logistic regression also is useful when some or all of the independent variables are dichotomous; others can be continuous.

Logistic Regression Model Specification

Logistic regression analysis (LRA) extends the techniques of multiple regression analysis to research situation in which the outcome variable is categorical.
for example, prediction may be for the dichotomous outcome of success / failure or improved /not improved. etc. similarly in this research the outcome is the customer satisfaction which is also categorical, this is because customer can either be satisfied or not, in logistic regression the success occurs with probability p given as below,

$$P = \frac{e^{\beta_0+\beta_1 X_1+\beta_2 X_2+...+\beta_k X_k}}{1+e^{\beta_0+\beta_1 X_1+\beta_2 X_2+...+\beta_k X_k}} \qquad 3.2.2.1$$

Now the equation establishing the estimated relationship between the explanatory variable and the odd in favor of the success is given below,

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 ... + \beta_k x_k$$

In this model, p is the probability that the dependent variable Y=1/0 and, … are the independent variables (predictors). Is a constant and are known as the regression coefficients.
Equation (2) can particularly be modified to suit the situation of this research as follows: -

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7$$

Where $\ln\left(\frac{p}{1-p}\right)$ and X's is the independent variables defined as follows:
= Ease Of use
= Accessibility
= speed
= reliability
= security/privacy

Method of Data Collection

The study adopted survey design to identify the level of customers' satisfaction with this very important aspect of the banking service, "e-banking" The universe in this study is defined as the entire population of customers that adopt

electronic banking service in The Federal polytechnic Bauchi, Bauchi State. Hence, having a definite sample was not very feasible. Therefore, we adopted convenience sampling in order to achieve the survey purpose. The survey was carried out in different days, using e-banking customers from different banks within the metropolis of FPTB. A total of 200 e-banking customers were identified through exploratory research. The research instrument was the questionnaire Developed on the basis of existing literature. The preliminary surveys helped in identifying general variables that leads to customers' satisfaction with e-banking. These variables were supported with relevant literature review. The questionnaire consists of sixteen questions to cover such variables as, Easy use, Information quality (i.e. quality of the information or the output that the system provides), design and features, Accessibility, speed, reliability, and security/privacy. Five point Likert scale (5=strongly agree, 4= agreed, 3= undecided, 2=disagreed 1= strongly disagreed) was used to measure the Satisfaction level.

DATA PRESENTATION AND ANALYSIS

The data collected were computed in simple percentages for each item based on the total number of responses. in this research, 200 questionnaires were produced and distributed. The interpretation and analysis of the responses have been given in the following descriptive and inferential results.

DESCRIPTIVE RESULTS

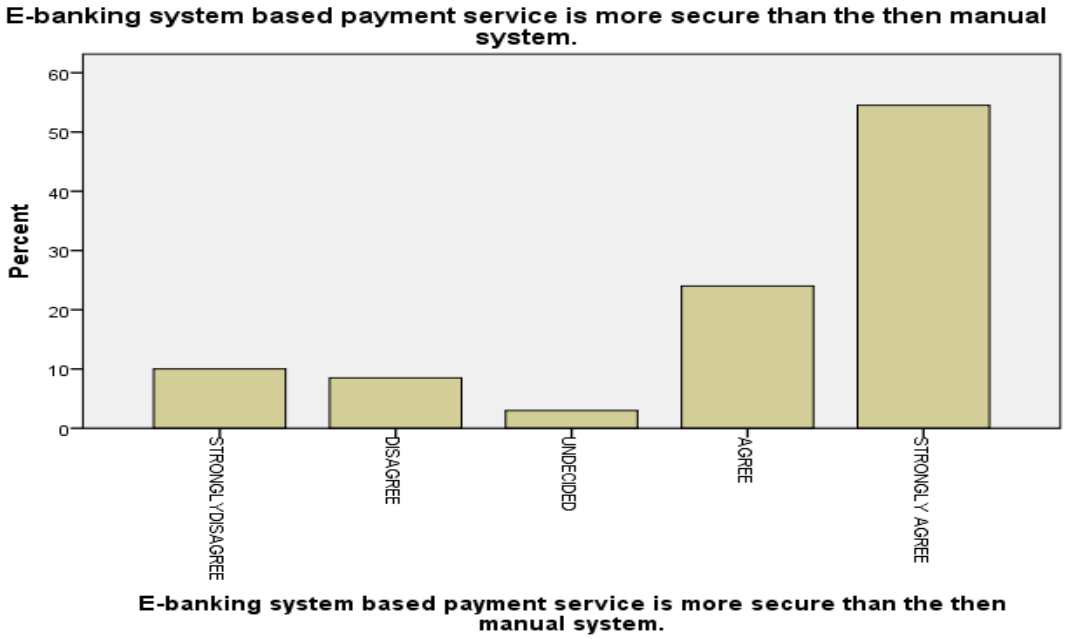

Fig 1: Bar chart showing the opinion of the respondents on whether e-banking system base payment service is more secure than manual system.

