Empirical Study in the Security of Electronic Payment Systems

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Abstract

The financial institutions seek to cut the cost of mediators through direct deal with the consumers and share information with the Internet users as well as encourage customers to pay on-line. One of the main problems faced by Organizations in terms of dealing and paying on-line that Internet users are worried and unwilling to send sensitive information through the Internet. In fact customers are scared that during the transactions hackers and Internet interlopers will steal their information. This study suggests that there are some security features such as authentication, authorization, privacy and encryption can influence user's perceptions of security for electronic finance transactions and contribute toward enhancing customers' perceptions that the e-finance transactions are secure and safe to send through sensitive information and pay on-line.

Keywords: *Electronic Payment, Authentication, Authorization, Privacy, Encryption.*

1. Introduction

The emergence of Internet, the improvement of Information Technology, and the fast growth of wireless telecommunication between organizations and individuals have affected the financial system greatly and also have increased the use of Electronic Finance E-Finance locally as well as globally [1].

E-Finance has affected businesses, individual consumers and has also reform the trading relationships. Most organizations need to adopt the new technology in the new environment and enhance their businesses efficiency to gain competitive advantage and to succeed in the global economy.

One of the new challenges in the competitive and global economy is E-Finance including electronic payment. E-finance technology is considered one of the most important factors to gain competitive advantage in the global economy.

Therefore organizations try to improve the interchange of information and electronic payment, and enhance the means of transactions between trading partners (suppliers and customers). This can be through breaking the barriers that restrict information sharing. When the volume of transactions and information sharing increases; the level of the associated risk will also increases. Therefore organizations need to ensure the security of data and the system itself to protect the users' information being shared [2], [3].

Today most organizations seeks to complete their data interchange with E-Finance and gain from the associated cost saving and convenience offered to consumers, at the same time they need appropriate security system to ensure that during the financial transactions and electronic payment, all customers' information will be protected. The researchers noticed that privacy is a significant important factor influencing e-businesses and E-Commerce [4].

Therefore electronic payment technology need to provide security mechanisms as a sufficient safeguards in the form of digital signatures, encryption and Web seal assurances…etc, whereby e-finance users perceptions can be gained. The fast growth of Internet and E-Finance usage require a fast and similar growth in security system to satisfy the E-Finance) users especially those who use the electronic payment transactions.

2. Literature review

2.1 Evolution of Electronic Payment

Organizations were used to deal with financial dealings in the traditional way such as paper work. But with advent of communication and internet technology most of financial procedures dealt with it electronically. However the appearance of internet and the development of electronic communications

technology impact significantly the growth of E-Finance. Accordingly E-finance defined as the provision of financial services and market using electronic communication and computation [5].

Electronic payment systems initiated since a quit long time. However in industrialized countries the interbank payment system was operated using telephone networks and mainframe networks. Furthermore, in 1970s Automated Clearing House (ACH) created in the US) in order to make payment of wages and other essential payments. Meanwhile European Giro system implement electronic format in order to reduce paper work as it is in credit cards organizations. On the other hand, the number of Automated Teller Machine (ATM) has increased from 18,500 in 1980 to 324,000 in 2000 and then increased by time to be well spread in the recent years [6].

2.2 Internet Banking Instruments

The Internet banking refers to the deployment over the Internet of retail and commercial banking services with individual and corporate clients including bank transfers, payments, settlements, documentary collections, credits, card business and others [7].

International banking statistics from the Bank of International Settlements and the European Central Bank shows that the popular payment instruments used for the payment of day-to-day purchases include cash, checks, debit cards, and credit cards. In general, EPS can be classified into five categories [8], [9], [10], [11], which are listed below.

1. Electronic-cash: transactions are (transactions which are) settled via the exchange of electronic currency.
2. Pre-paid card: customers use a pre-paid card for a specified amount by making an entry of the unique card number on merchant sites. The value of the card is decreased by the amount paid to the merchant.
3. Credit cards: a server authenticates consumers and verifies with the bank whether adequate funds are available prior to purchase; charges are posted against a customer's account; and the customer is billed later for the charges and pays the balance of the account to the bank.
4. Debit cards: a customer maintains a positive balance in the account, and money is deducted from the account when a debit transaction is performed.
5. Electronic checks: an institution electronically settles transactions between the buyer's bank and the seller's bank in the form of an electronic check.

