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Barriers in adoption of internet banking: A structural equation modeling - Neural network approach

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ABSTRACT

Comparatively, less attention has been paid to the factors that obstruct consumers to use internet banking. Therefore, this study aims to analyze the barriers in the adoption of Internet banking in Karachi, Pakistan. A survey research questionnaire was adopted and, in total, 300 useable responses were used from the banks' customers. First exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were applied for the establishment of measurement model and structural equation modeling (SEM) was used to find the significant influence barriers on Internet banking adoption. In the second phase, the neural network model was used to rank the relative influence of significant predictors obtained from SEM. The results indicate a significant positive relationship between value barrier, risk barrier, and image barrier with the usage of Internet banking. Only, the traditional barrier has a negative insignificant effect on the usage of Internet banking. The image barrier has a higher impact on usage of Internet banking followed by the value barrier and risk barrier. Results also indicate that males are facing high barriers in comparison with females. Findings provide guidelines to banks for developing facilities that enable the consumer to use Internet banking for their financial transactions. This study will be highly beneficial for the banking industry to improve their online services and revise their policies to facilitate consumers by meeting their needs.

1. Introduction

In today's competitive business world, the banking sector has witnessed remarkable technological innovation and it is considered to be the backbone of any country's economy [49]. Companies are facing fierce competition in the modern era of web-based technologies, when customers prefer using the web for their commercial and daily use. Internet banking is the latest technological development that allows consumers to have direct access to their financial records and transactions online [6]. The popularity of Internet banking in different countries confirms that the services provided online are much more attractive when compared to the traditional ones [38]. found that Internet banking is getting popular in Asian countries, and it is extremely useful for those consumers who embrace technological inventions. Similarly [86], stated that Asian countries are more involved in internet banking services. This extensive growth of Internet banking is due to more ease and comfort in conducting online transactions [37], and the quick acceptance of Internet banking has convinced banks to invest exponentially in the related IT sector to retain customers [45].

Although Internet banking provides convenience and ease, a large number of customers are still not using the technological facilities provided to them [55,57]. identified three types of groups in the adoption of advancement, namely: rejecters, postponers, and opponents. Rejecters are those who avoid taking any initiative to adopt any kind of innovation, and new offerings are not beneficial to them. Postponers are the ones who want to adopt but delay the adoption due to situational elements, whereas opponents also want to adopt the advanced methods, but have not decided when to adopt. According to Ref. [51], 94.4% of Pakistani banks provide Real-Time Online Branches (RTOB) to their account holders. During the second quarter of FY16, Pakistan Real-Time Interbank Settlement Mechanism (PRISM) settled 225,598 transactions of value Rs. 64.1 trillion, showing an increase of 5% and 19% in volume and value respectively compared to the first quarter of FY16 [41]. In addition, 3G/4G services in the country have added to the rapid diffusion of the Internet by connecting around 18 million smartphone users to the Internet [4], which could prove to be a catalyst for the adoption of

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Internet banking in Pakistan. Despite the growth in the values and volumes of transactions by the users through different banks, the share of Internet banking in overall transactions stands at a mere 4% [66]. According to Refs. [67,73], banks are still facing difficulties in fully maximize their operations due to the unwillingness to adopt internet banking irrespective of the benefits.

Earlier work on Internet banking has mainly focused on the productive characteristics of banking, with researchers mainly studying those determinants that create initial users' trust [54]. Consumer behavior towards Internet banking was examined by selecting different variables [11,19,30,32,57] but all these research was carried out in a developed economy, however developing economies remained unexplored and still scarce in the studied contest [69]. worked on mobile banking service adoption in Pakistan, but this study also examined the productive constructs. However, resistance to innovation and adoption is a less developed concept and it deserves more attention [89]. stated that consumer research related to technology adoption is pro-innovation biased. This means that innovation is always good and consumers always want to adopt new services and products [57]. According to Ref. [91], the majority of the innovations have slow penetrating rate and 50%–90% failure technology rate. Such failures are due to consumer resistance [90]. However, according to Ref. [68], developed economies embrace technological innovations rapidly in order to facilitate daily operations and to address their higher-order needs, whereas, developing nations have lower technological affluence. Therefore, the current study is an attempt to identify the barriers which become usage barrier for the consumer of banks in Pakistan via considering the innovation resistance model [47,57] as it is considered as the most appropriate model for investigating consumer resistance towards technology [89]. This research is also different from the methodological point of view and it is not designed to compare and contrast adopter, postpone and rejecter. Furthermore, previous studies did not highlight the barriers to the adoption of Internet banking on the basis of gender in Pakistan [70]. considered gender difference as an important aspect of the adoption of new technologies. Gender difference is one of the fundamental differences among individuals, as males and females have different decision-making processes [71] and this allows the practitioners to effectively serve the segment (i.e. males and females) using different marketing strategies [72]. Moreover, none of the mentioned studies have investigated the impact of four components on the usage barrier using the Neural Network approach.

