Effect of Cyber Security Costs on Performance of E-banking in Pakistan

Khalid Khalil[*], Abid Usman[†],Sheikh Raheel Manzoor[‡]

Abstract

The electronic-banking (e-banking) system face a serious concern related to the cyber-security. Most of the e-banks around the globe faced cyber-security related issues that result in billions of dollar loss and adverse impact on the image of the banks. As per the seriousness related to cyber security issues till yet the limited amount of studies was conducted to measure the cyber security investment influence on product innovation performance and e-banking financial performance. Therefore, the study objectives are a) to measure the causal relationship of cyber security costs on the product innovation performance and financial performance of e-banking and b) to find the intervening/mediating effect of product innovation performance in a relationship with cyber security costs and financial performance of e-banking in Pakistan. The targeted population was a managerial cadre staff member of e-banks working in Pakistan. The consequence exhibited that the cyber security costs put considerable influence on product innovation performance and e-banking financial performance and product innovation performance considerably mediates in an association with cyber security costs and e-banking financial performance. The study concluded that the introduction of emerging technology and creative services and products has obviously had a positive effect on banks' operations. The recommendations and future area are also included in the study.

Keywords: SEM, EFA, e-banking, performance

Introduction

The electronic banking (e-banking) plays a key role in the economic growth of any country (Siddik, et al., 2016). The e-banking is a banking method used by the client to electronically conduct transactions via the Internet (Gupta, 2019). Any e-bank's productivity relies on its enhanced financial results (Jepchumba & Simiyu, 2019). Financial output is defined as a subjective indicator of how effectively a company can utilize assets and generate revenue from its main business mode (Governance, 2019). The performance of product innovation is the success of the creation of new products and the subsequent introduction of a new

[*]PhD Scholar, IQRA National University, Peshawar

[†]Dean of Business Administration Department, IQRA National University, Peshawar

[‡] PhD, Lecturer, Agriculture University, Peshawar

product or service or an enhanced version of the previous product or service (Henri & Wouters, 2019). Cybercrime is defined as computer or Internet criminal activity (Yar & Steinmetz, 2019). It is possible to use the terms computer crime, high-tech crime, digital crime, e-crime and cybercrime with electronic crime interchangeably (Usman, 2017).

The computer is used in cyber-crimes either as a means for committing a crime, as a recording system or as a crime target (Padmaavathy, 2019). Computers may either store data as a storage device that helps to carry out a crime that is illegal for owners to own, such as theft of intellectual property. Njoroge (2017) stated that in order to protect the e-banking system from the cyber-attacks, the cyber security cost is consisted of the a) prevention & detection cost including (Firewalls, filters, antivirus), b) response cost (legal reputational), c) indirect cost (customer loss) and d) development cost (maintenance and quality). Studies stated that the cyber security cost puts considerable influence upon the product innovation performance of the organization (Jepchumba & Simiyu, 2019). Studies have also exhibited that the limited amount of studies was conducted on cyber security cost/expenditure and electronic-banking financial performance (Desta, 2018). Moreover, in Pakistan there exist no study that measures the relationship between cyber security cost and e-banking financial performance (Ahmed, 2018). So, therefore, the study objectives are a) to measure the relationship between cyber security costs, product innovation performance and financial performance, and b) to find the mediating effect of product innovation performance in a relationship with cyber security costs and financial performance of e-banking in Pakistan. The study is important for the academicians, in terms of providing the in depth and contemporary knowledge of the influence of the cyber security cost of product innovation and financial performance of e-banking in Pakistan. Moreover, this study enhances the literature in the context of security cost, product innovation performance and e-banking performance in Pakistan, which will be helpful for the scholars who are doing research in this area.

Literature Review

Costs & E-banking Performance

The empirical research on perception of e-banking adoption was conducted in Cameroon. The results of the study revealed that perceived security, trust, service cost, usefulness, and accessibility have a major impact on the adoption of e-banking by customers, which ultimately

affects the financial performance of e-banking (Fonchamnyo, 2013). Another research on the e-banking usage was conducted in Pakistan. The results show that privacy and security costs, website design and trust significantly predict the e-banking usage, which affects the financial performance of e-banking in Pakistan (Mehmood et al., 2014). In particular, researchers found that evidence of an overall negative stock market reaction to public announcements of information security breaches. The researchers established the study gap as there is minimal literature linked to financial sector-related information security breaches or cyber-crime (Arcuri et al., 2014). Here are the conclusions based on the above literature.