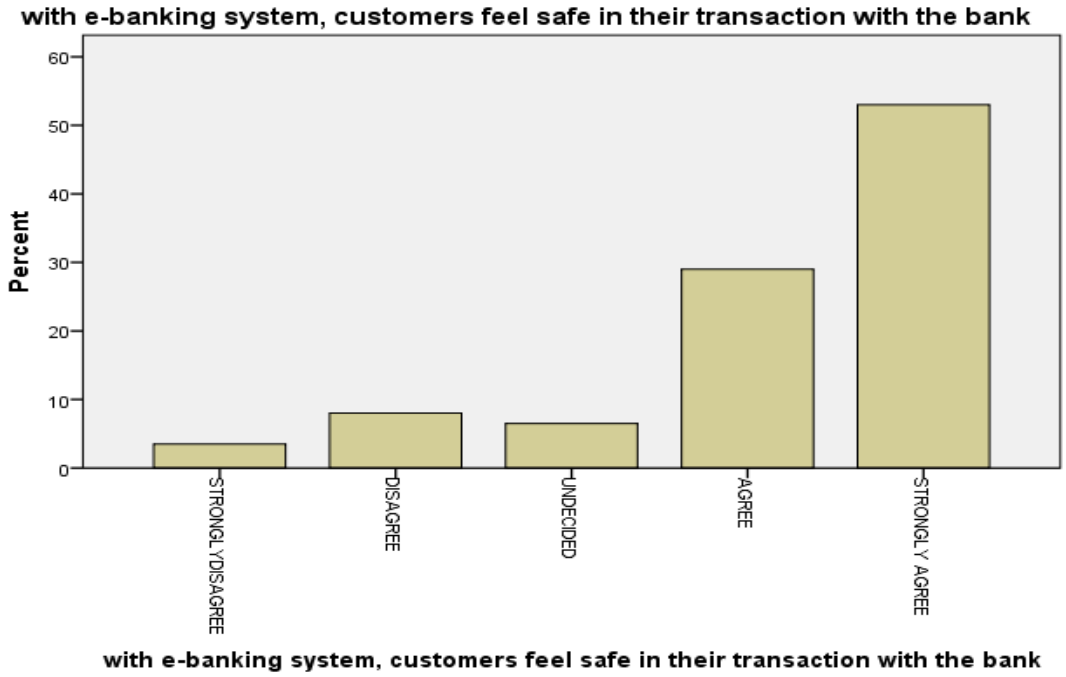

Fig 2: Bar chart showing the opinion of the respondents on whether customer feel save in their transaction with e-banking.