2. Literature review and hypothesis development

The rapid advancement in internet technology has made tremendous changes in the banking sector [87,88]. This resultant web-based application services [73] such as internet banking [88]. The availability of internet banking opened the horizon for the practitioners and researchers and the "acceptance of internet banking" has gained much popularity among researchers. Prior studies related to internet banking have used the theory of reasoned action (TRA), technology acceptance model (TAM) and theory of planned behavior (TPB) [83]. Also, the unified theory of acceptance and use of technology (UTAUT) model has also been widely used by researchers in examining determinants of e-banking adoption [73]. All these researches have worked on the productive elements of internet banking. However, studies have neglected the obstructing factors of innovation. Even though, major cause of innovation failure is consumer resistance towards the innovation [91].

[47] have identified the several barriers obstruct consumer for the adoption of an innovation and [32] explained that different risks are linked with the adoption of an innovation [47]. divided the barriers into two categories i.e. functional barriers and psychological barriers. Functional barriers are related to product usage patterns, product value, and risk associated with product usage. These barriers are more likely to emerge if a person perceives significant change by adopting innovation. On the other hand, psychological barriers become apparent because of the tradition and norms of the person. This barrier is linked with the persons' prior beliefs. Usage, risk and value barriers are the functional barriers whereas tradition and image barrier are related to psychological barriers [47,84]. Earlier studies have focused on the positive aspect of internet banking and little research has addressed the barriers to internet banking adoption. Therefore, this paper identifies the barriers for usage of internet banking via considering the barriers of innovation proposed by Ref. [47].

2.1. Image barrier

Every individual perceives things differently. The perceived image of something is built according to an individual's personal preferences on the basis of what he or she likes or dislikes. It is a perceptual issue that arises out of stereotype thinking and makes things difficult for innovation [47]. According to Ref. [57], it is a negative attitude of the consumer towards the product or services. Consumers, who have a negative mental image of the adoption of new technology, do not use Internet banking, and this negative image prevents them from using the Internet banking facility [28]. In a similar vein [84], stated that if the consumer perceives that the technology is difficult to use, they will refuse to adopt the technology. The negative perception may occur due to the complex procedure of using Internet banking services [21], because, if the consumer feels that the service is difficult in terms of usage, he or she will be reluctant to adopt it [18,58,61]. User-friendliness is also a noteworthy element for improving the image of Internet banking [33]. This barrier arises when the consumer feels uneasy to use a computer and has negative feelings related to using technology [84]. According to the above discussion, this can be hypothesized that:

H1 = Image barrier positively influence barrier to the usage of Internet banking

2.2. Value barrier

If the service does not offer the best price and superior performance, it is not considered as valuable for the customer [47]. In other words, if the customer does not see the value of how well the product functions, he/she will not use the product [84]. Concept or relative advantage is given by Ref. [49] explains the value barrier, which is similar to the perception of perceived usefulness resulting from TAM literature [61]. Consumers will adopt the facility of Internet banking if it provides benefits to them [45]. But, if the service is poor in terms of performance and value for money, it may create a value barrier [47]. Previously, it has been observed that perceived usefulness is the main factor for the adoption of Internet banking [12,20,45,60,63]. For some of the non-users, the comparative advantage of Internet banking may be poor, as it would be necessary to have a computer/smartphone and an Internet connection [22,28]. The absence of comparative benefit and the ease of use may prove to be the barrier to the usage of Internet banking [3]. Ease of use perceived by the consumers affects their intention to adopt and use the product or services [60,63]. In the same way, perceived ease of use has a direct impact on the adoption of internet banking, and it positively encourages the non-adopters to use internet banking services [29]. According to the above discussion, it can be hypothesized that:

H2 = Value barrier positively influence barrier to the usage of Internet banking

2.3. Risk barrier

Risk is always present in the mind of the individuals while performing or initiating any task; however, high risk is normally seen in financial dealings. The risk which stops or discourages an individual from performing a task is referred to as a risk barrier [21]. Every

innovation always naturally involves some extent of risk [47]. Many consumers are also afraid because human error can be committed easily via a computer [28] or mobile phone [32]. Consumers think that their passwords can be hacked and their bank accounts can be accessed by others if they use the Internet banking facility. Unclear instructions and need to change the PIN code discourage some consumers from using the Internet banking facility [28]; hence, security is one of the major concerns of the consumers [50]. Unreliable security technology increases the perception of risk and lowers the satisfaction level and willingness to use e-commerce among the customers [56,64]. [84] also stated that customer perceives internet banking to be risky due to several reasons. Such as, an internet connection will be lost, lack of documentation proving a transaction, fear of losing PIN and cybercriminal accessing. According to the above discussion, it can be hypothesized that:

H3 = Risk barrier positively influence barrier to the usage of Internet banking

2.4. Tradition barrier

On the basis of traditions or norms, individuals reject or accept things available in the environment. When the services or products are against tradition, it creates a barrier towards their usage [84]. There is always some amount of satisfaction or dissatisfaction for any innovation or technology [52]. This can happen due to some personality characteristics which influence the consumers to adopt or reject a technology [17]. The level of acceptance when adopting any technology is automatically reduced when there is a need for in-person contact between the customer and banks [59]. Prior beliefs and values are important to the consumers, and they follow certain routines [47]. Many of them are influenced by social circles or family. In fact, many of the consumers feel frustrated while adopting technologies or technology-based systems [43]. Attitudinal aspect also plays a noteworthy role in internet banking adoption [40].

According to the above discussion, it can be hypothesized that:

H4 = Tradition barrier positively influence barrier to the usage of Internet banking

The hypothesized model is presented in Fig. 1.

2.5. Moderator: gender

There are various moderators used in studies related to technology [83]. [79] classified moderators into three groups. A first group is related to organizational factors, the second group is related to technological factors and a third group is related to individual factors such as age and gender. Previous studies have suggested that gender plays a vital role in behavioral intention in information system research [79,81,82]. Gender schema theory considered gender in models of consumer behavior [85]. [57] stated that gender significantly influences the decision. Prior studies showed that males and females behave differently in decision-making processes [71]. Moreover [80], revealed that technological readiness, age and gender moderate attitude intention of internet banking consumers. In this study, we have used gender as a moderator variable.

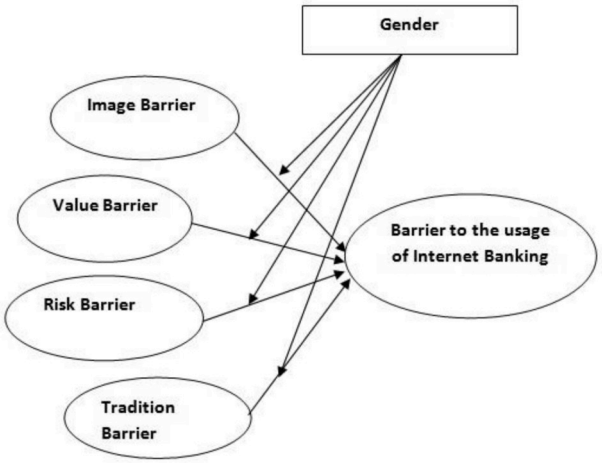

Fig. 1. The research model.

3. Research methodology

3.1. Measurement instrument

The study investigated how corporate customers recognize barriers to the adoption of Internet banking in Pakistan. A questionnaire was designed with a Likert scale ranging from 1 to 5 to collect the responses. These items were adapted from Refs. [11,30,32], and [1].

3.2. Data collection

On the basis of the non-probability purposive sampling technique, firstly data from 100 respondents were collected randomly for the pilot testing to check the appropriateness and validity of the designed instrument for the study. After the formulation of a questionnaire on the web, it was emailed to the target population to collect the responses. The survey was available on the web for two months. Also, responses were also gathered from face-to-face meetings with the targeted respondents. Potential respondents of the study were those who were qualified (university graduates) and had bank accounts. The questionnaire was sent to around 500 consumers of the bank from which 320 were returned. Hence the response rate was 64%. In data screening, 20 responses were removed which reduced the data to 300 responses. The target place was Karachi, for being the commercial hub of the country and lucrative in every aspect for local and international investors. The city is home to people from almost every part of Pakistan.