$H_{1:}$ Cyber security costs have a significant influence on e-banking financial performance (FP)

Product Innovation & E-banking Performance

The research was carried out in Bangladesh to assess the effect of the e-banking adoption on profitability of banks. The findings found that the ROA and ROE of online banking, banks were higher relative to banks without online banking (Mehmood et al., 2014). The findings, however, were negligible. In addition, ROA and ROE were found to be lower after internet banking was introduced and to be statistically relevant. This study concludes that the overall profitability of non-online banks is higher, although this may be because the initial expenditure in facilitating online banking services requires a few years of recovery. The void was highlighted by researchers as there are few recent studies to assess the effect of e-banking, on bank performance in developing countries (Islam et al., 2019). Centered on the literature underneath are the hypotheses

$H_{2:}$ Cyber security costs have a significant influence on product innovation performance (PIP)

Costs & Product Innovation Performance

Ayo & Ukpere (2010) published study on the unified and secure system of e-payment in Nigeria. The results of the study showed that in Nigerian banks, information technology is on the rise and this also increases cash circulation. The research was conducted in Kenya to assess the "effect of cyber-crime related costs on the development of financial innovation products/services". The analysis examined and observed that the costs of prevention and detection such as insurance premiums, direct costs such as market continuity costs, IT enforcement costs, direct

financial losses, compensation charges, legal costs and indirect costs such as reputational damage and loss of customer confidence were tremendous concerns and very important influences on the development of innovative banking fine (Mehmood et al., 2014). The hypothesis is underneath.

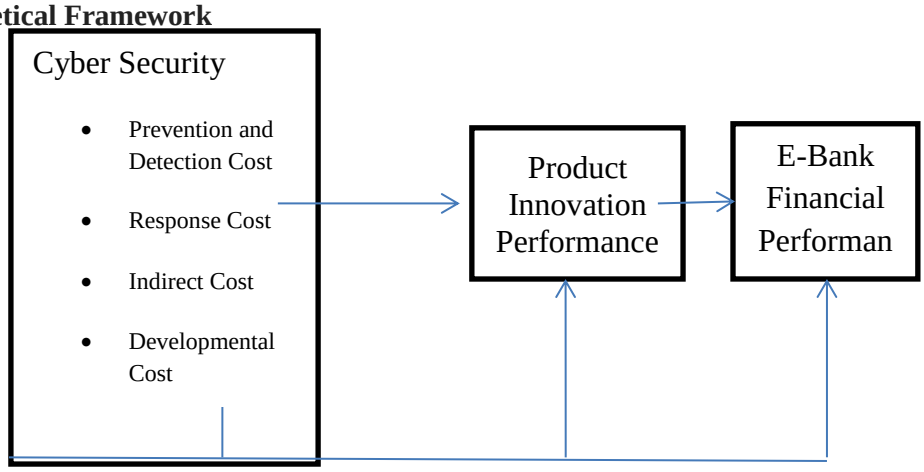
$H_{3:}$ Product innovation performance has a significant influence on e-banking FP.

Product Innovation Performance as Mediator

The research was performed in Taiwan to define the variables that persuade product innovation behavior. The results revealed that the conduct of product innovation / innovation behavior is intermediate between market relations and firm performance (Thongsri & Chang, 2019). In Georgia, another analysis was performed to assess the intermediate effects of product innovation in an organizational plus environmental variables and company performance partnership. The results revealed that product innovation intermediates significantly between organizational plus environmental variables and company performance in a relationship (Vincent, Bharadwaj & Challagalla, 2004). The results indicate that the performance of innovation significantly intermediates between innovation capabilities and company performance in a relationship (Rajapathirana & Hui, 2018). Hypotheses are based on the logical demise that follows.

$H_{4:}$ PIP significantly intermediates in an association amongst the cyber security costs and FP.

Theoretical Framework



Methodology

Population & Sample

The targeted population was a managerial cadre staff member of following banks located in the Khyber Pakhtunkhwa, Islamabad and Punjab cities of Pakistan.