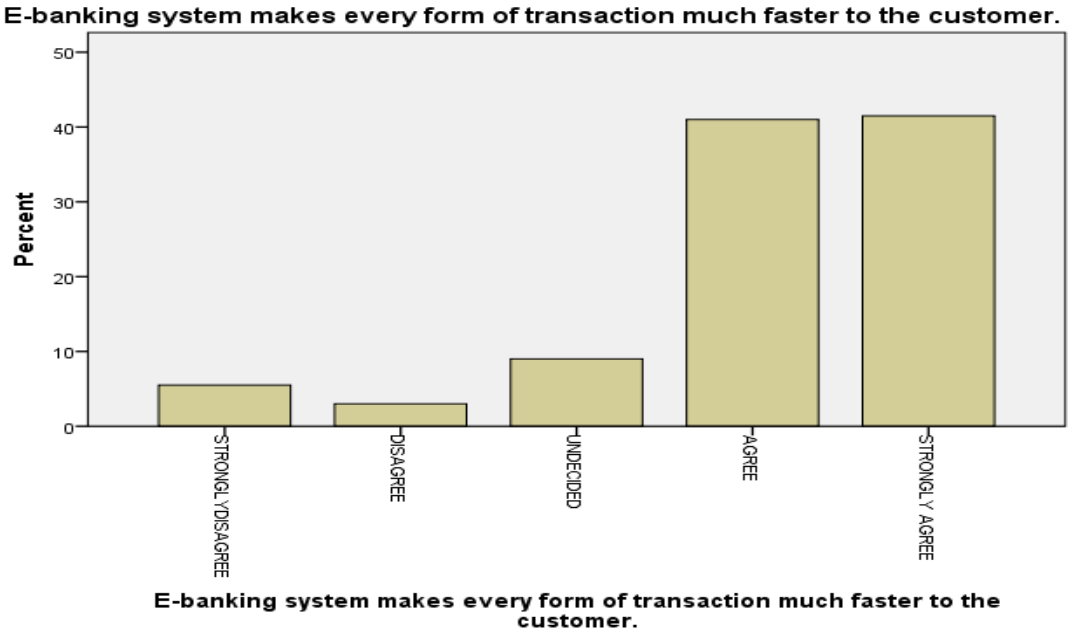

Fig 3: Bar chart showing the opinion of the respondents on whether e-banking systems makes every form of transaction much faster to the customer

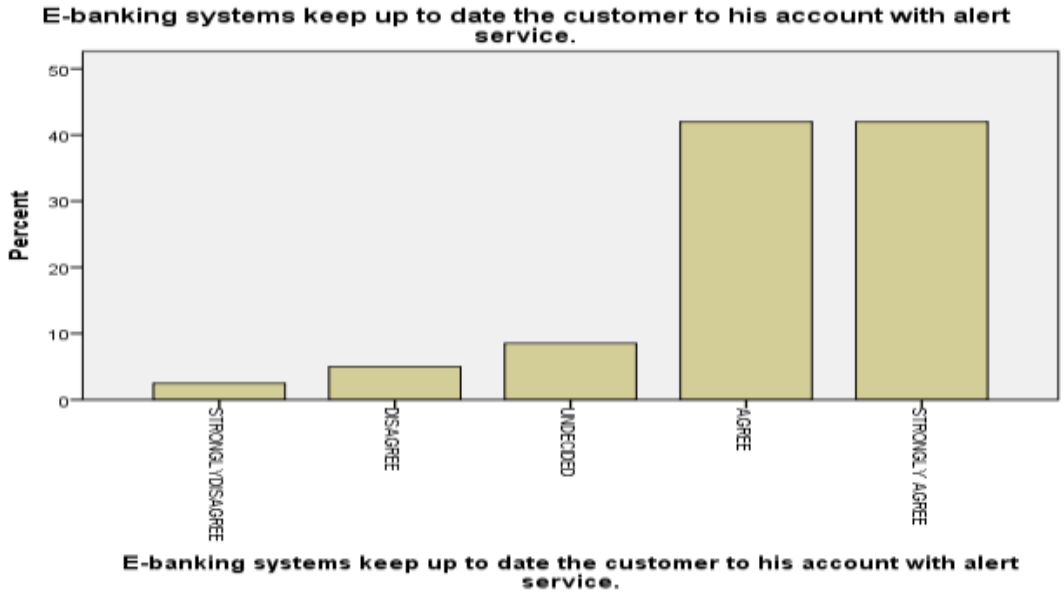

Fig 4: Bar chart showing the opinion of the respondents on whether e-banking keep up to date the customer to his account with alerts.