2.3 Limitations of Traditional Payment Systems in the Context of Online Payments

There are three factors stimulating the development of electronic payment systems: reduced operational and payments processing costs, growing online commerce and decreasing the costs of technology, Reduction of costs is one of the key reasons for research and development of EPSs. The central impetus for e-commerce and e-business is to provide a more efficient service, mainly in terms of costs. So, paying online with traditional payment systems such as credit cards is rather paradoxical, given that credit cards are one of the most expensive of all reachable mainstream payment means for both end consumers and merchants, defeated perhaps only by paper checks [12].

There are several limitations of traditional payment systems in the context of e-commerce can be outlined. Existing payment systems, such as credit cards, are inadequate for retail customer digital business from the following viewpoints as:

Lack of usability: Accessible payment systems for the Internet need from the end user to present a great amount of information, or make payments using complex elaborated web site interfaces. E.g. credit card payments via a web site are not the easiest way to pay, as these need entering wide amounts of personal data and contact details in a web form [13], [14].

Lack of security: Presented payment systems for the Internet are an easy target for stealing money and personal information. Clients have to give credit card or payment account details and other personal information online. This data is sometimes transmitted in an un-secured way. In practice this happens even in spite of introduction of secure transactions mechanisms, such as Secured Socket Layer. Providing these details by mail or over the telephone also entails security risks [13], [15], [16].

Lack of trust: Customers tend not to trust offered systems with the long history of fraud, misuse or low reliability. In the present situation, money loss by customers is quite possible when using existing payment systems, such as credit cards for Internet payments. Potential customers often mention this risk as

the key reason why they do not trust a payment service and for that reason do not make Internet orders [13], [14], [17].

Lack of applicability: Some web sites don't support a particular payment means, therefore limiting customer's ability to pay. Credit cards work only with merchants who have signed-up to the services of the corresponding credit card company, and do not support direct business-to-business or interpersonal payments [18], [13].

Lack of efficiency: Payments over the Internet can be too small to be handled by existing payment systems, because of expenditure included in the processing of payments and transaction. Credit cards are too expensive for effecting small payments and not appropriate for small transactions. The minimum fixed fee charged to the retailer for processing a transaction could even go beyond the value of the goods sold, [13], [15].

2.4 Web Security

Web security means the ability of the web to sustain and protect the personal sensitive information from any altering, misuse, disclosure, destruction or taken by unauthorized persons such as Internet intruders and hackers. In addition the web security system must prevent unauthorized users to use the computer system and control access to the network from inside and outside the organization [19], [20].

Security is the life of E-Commerce and it has become the most important issue for its growth [2], [21]. However the two most important areas preventing the successful implementation of E-Commerce globally are the Internet and E-Commerce transactions security.

According to [20] the security requirements of E-Commerce can be categorized in a number of ways:

1. The authentication of the partner.
2. The confidentiality of the transactions data.
3. The integrity of the transactions data.
4. The reliability of the E-Commerce system.

According to [22] they stated that during the transactions via the Internet, E-commerce transactions could be considered secure only when all customers' sensitive information arrives at its destination without any change. Essentially Internet transactions are risky because the Internet was firstly given to the public for sharing information among each other and not for business purpose. For that reason there were no security mechanisms to support business transactions. Therefore without appropriate security mechanisms to control E-Commerce transactions, customer's sensitive information will be susceptible to web threats such as hackers and Internet intruders.

The Internet security focuses more on security features such as, access control, authenticity, confidentiality, and data integrity. These features also help to maintain the security during the transactions process; as a result these features can help to minimize Company's transactions security threats and contribute toward enhancing perceived web security of trading partners as well as the general consumers. Moreover there are some basic security requirements for E-Commerce security, which includes authentication, integrity, confidentiality, availability and privacy [2], [23].

According to [24], [25] they noted that companies are still worried about their information during transit from one port to another through the Internet network. This is because the Internet security is still at the developing stage. Therefore it is very important to maintain the security reputation in the network and it is based on security perceptions among the trading parties.

3. Research Methodology

Depending on the previous literature and some interviews we posed the following hypothesis:

3.1. Hypothesis Research

H_1 Importance of Authentication is positively related to perceived security of E-Finance transactions.

H_2 Importance of Authorization is positively related to perceived security of E-Finance transactions.