3.3. Statistical techniques

Reliability analysis was performed in order to see the internal consistency of the instrument. Exploratory factor analysis and correlation analysis were performed by using SPSS-22. Next, Confirmatory factor analysis and Structural equation model were applied by using Amos 22. The model used for the research is:

$$UB = \alpha_0 + \alpha_1 VB + \alpha_2 RB + \alpha_3 TB + \alpha_4 IB + \varepsilon \quad (1)$$

where: UB= Barrier to the usage of Internet Banking, VB= Value Barrier, RB = Risk Barrier, TB = Tradition Barrier and IB= Image Barrier.

4. Results and findings

4.1. Demographic profile

Table 1 depicts the demographic profile of the respondents. Out of the total 300 respondents, 75% were male and 25% were female. 65.66% of respondents were within the age group of 26–33, 24.66% were in the 18–25 age group, and 9.66% were in the age group of 34–41. Educated respondents were selected for the study; 67% had graduate degrees. Around 77.33% of the respondents were active Internet users. People who use the Internet on a daily basis were categorized as expert users, and those who use the internet once in a week were called the moderate users in this study.

Table 1
Demographic profile of respondents.

	Frequency	%
Gender		
Male	200	66.66
Female	100	33.33
Age		
18-25	74	24.66
26-33	197	65.66
33-41	29	9.66
Education Level		
Under Graduate	95	31.66
Graduate	201	67
Above Graduate	4	1.3
Internet User		
Moderate User	68	22.66
Expert User	232	77.33

4.2. Reliability analysis and exploratory factor analysis

Exploratory factor analysis (EFA) and Confirmatory factor analysis (CFA) were used to determine the level of adequateness. Table 2 represents the results of exploratory factor analysis by using the Varimax rotation and the value of Cronbach coefficients of the variables. The value of Cronbach's coefficient should be greater than 0.6, as recommended by Refs. [16,44], while a stricter minimum requirement of 0.70 is recommended by Nunnally [39]. All the values of the scale are greater than 0.70 and satisfy the criteria of [39]. The factor loadings of the individual items should be greater than 0.5, as suggested by Ref. [23]. One item was removed as the factor loading of this item was found to be less than 0.5. After getting the desired results, CFA has been performed and model fitness, convergent validity, and discriminant validity has been checked. Lastly, the structural equation modeling (SEM) technique was applied to see the causal relationships between the variables.

Table 2
Exploratory factor Loading.

Items	Factor Loadings
Image Barrier (Cronbach's a = 0.822)	0.695
In my opinion, new technology is often too complicated to be useful.	0.702
I have such an image that internet banking services are difficult to use.	0.688
I have a very negative image of internet banking services.	0.666
In my opinion, I will have fewer problems by using bank branches for my transactions.	0.745
In my opinion, my transactions done by Internet banking can be wrong.	
Barriers to the usage of Internet Banking (Cronbach's a = 0.840)	0.769
	0.772
In my opinion, internet banking services are easy to use.	0.698
In my opinion, the use of internet banking services is convenient.	0.731
In my opinion, internet banking services are fast to use.	0.521
In my opinion, progress in internet banking services is clear.	
The use of changing PIN codes in internet banking services is convenient.	
Value Barrier (Cronbach's a = 0.782)	0.663 0.693 0.779
The use of internet banking services is economical.	0.749
In my opinion, the use of internet banking services increases my ability to control my financial matters by myself.	0.536
In my opinion, the use of internet banking is a convenient way to manage my financialtransactions.	
In my opinion, the use of internet banking is useful for my financial transactions.	
I like to make use of technology.	
Risk Barrier (Cronbach's a = 0.787)	0.524
I fear that while I am using internet banking services, the connection will be lost.	0.691
I fear that while I am using an internet banking service, I might tap out the information of the bill wrongly. I fear that the list of PIN codes may be lost and end up in the wrong hands I think my money could be stolen easily if I use internet banking.	0.705
	0.736
	0.744
I fear that when using internet banking services other people could access my account.	
Traditional Barrier(Cronbach's a = 0.787)	0.702
Visiting the bank branch and chatting with the teller is a nice occasion on a weekday.	0.769
I find self-service alternatives more pleasant than personal customer service.	0.742
I prefer to carry out my financial transactions through the bank branch rather than using internet banking services	0.637
I am so used to the means provided by the bank branch to do my financial transactions that I find it difficult to move to internet banking.	