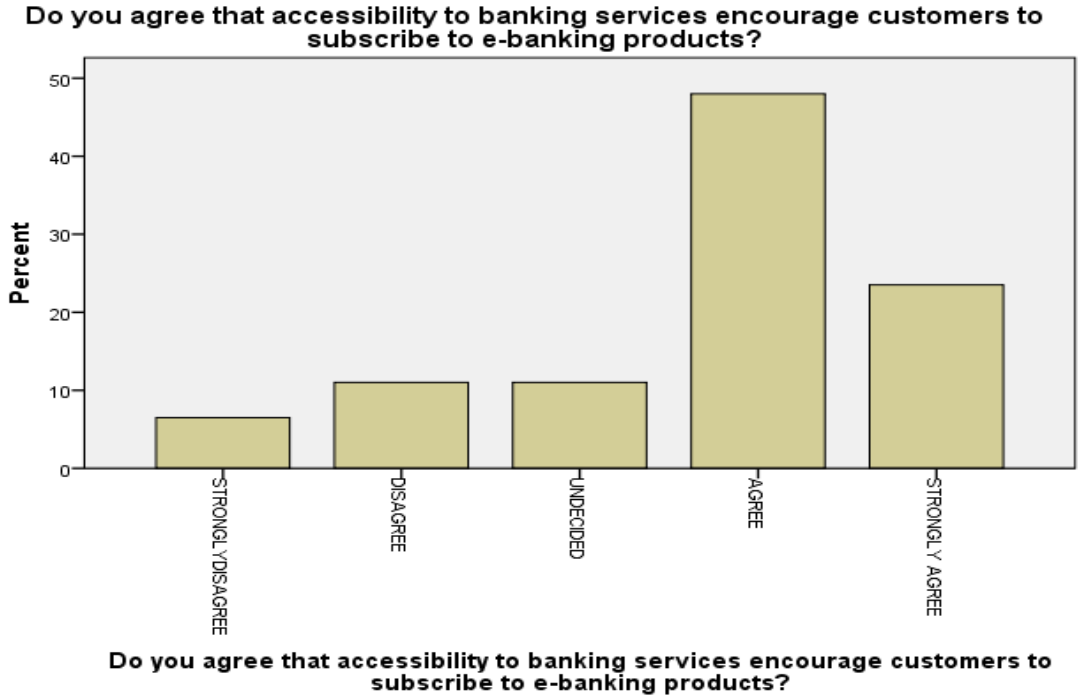

Fig 5: Bar chart showing the opinion of the respondents on whether accessibility to banking services encourage customers to subscribes to e-banking products.

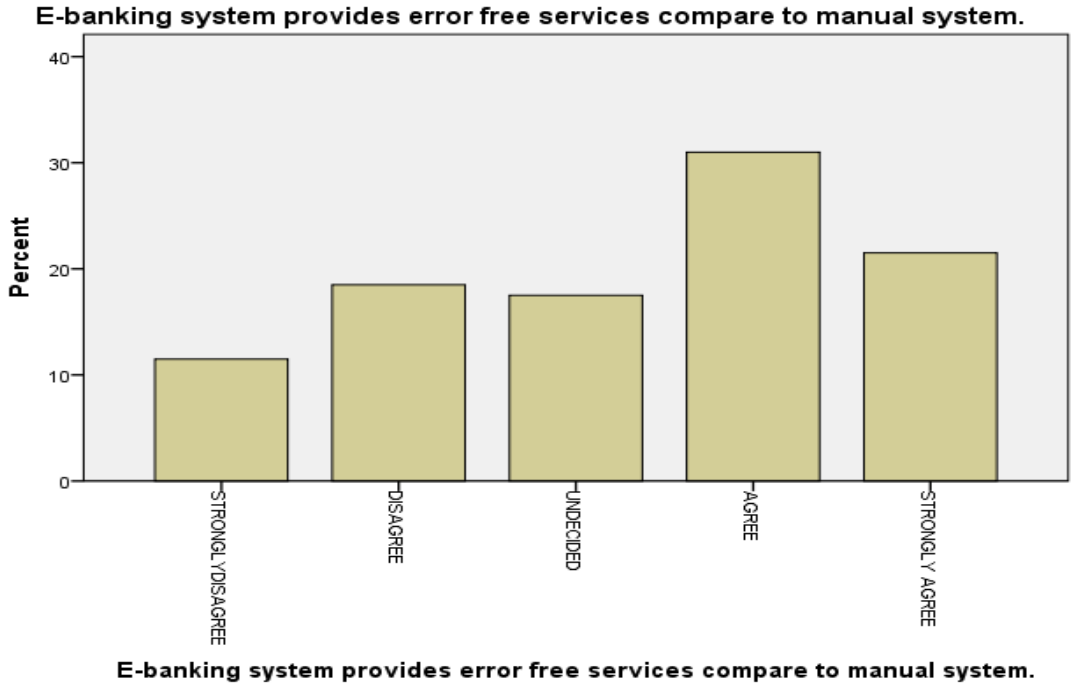

Fig 6: Bar chart showing the opinion of the respondents on whether e-banking system provides error free services compare to the manual system.