H_3 Importance of Privacy is positively related to perceived security of E-Finance transactions.

H_4 Importance of Encryption is positively related to perceived security of E-Finance transactions.

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3.2. Measurement

The research instrument that was used for data collection, it was distributed to the respondents contained multiple measurement items to measure each variable in the research model. However the perceived web security scale was developed by Salisbury, Pearson, Pearson and Miller [26]. This measurement was develop to measure the extent to which one believes that the web and Internet is secure for transmitting sensitive information such as credit card number, social security number and bank account number.

3.3. Questionnaire Design

The questionnaire was distributed among E-Finance users (partners and customers) in the UUM campus, the objective of the questionnaire was to investigate and gain the E-Finance user's perceptions about electronic payment security.

The questionnaire consists of five main sections. The first section consists of 6 questions to gather information about the profile of the respondents. The second section contains eight questions to gather information about the respondent's electronic payment usage. Section 3 contains 12 questions to know the respondent's perceptions of E-Finance and electronic payment security. The fourth and fifth sections each consist of 12 questions to measure the importance and the presence of authentication, authorizations, privacy and encryption during electronic payment transactions.

3.4. Sampling

3.4.1. Population and Unit of Analysis

The population in this study was UUM students who have E-Finance access who may purchase or pay using services such as Air Asia's. And they were already or potentially performing electronic payment transactions in UUM as well as bank.

The unit of analysis of this study was Individuals who already or potentially using electronic payment transactions.

3.4.2. Sample Size

The sample size for this study was around 300 sampling students and bank officers in UUM Who used or potential to use electronic payment transaction. The 300 questionnaires were distributed among individuals in order to gain information and complete this study.

3.5. Data Analysis

After the data collection, the data was entered into the Statistical Package for Social Sciences (SPSS) in order to analyze the collected data, the statistical tools and methods used in this study was descriptive statistics, factor analysis, linear regression, and reliability test. These techniques used in order to analyze the data and test the result of this study.

3.6. Factor Analysis

A factor analysis was used in this study on all the data that was collected from respondents through the questionnaires to identify the variables that can be used in regression analysis and also the factors that explain the correlations within the observed variable. Principal components with Varimax rotation method is used to extract the number of factors that influence the dependent variable.
There are four independent variables suggested in this study:

1. Importance of Authentication
2. Importance of Authorization
3. Importance of Privacy
4. Importance of Encryption

Where as, the dependant variable in this study was the perceived security of E-Finance transaction.

The results of factor analysis on the independent variables showed four factors were extracted for the independent variables. The four factors for independent variables were named as Importance of Authentication, Importance of Authorization, Importance of Privacy, and Importance of Encryption. While for dependent variable one factor was extracted as perceived security of perceived security of E-Finance transactions. The summary of factors analysis is shown in the following tables.

Table 1: Results of Factor Analyses

Variable	Factor			
	1	2	3	4
Privacy 6	.745			
Privacy 4	.742			
Encryption 5	.693			
Encryption 6	.686			
Privacy 5	.679			
Authorization 4	.609			
Authentication 5	.601			
Authentication 4	.582			
Authentication 6	.571		.301	
Authorization 6	.520			
Authorization 5				
Encryption 4				
Privacy 1		.778		
Privacy 2		.716		
Privacy 3		.667	.319	
Authorization 3		.625	.415	
Authentication 2			.733	
Authentication 1			.707	
Authorization 1	.301	.397	.620	
Authorization 2		.360	.535	
Authentication 3		.316	.326	
Encryption 2		.360		.728
Encryption 3		.441		.641
Encryption 1	.325	.301	.336	.589

3.7. Reliability Test

A reliability test was conducted on five factors using the Cronbach's Alpha to measure the reliability of inter-item. In this study, a value of 0.60 or higher is accepted, as shown in the following table the Cronbach alphas of the measures were all comfortably above the lower limit of acceptability (Cronbach's alpha > 0.60). Thus, all the measures were highly reliable.

Table 2: Reliability Analyses

Variable	Number of Items	Cronbach's Alpha
Importance of Authentication	6	0.80
Importance of Authorization	6	0.75
Importance of Privacy	6	0.84
Importance of Encryption	6	0.79
Perceived Security of E-Finance Transactions	10	0.86

3.8. Descriptive Analysis

As shown in the following table, the mean values for importance of Authentication, importance of Authorization, importance of Privacy, and importance of Encryption are 4, 4.11, 4.28 and 4 respectively which indicate that the respondents feel the importance of authentication, authorization, privacy and encryption during online E-Finance transactions. Whereas the table shows also the mean of perceived security E-Finance transactions is 4.66, which shows that the respondents does not perceived security during E-Finance transactions.