4.3. Composite reliability and confirmatory factor analysis

Table 3 represents the parameters of convergent validity i.e. Average variance extracted and composite reliability and also the values of factor loadings. The value of the composite reliability coefficient should be greater than 0.7, which represents the highest level of consistency of the scales [23]. The factor loading of the variables should be greater than 0.5, as suggested by Ref. [23]. But according to Ref. [74], the value of factor loadings should be atleast 0.6. Three items, i.e. 'In my opinion, my transactions done by Internet banking are as correct as those done at bank branches', 'I like to make use of technology' and 'I fear that while I am using internet banking services, the connection will be lost' were removed not only because of the lower factor loading but also for adjusting the model fit. The average variance mentions the exposure of the variables. According to Refs. [74,75] to achieve convergent validity, each variable should have atleast 0.50 coefficients for AVE and 0.70 coefficients for composite reliability. Hence, convergent validity is achieved as all the values are above the recommended values.

According to the criteria of [76], discriminant validity has been checked. It was assessed by comparing the square root of AVE with the correlation among the constructs. The value of the square root of AVE should be greater than the correlation between any pair of constructs [77,78]. Table 4 validate that all variables distinguish from each other.

All the values of the correlation in Table 4 were found to be less than 1, which shows a positive and significant correlation. The Skewness of the variables lies in between 1.462 and 0.065, which is below 2. Kurtosis of the variables lies in between 2.831 and −0.520, which is below 10. Both skewness and kurtosis are less than the threshold and reveal that the scores are normally distributed.

Table 3
Reliability & confirmatory factor loading.

Constructs	Items	Standardized Loadings	Composite Reliability	Average Variance Extracted
Image Barrier	IB1	0.74	0.796	0.624
	IB2	0.77		
	IB3	0.70		
	IB4	0.62		
Value Barrier	VB1	0.66	0.793	0.617
	VB2	0.66		
	VB3	0.75		
	VB4	0.73		
Risk Barrier	RB2	0.64	0.783	0.610
	RB3	0.66		
	RB4	0.71		
	RB5	0.76		
Traditional Barrier	TB1	0.68	0.794	0.619
	TB2	0.73		
	TB3	0.77		
	TB4	0.63		
Barriers to the Usage of Internet Banking	UB1	0.65	0.840	0.610
	UB2	0.74		
	UB3	0.69		
	UB4	0.79		
	UB5	0.71		

Table 4
Correlations analysis between variables.

	1	2	3	4	5
(1) Image Barrier	**0.789**				
(2) Value Barrier	.413[a]	**0.785**			
(3) Risk Barrier	.574[a]	.301[a]	**0.781**		
(4) Tradition Barrier	.376[a]	.597[a]	.357[a]	**0.786**	
(5) Barriers to the usage of Internet Banking	.584[a]	.413[a]	.455[a]	.300[a]	**0.781**
Mean	4.02	3.20	3.86	2.88	4.08
Std. Deviation	0.73	0.94	0.80	0.94	0.78
Skewness	−1.28	−0.22	−0.82	0.65	−1.48
Kurtosis	2.69	−0.38	0.94	−0.52	2.83

[a] Correlation is significant at the 0.01 level (2-tailed).

Based on the model-fit indices obtained Table 5, the model has adequate and acceptable goodness of-fit indices: $\chi^2/df = 2.02(<3)$, *GFI* = 0.91(>0.90), *RMSEA* = 0.059(<0.08), TLI = 0.911(> 0.90), *CFI* = 0.924(>0.95), *IFI* = 0.925(>0.95), *PCFI* = 0.788(>0.50) and *PNFI* = 0.*735*(>0.50). These indices are among the most frequently used, as they are less affected by sample size [23].

4.4. Path analysis

Table 6 and Fig. 2 represent the path estimates of the constructs. According to the results, the image barrier, value barrier and risk barrier support the hypothesis that H1, H2, and H3 are significant. Only tradition barrier is found to be insignificant (−0.07, *p-value* = 0.343), hence H4 is rejected.

It is noted from the result that image barrier has the highest impact on the usage barrier of Internet banking (0.50, *p-value* = 0.000), followed by the value barrier (0.27, *p-value* = 0.000), and the risk barrier (0.21, *p-value* = 0.006). Results indicate that consumers of the banks are feeling complications and difficulties in using Internet banking services. They have a negative image of the usage of Internet banking and the fear of connection break-ups or PIN theft is also, a cause discouraging the use of Internet banking services and usage become a barrier to them.