Table 3.1: Population

	Bank Name	KPK	Punjab	Islamabad
1	MCB	86	46	84
2	HBL	300	500	100
3	Faysal	30	100	10
4	Meezan	17	50	10
5	Alfalah	14	120	18
6	Allied	135	500	50
7	Bank Islami	50	120	80
8	BoK	110	32	5
	Total	742	1468	357

Source (Concerned Offices, 2019)

Size Determination

For the creation, the exact size of the sample size was used (Yamane, 1967) which is mentioned beneath

Table 3.2: Size of Sample

Managers Populace	Sample
$n=511/1+511*(.05)^2$	n = 224
Operations Managers Populace	Sample
$n=2056/1+2056*(.05)^2$	n = 335

After calculation the sample shown those 224 managers and 335 operations managers of aforesaid banks located in the Khyber Pakhtunkhwa, Islamabad and Punjab cities of Pakistan.

Measurements

For collection, a Likert scale questionnaire was used.

Table 3.4: Measurement

S#	Variable	Items	Source	Scale
1	Prevention & Detection Cost	8	Njoroge (2017)	Likert-5-point

2	Response Cost	8	-do-	-do-
3	Indirect Cost	8	-do-	-do-
4	Development Cost	5	-do-	-do-
5	Product Innovation Performance	8	Chen et al (2015)	-do-
6	Financial Performance	6	Gounaris & Tzempelikos (2014)	-do-

Data Analysis

Table 4.1: Demographic Details

Gender	Freq	Percentile
Male	408	74.2
Female	142	25.8
Sum	550	100.0
Age	Freq	Percentile
20-30 year	340	61.8
31-40 year	181	32.9
41> above	29	5.3
Sum	550	100.0

*Exploratory Factor Analysis (EFA***)**

Table 4.2: Assumption of EFA

KMO		.721
BTS	Chi-Square	114432.36
	Df	703
	Sig.	.000

Note: KMO=Kaiser-Meyer-Olkin, BTS=Bartlett's-test-of-Sphericity

The consequence of statistical calculations showed that the KMO and BTS value was in good range (Fabrigar & Wegener, 2011).

EFA

Table 4.3: EFA

Items	Loading						Commonality	E.Value
	1	**2**	**3**	**4**	**5**	**6**		
PDC1	.624						.541	7.86

PDC2	.536				.725	6.16
PDC3	.744				.553	5.88
PDC4	.643				.776	4.87
PDC5	.722				.541	4.27
PDC6	.741				.725	3.98
PDC7	.681				.512	3.56
PDC8	.611				.643	3.09
RC1		.541			.517	3.01
RC2		.725			.734	2.93
RC3		.553			.593	2.77
RC4		.776			.741	2.45
RC5		.614			.643	2.30
RC6		.611			.778	2.29
RC7		.771			.824	2.21
DC1			.631		.871	2.11
DC2			.664		.678	2.08
DC3			.612		.748	2.03
DC4			.521		.696	1.98
DC5			.690		.668	1.93
IC1				.521	.538	1.87
IC2				.614	.615	1.81
IC3				.715	.709	1.76
IC4				.742	.542	1.71
IC5				.513	.608	1.65
IC6				.711	.719	1.55

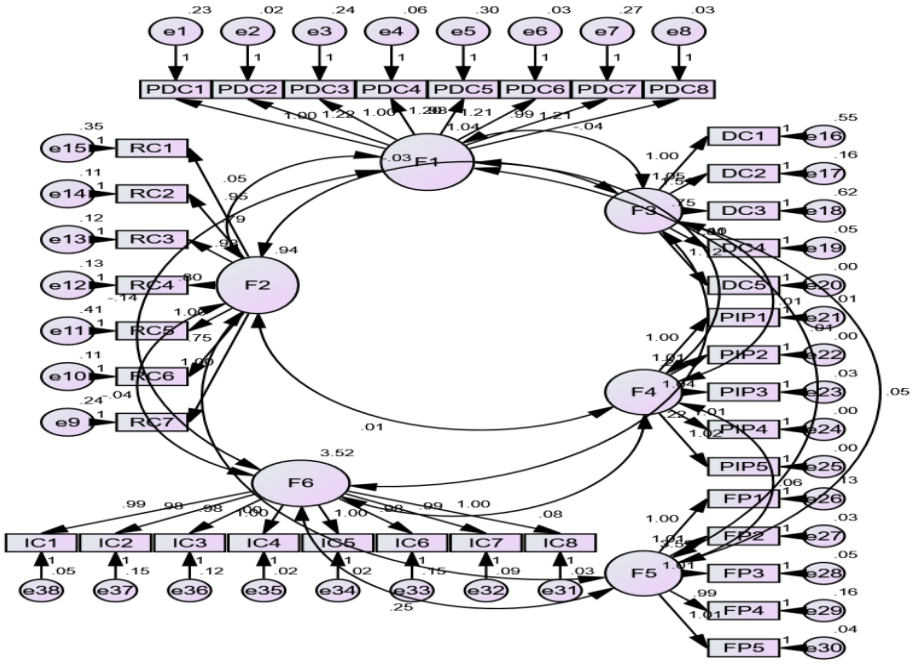
IC7	.631		.548	1.51
IC8	.767		.558	1.48
PIP1		.613	.698	1.41
PIP2		.757	.548	1.39
PIP3		.584	.543	1.34
PIP4		.581	.522	1.29
PIP5		.640	.629	1.25
FFP1			.541 .586	1.11
FFP2			.731 .678	1.09
FFP3			.630 .777	1.07
FFP4			.700 .786	1.05
FFP5			.811 .567	1.03