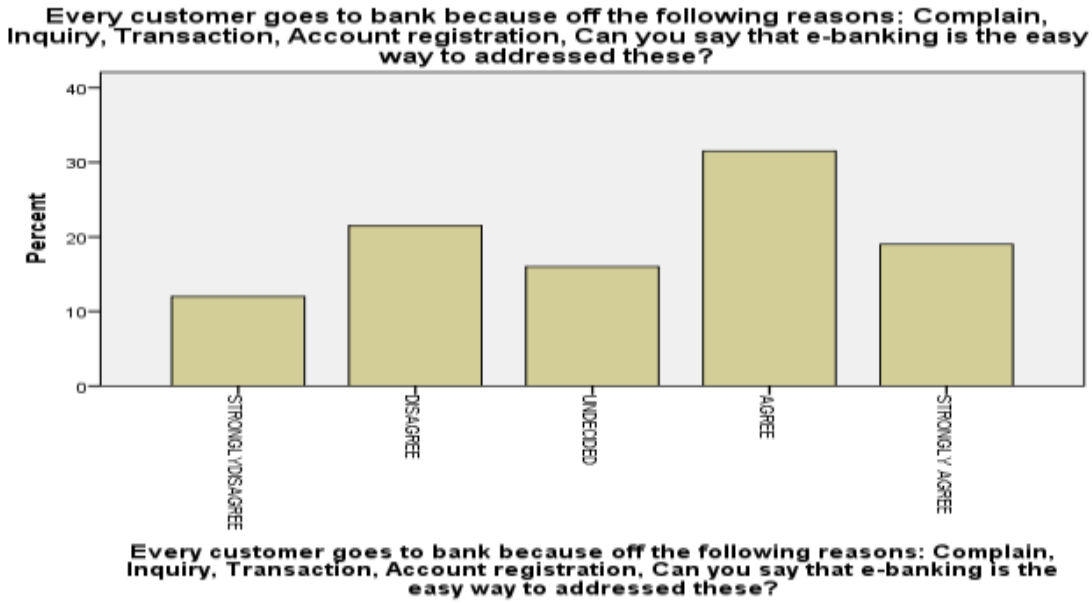

Fig 7: Bar chart showing the opinion of the respondents on whether e-banking system is the easy way to addressed complain, balance inquiry, transaction, and account registration.