4.5. Structural model results on basis of gender

To test the moderating effects of the gender, we grouped the data on male and female respondents and then analyzed it via grouping variable technique of Amos procedure adapted from Ref. [25]. In our data, the sample of male and female responses is unequal, but [96] suggested that unequal sample size can also be used for comparison if the variances in the two groups are homogenous. In this study, the data was collected from the same population; therefore, it can be assumed that the variance is homogeneous. In addition [97], also suggested that a comparison between groups with different sample sizes is possible. Table 7 represents the results of the path coefficients. According to the results, all the constructs, except for the tradition barrier, were found to be significant for the male category. Visiting the branch, chatting with the teller, and using self-service make them feel more pleasant. In the case of females, a tradition was not a barrier to them; however, image, value, and risk were the barriers for them. The value of R-square in case of male and female are 0.48 and 0.41 respectively.

Table 5
Model fit.

Model	Recommended Model Fit	Model Value
x2 (chi-square)		362.798
df (degrees of freedom)		179
Chi-square/df (x2/df)	$<3^a$	2.02
GFI (Goodness of Fit Index)	$>0.9^a$	0.91
RMSEA (Root Mean Square Error of Approximation)	$<0.08^b$	0.059
TLI (Tucker-Lewis index or NNFI non-normed fit index)	$>0.90^a$	0.911
CFI (Comparative Fit Index)	$>0.90^a$	0.924
IFI (Incremental Fit Index)	$>0.90^a$	0.925
PCFI (Parsimony Comparative of Fit Index)	$>0.50^a$	0.788
PNFI (Parsimony Normed Fit Index	$>0.50^a$	0.735

Table 6
Hypothesis testing (n = 300).

Path	*B*	S.E.	C.R.	P	Results
IB→UB	0.491	0.086	5.723	0.000	Supported
VB→UB	0.247	0.074	3.314	0.000	Supported
RB→UB	0.216	0.078	2.762	0.006	Supported
TB→UB	−0.067	0.071	−0.949	0.343	Not Supported

4.6. Neural network analysis

For robust results, this study uses a multi-explanatory approach by merging SEM and neural network analysis. Neural network is one of the most standout techniques of artificial intelligence, which helps in identifying non-linear relationship of complex problems, as compared to SEM and Multiple Regression Analysis (MRA), which over-simplifies complex decision process [56,58]. There are many types of neural systems, but feedforward back-propagation multilayer perceptron (MLP) was found to be the most appropriate for our study [56,58]. For performing the analysis, a two-stage organized approach is implemented. Firstly, SEM is used to test the entire model and determine the relative significance of every predictor variable, which are then, in a second stage, used as inputs to determine the relative significance of each predictor variable [14,94,95].

The neural network analysis was performed on SPSS 22. Specifically two layers, input and output, were analyzed. The input layer involved three independent significant factors from SEM (i.e. image barrier, value barrier, risk barrier), whereas the output layer comprised of one output variable (usage of internet banking) with the standardized range [0, 1]. Furthermore, to avoid over-fitting, the researcher performed a ten-fold cross validation in which 90% of the data was utilized for network training and the remaining 10% was used for testing [13–15]. Later, the Root Mean Square of Error (RMSE) of both training and testing values for all ten neural networks, along with averages and standard deviations were computed to check the accuracy of our model. Table 8 shows the RMSE of the validations in which the average cross-validated RMSE for the training model is 0.591, while the testing model is.0.637.

Lastly, the importance of normalized variables for the 10 neural networks was performed and displayed in Table 9. Based on the order of importance, image barrier, risk barrier and value barrier are found to be important predictors with the values 1.000, 0.857 and 0.557 respectively.

5. Discussion

The core purpose of this study was to identify the barriers which discourage the banking consumer towards the usage of Internet banking. Through path estimate, it was found that the value barrier, risk barrier, and image barrier have a significant and positive impact on the usage of Internet banking, whereas tradition has an insignificant and negative impact on the usage of Internet banking. The same results for the value barrier and risk barrier were found by Refs. [30,57]. Due to the uncertain environment of developing countries, the consequences of transactions become unclear [62]. For instance, if personal assistance is not available, it causes doubt in the mind of the consumer regarding whether the transactions are correctly processed or not. These doubts generate fear of password theft or identity hack.