Method:PCA Iterations: 5

The EFA investigation showed that there are six factors in the measurement, and each items weight was above p.50. The commonality and eigenvalues were estimated using principal component analysis (PCA) and a total of five iterations were performed for 38 elements.

CFA (6-Factor) Model

The CFA consequence of PDC, RC, DC, IC, PIP and FP is depicted underneath.



F1=PDC,F2=RC,F3=DC,F4=IC,F5=PIP,F6=FP Figure (4.12)

Table 4.4: CFA Stat

Weights plus Indices							
GFI	RMSEA	X^2/df	SRMR	AGFI	NFI	CFI	TLI
.93	0.08	2.9	.04	.87	.93	.92	.96

For CFA estimation entirely, 8 suitable indices/catalogues were intended and consequence confirmed regarding the arithmetical values were in acceptable assortment of the sixfold factor archetypal, i.e. (PDC, RC, DC, IC, PIP and FP). The arithmetical values of 8 indices/catalogues are adequate as per (Hu & Bentler, 1995). Consequently, neither any of factor items is removed or detached.

Regression (Cyber-Security-Costs----PIP----FP)

The straight and indirect effect of Cyber security costs, PIP and FP was sedate and indicated underneath.

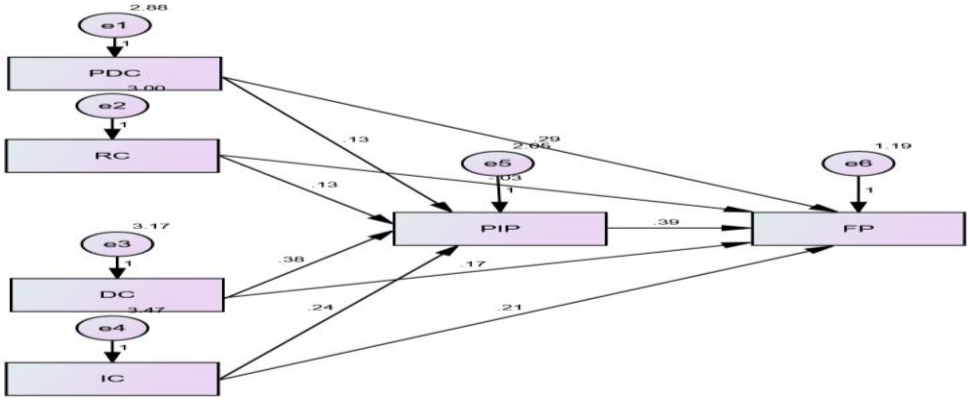


Table 4.6: Regression (IC----PIP-----FP)

Effect			Estimations	CR	SE	P
PIP	<---	PDC	.126	4.64	.027	***
PIP	<---	RC	.132	4.97	.027	***
PIP	<---	DC	.379	14.68	.026	***
PIP	<---	IC	.240	10.41	.024	***
FP	<---	PIP	.394	18.68	.021	***
Indirect Effect			Estimations	CR	SE	P
FP	<---	PDC+PIP	.290	13.8	.021	***
FP	<---	RC+PIP	.028	1.36	.020	
FP	<---	DC+PIP	.170	9.41	.018	***
FP	<---	IC+PIP	.210	10.5	.020	***