Table 3: Description Data Analysis

Composite	Mean	Std. Deviation
Importance of Authentication	4	.90
Importance of Authentication	4.11	.88
Importance of Privacy	4.28	.87
Importance of Encryption	4	.76
Perceived Security of E-Finance Transactions	4.66	.97

3.9 Conceptual model

From the result of factor analysis, the independent variables includes four variables named as importance of authentication, importance of authorization, importance of privacy and importance encryption while the dependant variable is the perceived security of E-Finance transactions. So we proposed the following conceptual model which is presented in Figure 1.

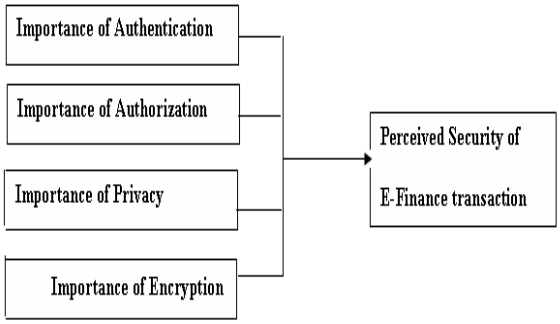

Fig.1: The Conceptual model.

3.10 Hypothesis Testing

In this study a regression analysis was conducted in order to test the relationship between the independent variables and dependant variable, the hypotheses are as follows:

H_1 Importance of Authentication is positively related to perceived security of E-Finance transactions.

H_2 Importance of Authorization is positively related to perceived security of E-Finance transactions.

H_3 Importance of Privacy is positively related to perceived security of E-Finance transactions.
H_4 Importance of Encryption is positively related to perceived security of E-Finance transactions.

The extract of Pearson Correlation from the correlation analyses for Perceived Security of E-Finance Transactions is shown in table 4. In this table the information has been extracted to indicate the relationship of each independent variable with the dependant variable. Based on the analyses, Importance of Authentication, Importance of Authorization, and Importance of Privacy is negatively correlated with Perceived Security of E-Finance transactions, and the Importance of Encryption is positively correlated with Perceived Security of E-Finance transactions.

Table 4: Extracts of Pearson Correlation from Regression Analyses

Pearson Correlation	Perceived Security of Transactions
Importance of Authentication	-.009*
Importance of Authorization	-.04**
Importance of Privacy	-.003*
Importance Encryption	.05**

***Significant at0.01 **Significant at0.05 *Significant at 0.1

In order to verify the proposed hypotheses, we must have a close look at following tables. According to the result in table 5, the R-square value was 0.8% of the variance of Perceived Security of E-Finance Transactions which can be explained) by all the independent variables. The F-Value was .5, which indicate that there is a significant linear model at Alpha = 0.1.

Table 5: Multiple Regressions: (Std. Beta coefficient).

Variables	Perceived Security of On-Line Transactions
Importance of Authentication	-.07***
Importance of Authorization	.09**
Importance of Privacy	-.06***
Importance of Encryption	.08**
R	.09
R Square	.008
F	.5*

*** Significant at 0.01 * * Significant at 0.05 *Significant at 0.1

The result in the above table shows that there is a n egative impact of Importance of Authentication on Perceived Security of E-Finance Transactions at Beta = -.07, p< 0.01. The table also shows a positive impact of Importance of Authorization on Perceived Security of E-Finance Transactions at Beta = .09, p<0.05. Moreover, the table demonstrates a negative impact of Importance of Privacy on Perceived Security of E-Finance Transactions at Beta = -.06, p< 0.01. Whereas there is a positive impact of Importance of Encryption on Perceived Security of E-Finance Transactions at Beta = .08, p<0.05.

According to the research findings, hypotheses first and third hypothesis are rejected because their Beta are negative. In other hand, hypotheses two and four are supported because their Beta is positive.