It is suggested that by providing the best value to the customers, these barriers towards the adoption of Internet banking can be reduced.

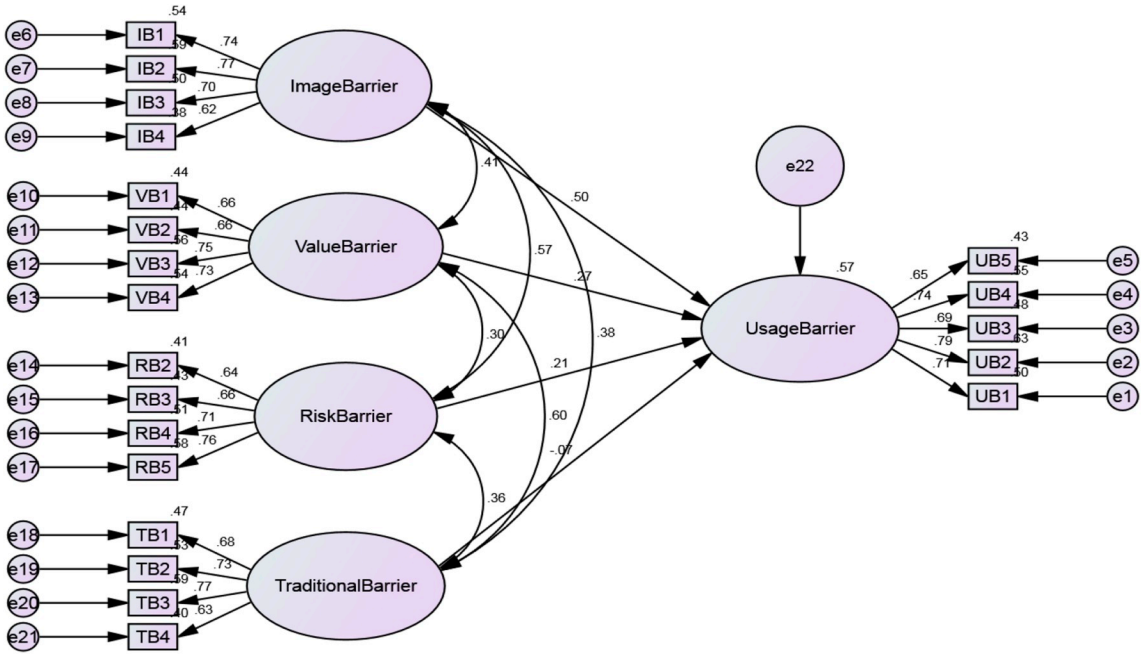

Fig. 2. Structural Equation Model *** *p-value* < **0.01**.

Table 7
Comparison of the Path coefficients on basis of Gender.

	Male(n = 200)		Female(n = 100)		T-Value
Path	*B*	S.E.	*B*	S.E.	(Male-Female)
IB→UB	0.441***	0.069	0.395***	0.049	5.955***
VB→UB	0.279***	0.049	0.202***	0.038	13.77***
RB→UB	0.232***	0.062	0.199***	0.042	4.798***
TB→UB	−0.114*	0.051	0.044(n.s)	0.037	−32.7884

*$P < 0.05$, ***$P < 0.001$, n.s = not significant.

Table 8
RMSE for the neural network.

Neural Network	Training	Testing
ANN1	0.563	0.685
ANN2	0.590	0.496
ANN3	0.594	0.545
ANN4	0.576	0.345
ANN5	0.595	0.779
ANN6	0.548	0.726
ANN7	0.537	0.593
ANN8	0.591	0.733
ANN9	0.727	0.837
ANN10	0.591	0.634
Average	0.591	0.637
Standard Deviation	0.052	0.147

Table 9
Normalized variable importance.

Predictors	Normalized importance
Image Barrier	1.000
Value Barrier	0.557
Risk Barrier	0.857

It could be done by providing a one-to-one explanation to the customers regarding the usage of Internet banking and offering them convenient and economical ways to conduct their transactions online. Customer service representatives should guide walk-in customers about Internet banking facilities. There is a need to develop confidence in the minds of consumers towards the usage of Internet banking. Past studies have shown that Internet banking can increase efficiency and save time [31,32]. To reduce the value barrier, banks should provide proper feedback to the customers and give them a sense of control over their financial transactions.