*Note: p=probability/signi***(p<.01),CR=CritPIPalRatio,SE=StandardError*

The straight effect cyber security costs upon PIP was computed and outcome values confirmed that PDC, RC, DC and IC have considerable persuasion on PIP depicting *(t=4.64, p<.05), (t=4.97, p<.05), (t=14.6, p<.05)* and *(t=10.4, p<.05)* respectively. Result originated that cyber security costs i.e. (PDC, RC, DC, IC) has considerable and affirmative conjecture of PIP. The straight effect of PIP on FP was computed and outcome values confirmed that PIP has considerable persuasion on FP depicting *(t=18.6, p<.05).* Moreover, the intervening influence of PIP was computed in a relationship amongst PDC, RC, DC, IC and e-banking FP. The outcome values confirmed that PIP partially intermediates in an association amongst the PDC, DC, IC and FP depicting *(t=13.8, p<.05), (t=9.4, p<.05)* and *(t=10.5, p<.05).* Whereas, the intervening influence of PIP in a relationship amongst RC and e-banking FP. The outcome values confirmed that PIP insignificantly

intermediates in an association amongst the RC and FP depicting *(t=1.36, p>.05).*

Discussion

The effect of cyber security costs was estimated upon FP. The outcome revealed that the cyber security costs, including PDC, RC, DC and IC are considerable and affirmative conjecture of FP. The result was match with prior studies of (Aral & Weil, 2007) as these studies stated in essence; companies need to make information security investments to better protect their tangible and intangible or physical and intellectual properties. This outcome found was dissimilar with (Menon & Lee, 2000). The outcome revealed that the cyber security costs, including PDC, RC, DC and IC are considerable and affirmative conjecture of PIP. The result was match with prior studies of (Njoroge & Njero, 2017), as these studies stated that investment in technology and cyber security has been recognized as a significant strategy that affects the success of innovation. This outcome found was dissimilar with study of (Wu, 2012) because of fierce competition, high-tech sectors may be offset, primarily due to strong inducements to keep pace with rapid technological growth and to minimize the inherent uncertainties associated with new technologies and goods. The effect of PIP on the FP was estimated. The outcome revealed that PIP is considerable and affirmative conjecture of e-banking FP. The result was match with prior studies of (Zu et al., 2019). The PIP was partially mediated in an association with cyber security costs, including (PDC, RC, DC, IC)) and e-banking FP. The result was similar to some of the prior studies that found (Thongsri & Chang, 2019).

Conclusion

The introduction of emerging technology and creative services and products has obviously had a positive effect on banks' operations today. On the positive hand, they have helped boost customer service delivery and thereby strengthened the banks' bottom line. The research therefore aimed to analyze the effects of the costs associated with the implementation of emerging trends and novel technologies. The study analyzed and acknowledged that the cost of prevention and detection, such as insurance costs for information technology, had a major impact on the production of banking products. Some other costs, direct costs, such as

business continuity costs, direct financial losses, compensation fees, legal costs and indirect costs, such as reputational harm and consumer loss of trust, were enormous concerns and very important influencers of the PIP of banks. These costs include the relevant steps that a financial institution must take to adjust to the damages that other parties, such as customers, might have suffered as a result of an online platform attack.

Recommendations

The banking products and services become very common, so the government should intervene the banking service providers to offer the innovative technologies that are cost-effective for the customer as well as for bank operations. The crime is unavoidable factors in the current world in which banks are working. Therefore, it is suggested that the bank manager takes more cost-effective steps and more reliable technologies that do not offer loopholes for illegal activities to take place. There should also be more investment in prevention and detection techniques, because banks invest significant sums in the production of these goods.

Limitations

There are some research limitations; the study was primarily focused on self-assessment measurements, leading to concern about variance that inflates the relationship between variables. Secondly, in terms of gender representation, the sample is limited, i.e. less female respondents participated in the study, which may lead to the issue of the generalizability of both genders.

Forthcoming Research

In the future, by adding some more moderating and mediating variables to the same framework, the researcher will concentrate on Pakistan's banking non-financial performance under the same structure.

References

Ahmed, Q. M. M. (2018). Analysis of the recent attacks on Pakistani Banks. PakCERT Threat Intelligence Report. 1(3), 20-34.

Aral, S., & Weill, P. (2007). IT assets, organizational capabilities, and firm performance: How resource allocations and organizational

differences explain performance variation. Organization science, 18(5), 763-780.

Arcuri, M. C., Brogi, M., & Gandolfi, G. (2014). The effect of information security breaches on stock returns: Is the cyber-crime a threat to firms? In European Financial Management Meeting.

Ayo, C. K., & Ukpere, W. I. (2010). Design of a secure unified e-payment system in Nigeria: A case study. African Journal of Business Management.