4. DISCUSSION AND CONCLUSION

4.1. Discussion

4.1.1. The influence of Importance of Authentication on Perceived Security of E-Finance Transactions

This study shows that authentication has negative impact on perceived security of E-Finance transactions. The reason of this finding is that, when respondents reflect their perceptions of authentication on Internet, E-Finance transactions, it depends on the type of information that the users uses during the transactions. Usually the users feel the importance of authentication during E-Finance transactions when the information that they send through the Internet is sensitive information such as credit card serial number, name, address…etc, otherwise they will not feel the importance of authentication during their transactions.

4.1.2. The influence of Importance of Authorization on Perceived Security of E-Finance Transactions

The finding of this study shows a positive impact of the importance of privacy on perceived security of E-Finance transactions, based of this finding, hypotheses 2 has been accepted. The finding indicates that the authorization during E-Finance transactions is important and this is having a wide consensus because E-Finance users want their information to be used by authorized persons only.

4.1.3. The influence of importance of privacy on perceived security of on-line transactions

This study found that the influence of privacy on perceived security of online transactions was negative, thus hypotheses 3 was rejected. Privacy is important during E-Finance transactions but only for sensitive information, most of E-Finance users feel the importance of privacy because they use their sensitive information, but for those who don't deal much with E-Finance transactions they do not really feel this importance. However perceived the importance of privacy can be formed through encryption. During E-Finance transaction users believe that encryption mechanism will protect their sensitive information from hackers and any misuse as well as it will be safe during the transactions, thus users feel the privacy through encryption, because encryption ensure that the clients' information will be with authorized people only, and this is comes according with the following.

4.1.4. The influence of Importance of Encryption on Perceived Security of E-Finance Transactions

According to the data analysis and findings, the influence of Encryption on perceived security of E-Finance transactions was positive, thus supposition 4 which has been supported. Encryption is important in order to insure the privacy for the users of E-Finance. On the other hand, and as mentioned earlier, during E-Finance transaction the clients believe that encryption mechanism will protect their sensitive information from hackers and any misuse as well as it will be safe during the transactions, thus users feel the privacy through encryption, because encryption ensure that clients information will be with authorized people only. Since perceived the importance of privacy can be formed through encryption and the encryption has a negative impact on perceived security of E-Finance transactions, thus this result is consistent with the previous study in the literature.

4.2. Implications of the Study

In general the finding of this study indicate that, Importance of Authorization and Importance of encryption influence the Perceived Security of E-Finance Transactions, these features can contribute toward enhancing the perceptions of the users that the web and online transactions including E-Finance transaction are secure, and encourage them to use the online system and do financial transactions online.

Organizations are searching for appropriate ways that can encourage their clients to make the financial transactions online and share their information with the organizations. This research can help organizations to find some ways that can contribute to encourage clients and users to make financial transaction and share their information through the Internet. As it was proposed in this research there are some appropriate features that can contribute toward enhancing clients perception that the E-Finance transactions are secure to share information with other parties and to encourage users to make financial transactions and share information online, some of these features found in this study are authorization and encryption.

From the research's result we can find\ that authorization and encryption can contribute toward enhancing clients' perceptions that the web and financial transactions are secure to share sensitive information with other parties and it can also contribute to encourage clients to make E-Finance transactions. These features can be used by organizations to enhance the perceptions of the clients that the web and the E-Finance transactions are secure, and encourage them to financial transaction online.

If organizations used these features through E-Finance transactions and ensure to the clients that their information will be protected from any misuse and therefore the clients perceived that their information will be safe during the transactions, this can help organisations to encourage users to make financial transactions online and share the information with the organisation, then it will be helpful to the organisation to deal with their clients online in order to save time as well as paper work. This also will help in cutting the cost of intermediaries and to be competitive in the global economy, at the same time the clients can get the transactions fast and smooth and safe the cost of intermediaries.

5. Conclusion

This section reviews the finding and provides conclusion of the results of this study. According to the descriptive analysis in chapter four, it can be concluded that the security features such as authorization and encryption are important mechanisms to be present and practiced during E-Finance transactions.

Currently E-Finance user's does not perceived the security of E-Finance transactions and they did not feel secure to send sensitive information through the Internet. However, they feel secure to send their sensitive information through Internet if such mechanisms are present and practiced. Moreover these features will encourage clients to make financial transactions online and share information through Internet which will help organizations to cut intermediaries and to improve B2B and B2C as well as to be competitive in the global economy. However those users who have greater usage are more concern about the security features.

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