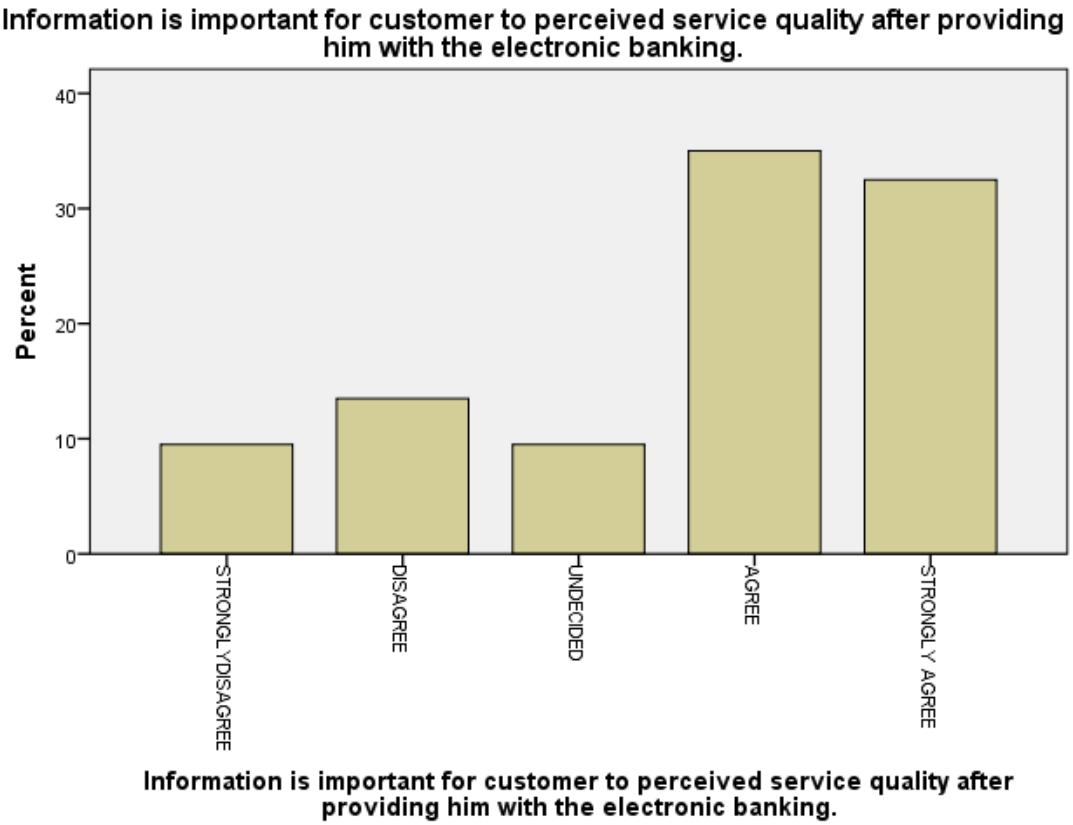

Fig 8: Bar chart showing the opinion of the respondents on whether information is important for customer to perceived service quality after providing them with the e-banking.

DISCUSSION ON DISCRIPTIVE RESULTS

The fig 1 shows the frequency of responses with strongly disagree had 20 respondents representing 10.0%, disagree had 17 respondents representing 8.5%, undecided had 6 respondents representing 3.5%, Agree had 48 respondents representing 24.0%, and Strongly Agree had 109 respondents representing 54.5% based on the response from the respondents, it is agreed that e-banking system based payment is more secure than the then manual system with a reasonable percentage of 54.5% out of 100% compared to using the manual banking system.

The fig 2 shows the frequency of responses with strongly disagree had 7 respondents representing 3.5%, disagree had 20 respondents representing 10.0%, undecided had 4 respondents representing 2.0%, Agree had 60 respondents representing 30.0%, and Strongly Agree had 105 respondents representing 52.5% based on the response from the respondents, it is agreed that e-banking system based payment is more secure than the then manual system with a reasonable percentage of 52.5% out of 100% compared to using the manual banking system.

The fig 3 shows the frequency of responses with strongly disagree had 11 respondents representing 5.5%, disagree had 6 respondents representing 3.0%, undecided had 18 respondents representing 9.0%, Agree had 82 respondents representing 41.0%, and Strongly Agree had 83 respondents representing 41.5% based on the response from the respondents, it is strongly agreed that e-banking system makes every form of transaction much faster to the customer with a reasonable percentage of 41.5% out of 100%.

The fig 4 shows the frequency of responses with strongly disagree had 5 respondents representing 2.5%, disagree had 10 respondents representing 5.0%, undecided had 17 respondents representing 8.5%, Agree had 84 respondents representing 42.0%, and Strongly Agree had 84 respondents representing 42.0% based on the response from the respondents, it is agreed that e-banking system keep up to date customer to his account with alert services with a reasonable percentage of 42.0% out of 100%.

The fig 5 shows the frequency of responses with strongly disagree had 13 respondents representing 6.5%, disagree had 22 respondents representing 11.0%, undecided had 22respondents representing 11.0%, Agree had 96 respondents representing 48.0%, and Strongly Agree had 47 respondents representing 23.5% based on the response from the respondents, it is agreed that accessibility to e-banking services encourage customers to subscribe to e-banking products with a reasonable percentage of 48.0%, out of 100%.

The fig 6 shows the frequency of responses with strongly disagree had 23 respondents representing 11.5%, disagree had 37 respondents representing 18.5%, undecided had 35 respondents representing 17.5%, Agree had 62 respondents representing 31.0%, and Strongly Agree had 43 respondents representing 23.5% based on the response from the respondents, it is agreed that

e-banking system provides error free services with a reasonable percentage of 31%, out of 100% compare to the manual system.

The fig 7 shows the frequency of responses with strongly disagree had 24 respondents representing 12.0%, disagree had 43 respondents representing 21.5%, undecided had 32 respondents representing 16.0%, Agree had 63 respondents representing 31.5%, and Strongly Agree had 38 respondents representing 19.0% based on the response from the respondents, every customer goes to bank either because of complain, inquiry, transaction, and account registration. It is agreed that the easiest way to addressed these is through e-banking with a reasonable percentage of 31.5%, out of 100%.

The fig 8 shows the frequency of responses with strongly disagree had 19 respondents representing 9.5%, disagree had 23 respondents representing 11.5%, undecided had 19 respondents representing 9.5%, Agree had 70 respondents representing 35.0%, and Strongly Agree had 65 respondents representing 32.5% based on the response from the respondents It is agreed that information is important, for customer to perceived service quality after providing with the electronic banking with a reasonable percentage of 35.0%, out of 100%.