Desta, Y. (2018). Customers' e-banking adoption in Ethiopia, PhD Dissertation, Addis Ababa University, Ethiopia.

Fonchamnyo, D. C. (2013). Customers' perception of E-banking adoption in Cameroon: An empirical assessment of an extended TAM. International journal of economics and finance, 5(1), 166-176.

Gaskin, J., & Lim, J. (2016). Model fit measures. Gaskination's StatWiki, 1-55.

Governance, C. (2019). Corporate Governance and Financial Performance of Nigerian Banks–PDF–Complete Project Material. Accounting & Finance.

Gupta, M. (2019). A Study of Customer Awareness Towards Internet Banking. Advance and Innovative Research, 86.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2013). Partial least squares structural equation modeling: Rigorous applications, better results & higher acceptance.

Henri, J. F., & Wouters, M. (2019). Interdependence of management control practices for product innovation: The influence of environmental unpredictability. Accounting, Organizations and Society, 101073.

Hu, L. T., Bentler, P. M., & Hoyle, R. H. (1995). Structural equation modeling: Concepts, issues, and applications. Evaluating model fit, 54, 76-99.

Islam, S., Kabir, M. R., Dovash, R. H., Nafee, S. E., & Saha, S. (2019). Impact of Online Banking Adoption on Bank's Profitability: Evidence from Bangladesh. European Journal of Business and Management Research, 4(3).

Jepchumba, P., & Simiyu, E. (2019). Electronic Banking Adoption and Financial Performance of Commercial Banks in Kenya, Nairobi City County. International Journal of Finance and Accounting, 4(2), 19-38.

Mehmood, N., Shah, F., Azhar, M., & Rasheed, A. (2014). The factors effecting e-banking usage in Pakistan. Journal of Management Information System and E-commerce, 1(1), 57-94.

Menon, N. M., & Lee, B. (2000). Cost control and production performance enhancement by IT investment and regulation changes: evidence from the healthcare industry. Decision Support Systems, 30(2), 153-169.

Mohamud, A. A., & Mungai, J. (2019). Financial innovation on performance of commercial banks in Garissa County, Kenya. Strategic Journal of Business & Change Management, 6(1), 491-504.

Nazaritehrani, A., & Mashali, B. (2020). Development of E-banking channels and market share in developing countries. Financial Innovation, 6(1), 12.

Njoroge, E. W. (2017). Effect of cyber security related costs on development of product innovation performances and services: A case study of NIC bank of Kenya. PhD Dissertation. Kenyatta University of Agriculture and Technology.

Padmaavathy, P. A. (2019). Cyber Crimes: A Threat To The Banking Industry. International Journal of Management Research and Reviews, 9(4), 1-9.

Rajapathirana, R. J., & Hui, Y. (2018). Relationship between innovation capability, innovation type, and firm performance. Journal of Innovation & Knowledge, 3(1), 44-55.

Siddik, M. N. A., Sun, G., Kabiraj, S., Shanmugan, J., & Yanjuan, C. (2016). Impacts of e-banking on performance of banks in a developing economy: empirical evidence from Bangladesh. Journal of Business Economics and Management, 17(6), 1066-1080.

Söylemez, S. A., & Ahmed, A. H. (2019). The Role of New Economy Indicators on Banking Sector Performance in Ghana: Trend and Empirical Research Analysis of Banks' Clients and Experts Perception. Journal of Finance and Economics, 7(1), 23-35.

Thongsri, N., & Chang, A. K. H. (2019). Interactions among factors influencing product innovation and innovation behaviour: Market orientation, managerial ties, and government support. Sustainability, 11(10), 2793.

Usman, M. (2017). Cyber Crime: Pakistani Perspective. Islamabad Law Review, 1(3), 18-III.

Vincent, L. H., Bharadwaj, S. G., & Challagalla, G. N. (2004). Does innovation mediate firm performance? a meta-analysis of determinants and consequences of organizational innovation.Georgia Tech Library.

Wu, J. (2012). Technological collaboration in product innovation: The role of market competition and sectorial technological intensity. Research Policy, 41(2), 489-496.

Yamane, Taro. 1967. Statistics, An Introductory Analysis, 2nd Ed., New York: Harper and Row.

Zu, J., Gu, Y., Li, K., & Bonsu, O. A. M. (2019). Impacts of Financial Innovations on Financial Performance Evidence of Electronic Banking in Africa. methodology, 3(7), 56-60.