To overcome the risk barrier, the banking sector should provide trial services to the customers. This trial service can be provided to the consumer on some random account, so they can feel more comfortable using Internet banking and do not feel the fear of losing the information or funds from their bank accounts. The trial will help strengthen the trust of customers in Internet banking.

The results of the image barrier were found to be significant, which is similar to Ref. [57] and it means that the image barrier hinders the adoption of Internet banking due to a person's perception of Internet banking. To overcome this barrier, banks should develop a positive image of Internet banking by providing the best value services to their customers. This positive image can be created by providing a user-friendly, trustworthy, and easy–to- use Internet banking structure. Cross-check and balance service facility can also develop confidence in the usage of Internet banking. According to Ref. [36], providing an easy-to-use and user-friendly structure lowers the image barrier and gives a sense of convenience.

The tradition barrier was found to be negatively insignificant towards the usage of Internet banking whereas [57] find it negatively significant. The insignificant result reveals that tradition has no impact on the usage of Internet banking in Karachi. It also shows that if the tradition of physical presence at the banks increases for the financial transactions, it will automatically reduce the usage of Internet banking and the status quo will prevail.

The results of gender moderation showed that male users are facing more barriers to the usage of Internet banking than female users. Similar results were found in a previous study in Malaysia; females tend to adopt Internet banking more quickly than males [35,64]. The reason for the higher adoption rate of Internet banking by females in the current study might be due to the higher education levels among the females compared to the males in the target audience.

5.1. Managerial recommendations

The outcomes of the study have important implications for the managing authorities of banks in Pakistan. It is recommended that the banks' management formulate and implement strategies which may increase the use of the Internet banking system among the customers. Marketing campaigns emphasizing the speed, convenience, and security of Internet banking can be launched, and Internet banking manuals can be published to provide detailed information to the customers. Booklets and brochures about Internet banking should be published in Urdu and English, as well as the regional languages of Pakistan in order to access a large segment of the population.

Banks also need to deal with the barriers identified in the current study which hinder the adoption of online banking. Rules and regulations need to be devised to provide a secure, safe, and reliable Internet banking system to the customers in order to positively influence the customer's behavior towards online banking. Publishing easy-to-understand guidelines regarding Internet banking on the banks' websites can be beneficial in this regard.

Risk is one of the most important barriers to Internet banking, which cannot be completely removed, but can certainly be reduced. Banks should put a strict check-and-balance system in place for each Internet banking transaction in order to build customers' trust. In addition, banks should build a system that provides rechecking facilities for the online transactions made by the customers.

5.2. Theoretical contribution

From the theoretical perspective, this study provides the deep understanding of the psychological and functional barriers on internet banking. This study also highlights the role of gender influencing usage barrier. The results added the literature of the resisting barriers towards internet banking in the developing economies by providing the significant relation of image barrier, value barrier and risk barrier. This study identified that image barrier i.e. psychological barrier is the main contributor in resisting in using internet banking, whereas, traditional barrier found insignificant in context of internet banking which is also a psychological barrier. However, both risk and value barrier i.e. functional barriers works as barrier to use internet banking.

5.3. Future area of research

A few notable limitations open avenues for the future research. The first limitation is related to the sample size of the study. Future studies can be carried out by expanding the sample size as well as collecting data from different cities in Pakistan to obtain more in-depth and holistic results. The data was only gathered from both expert and moderate users of internet. However, it is suggested to the future researchers to expand the research via comparing the moderate and expert users of internet. Also, convenience sample restricts generalizability and a more representative sample is always recommended. Additional, the trust barrier can be investigated in order to analyze the usage of Internet banking. Few other control variables such as educational level and age of customers can also be used to see their impact on the usage of Internet banking. Most previous literature assumed that elders are non-attractive and disadvantaged prospects [92] because they easily develop stress and anxiety towards the innovation and highly resist to adopt any technology [93]. Also, non-adopters behavior towards internet banking can also be examined. A cross-country analysis can also be done by focusing on the banks which are operational in both the target countries to check the service criteria provided. The major limitation of the study is related to gender-biased data, hence it is recommended to the future researchers to collect an equal percentage of data of both genders and test the model. Also, the research model can be tested to the barriers to the usage of mobile banking. It is also recommended for future research to test the model in different innovative services or industries such as barriers of the mobile application or online shopping.

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