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ORIGINAL ARTICLE

Relationship between financial innovations and the performance of commercial banks

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Abstract

The objective of this research paper is to analyze the impact of financial innovations on the financial performance of commercial Banks in Pakistan. For this purpose, we used six years data from 2013 to 2019. The financial performance of banks was chosen as dependent variable, and it was measured through three profit indicators such as return on assets (ROA), return on equity (ROE) and earning per share (EPS), while number of ATMs, number of credit card users, number of debit card users and internet banking were taken as independent variables. Out of total 44 commercial banks, 12 banks were selected as a sample of study. Econometric techniques such as descriptive statistics, correlation Matrix, ADF test, ARDL model, Bound test and Error Correction Model were applied to analyze the data and draw the results. The findings of the study reveal that number of ATMs, number of credit card users, number of debit card users and internet banking have positive and significant relationship with banking profitability in Pakistan as the profitability of selected banks was improved substantially during the study period. The insight for the policy makers is that they should devise such policies which enhance maximum use of internet banking in order to reduce automation cost of banks, boost their efficiency and boost their profitability in future.

Keywords Financial innovations · ATM cards · Efficiency · Internet banking · Profitability · Performance of banks

Introduction

All classical and new classical economists like Mill (1874), David Ricardo (1821), Pigou (1932), Adam Smith (1904) and Marshal (1920) considered new methods of production, division of labor, specialization and comparative advantage as prerequisites for attaining rapid growth and sustainability. Joseph Schumpeter (1939) was the first economist in the earliest period of the twentieth century who postulated theory of innovation by differentiating between invention and innovation. He discussed different dimensions of innovations such as introduction of a new product or modifying existing product, exploring a new market, adoptions of new methods of product manufacturing, obtaining new sources or raw materials for the production, making production process more efficient and developing new organizational structure to accelerate pace of growth and organizational performance (Schumpeter 1960). He emphasized on continuous innovations to maintain momentum of growth. He argued that new innovation destroys old one and inefficient innovation and disrupts market equilibrium. He termed this process as a "creative destruction" (Schumpeter 1994). He considered supply side of the market as a source of innovation because it is associated with creative entrepreneurs. He opinioned that entrepreneurial activity trigger economic changes in the economy, while Peter Drucker (1992) assumed these changes as an opportunity to propose new solutions by the entrepreneurs. In contrast, Ericvon Hippel (2005) presented a new concept of innovation by saying that innovations in general are created by customers who in the digital era, are called users.

Since the emergence of Schumpeter's theory of innovation, many economists and researchers define innovation in different ways but all definitions mostly evolved around this theory. The economists such as Mansfield (1968); Freeman and Soete (1997); Barnett (1953); Kuznets (1959); Harman (1971); and Rogers (2003) recognized the breakthrough of

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Schumpeter' theory of innovation but they believed demand-side of the market as a source of innovation which means customer's demand forces the entrepreneur to make new innovations, not entrepreneurs himself take initiatives to introduce innovative products as postulated by Schumpeter. In 1992, the European Commission and the Organization for Economic Co-operation and Development (OECD) jointly published "Oslo Manual" in which they synthesized the definition of innovation for standard research and considered "innovations as the practical application of new or significantly improved products or services, process or even improvement at the marketing or an organizational level." This definition divided innovations into four classes such as product, process, marketing and organization (Oslo Manual 2005).

The banking sector within the growing economy is bolstered by financial innovations that have widen the scope of the services of banking. The most effective drivers of banking services include automated teller machines (ATM), cellular banking and digital banking. The new features of the banking are very different from the features commonly found in other sectors. Financial expertise incorporates developments that enable optimal cash allocation and operating procedures that reduce transaction costs in the major secondary market where such products are sold. Mobile banking is one of the financial services which involves online shopping and online payment without physical hassles. This service helped the customers to carry out online transactions during the period of COVID-19 lockdown. It reduces physical contact between customers and bankers. It really was a new experience in the field of financial services.

Background

The COVID-19 pandemic brought a revolution of innovations in financial sector as it expands financial services and enhance financial inclusion. The Global Findex (2021) reveals that two-thirds of adults used their accounts to store money for cash management, about 40% used their accounts to save and 40% used their accounts to borrow money in the developing countries. The report further disclosed that despite expansion in adoption of digital payments during pandemic, hundreds of millions of adults still receive payments of their wages, agricultural products sale, agriculture land sale, government transfers and shopping of goods and services in cash and shifting of these transactions to financial institutions or mobile money accounts is a great challenge in the developing countries due to low financial inclusion. About 39% of adults opened their first account (excluding mobile money) at a financial institution only to receive a wage payment or emergency assistance from the government during pandemic in the developing countries. However, 1.6 billion adults are still preferring to make payment in cash in the developing economies.