INFERENTIAL RESULTS

Table: 1 Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step	Step	24.659	7	.001
1	Block	24.659	7	.001
	Model	24.659	7	.001

The **table 1** shows the omnibus test of model coefficients is used to check that the new model (with explanatory variables included) is an improvement over the baseline model. A p-value (sig) of less than 0.05 (i.e. $p<0.05$) for block means that the new model is a significant improvement of the baseline model. In our case model chi square has 7 degrees of freedom, a value of 24.659 and probability of 0.001 (i.e. $p<0.05$). Thus, the indication is that the model containing only the constant has a poor fit, indicating that the predictors do have

a significant effect and create essentially a different model, so our new model is better.

Table: 3 Classification Table

Observed			Predicted		
			Satisfaction		Percentage Correct
			Yes	No	
Step 1	Satisfaction	Yes	197	0	100
		No	6	0	.0
	Overall Percentage				97.0

a. The cut value is .500

The table 4.2 provides the -2LL and pseudo- values for the full model. The -2LL value for this model (29.238) is what compares to the -2LL for the previous null model in the 'omnibus test of model coefficients' (i.e. 24.659) which told us there was significant decrease in the -2LL, i.e. That our new model (with explanatory variables) is significantly better fit than the null model. The value tells us approximately how much variation in the outcome is explained by the model. **Cox and Snell** here is indicating that 29% of the variation in the dependent variables is explained by the logistic model, and the **Nagelkerke** that does range from 0 to 1 is more reliable measure of the relationship and it is normally higher than Cox and Snell's measure, in our case it is 0.491 indicating a moderately strong relationship of 49.1% between the predictor and prediction.

Table: 2 Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	29.238[a]	.116	.491

a. Estimation terminated at iteration number 11 because parameter estimates changed by less than .001.

Step 1	Satisfaction	Yes	197	0	100.0
		No	6	0	.0
	Overall Percentage				97.0

a. The cut value is .500

Table 3 is based on the model that include our explanatory variables. The columns are the two predicted values of the dependent variables, while the rows are the two observed (actual) values of the dependent. In a perfect model all cases will be on the diagonal and the overall percent correct will be 100%. In this study 100% were correctly classified as satisfied group and 0.0% as not satisfied group. Overall of 97.0% were correctly classified. This is a considerable improvement on the 97.0% correct classification with the constant model so we know that the model with predictors is a significantly better model. But are both predictor variables responsible or just one of them? This is answered by the Variables in the Equation table i.e. (Table 4).

Table:4Logistic Regression Coefficient of the Predictor Variables

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	Security	-.6.109	3.873	2.488	1	.115	.002
	Speed	.634	.823	.592	1	.441	1.884
	Design Features	5.158	2.222	5.391	1	.020	173.814
	Accessibility	.429	0.932	.212	1	.645	1.536
	Reliability	2.496	1.363	3.350	1	.067	12.129
	Ease Of Use	-3.462	1.733	3.993	1	.046	.031
	Information Quality	.370	1.383	0.72	1	.789	1.448
	Constant	11.236	6.667	2.841	1	.092	75846.987

Table: 4

The variable in the equation table have several important elements. The Wald statistics and associated probabilities provide an index of the significance of each predictor in the equation, it has a chi square distribution. The simplest way to assess wald is to take the significance values and if less than 0.05 reject the null hypothesis as the variable does make a significant contribution, in this case, we note that Design Features (p = 0.020) and Reliability (p = 0.067) contributed significantly to the prediction.

Conclusion

From the results obtained in the descriptive analysis one can easily say that there is relationship between satisfaction and the predictors' variables such as security, ease of use, accessibility, information quality, design and features, reliability, and speed. Generally based on the response from the respondents one can say that customers are fully satisfied with overall service of the e-banking with a reasonable percentage of 97.0% out of 100%, this means that the explanatory variables contribute significantly towards the satisfaction of customers. In this study 97% were correctly classified as satisfied group and 3.0% as not satisfied group. Overall of 97.0% were correctly classified. This is a considerable improvement on the 97.0% correct classification with the constant model so we know that the model with predictors is a significantly better model.

Recommendation

Based on the findings of this study, we recommend the banks to sensitize and generally educate customers to widely embrace the use of e-banking, as innovative alternative to the over reliance on the traditional banking services through media advertisement, the use of screens at the banking halls and setting up personnel-assisted unit to easily manage customers' challenges or difficulties towards e-banking usage.

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