The same situation is in Pakistan where most of business and personal transactions are made in cash. The level of innovation in any country is measured through Global Innovation Index (GII) and the Global Competitiveness Index (GCI). In the Global innovation index, Pakistan ranked 87th among 132 economies of the world in 2022 and 110th among 140 countries in the Global competitive index in 2019. This ranking show low capability of innovation and slow pace of innovation adaptation.

In order to enhance financial inclusion and to expand financial services, Government of Pakistan and the State Bank of Pakistan launched national financial inclusion plan in 2015. Under this plan, the State Bank of Pakistan improved regulatory environment, modernized financial market infrastructure, enhanced finance access through cost effective digital financial products and created awareness about the benefits of financial inclusions. The progress made during 2015–2021 in financial inclusions are presented in Table 1.

Table 1 Financial inclusion indicators *Source:* State Bank of Pakistan report, 2022

Indicators	June 15	June 21	Growth (percentage)
In terms of outreach			
No. of depositors accounts (million)	41.7	62.0*	49
No. of branchless banking accounts (million)	10.8	74.62	591
Scheduled Bank deposits (Rs. in billion)	9153	19,796	116
In terms of payment infrastructure			
No. of ATMs	9597	16,355	70
No. of bank branches	11,937	16,308	37
No. of POS machines	41,183	71,907	75

*The target of total active digital transactions accounts of 65 million, there must be 20 million women's acounts

The Government of Pakistan has set a target of 65 million active digital transaction accounts including 20 million accounts of women by 2024 (Pakistan Economic Survey 2020).

As it is undeniable fact that financial innovations have significant value and their impacts are multi-dimensional for business organizations and society but the pace of their adoption and the pace of their diffusion is very slow in Pakistan. Contrary to advanced countries, the problem in Pakistan is neither number of customers nor customers' satisfaction but the low impact of financial innovations on banks' profitability is due to low financial literacy, low financial inclusion and lack of trust in the security of online financial transactions. Another trend noted in this study is that Pakistani banks focus more on the generation of income from fee by providing different digital services to their customers rather than through their core business of lending to their clients because there is a high risk of loans default due to volatile economic condition of the country. So, the banks are competing in introduction of innovative products and persuading their clients to use them. The State Bank of Pakistan has provided free of cost "Rast Fund transfer facility" under which transfer of money from bank to bank can be made 24 h without any cost. But the problem is that majority of the bank account holders do not trust in digital banking transactions due to lack of awareness and possibility of losing money due to cybercrimes which are common in Pakistan. According to the State Bank of Pakistan report (2022), although number of branchless banking accounts were increased from 10.8 million in 2015 to 74.62 million in 2021 which was an increase of 591%, but 65 percent of these accounts are inactive. It means there is no remarkable improvement in the financial inclusion in real sense. The fact is that majority of adult customers are still using traditional banking and are making physical transactions in cash. This is the reason that empirical evidence about the impact of innovation on banks' performance and profitability is weak and results are mixed as pointed out by Mabrouk and Mamoghli (2010).

This creates a gap in the literature and emphasizes on the need of an in-depth investigation and, therefore, the objective of this study is to analyze the slow pace of financial innovations adoption and the performance of commercial banks in Pakistan. The adoption of financial innovations will be measured in terms of the volume of the use of ATM machine, credit card, debit card and internet banking by banking customers. The financial performance of the banks will be measured through three profitability indicators, return on assets (ROA), return on equity (RPE) and earning per share (EPS). The positive change in these profitability indicators will show the effectiveness of financial innovation in banking sector in Pakistan. It is also equally important to investigate the causes of low financial inclusion and adults banking customers' aversion to use various products of digital banking in Pakistan. The findings of this study will likely to be a great theoretical and managerial contribution and provide a guideline to frame policies to expedite diffusion and adoption of technologies in banking sector to improve its performance.

Analysis of literature

In brief review of literature, we will analyze the nature of disruption of market equilibrium by innovations in general term, relationship between financial innovations and the financial performance of banks and the impact of financial innovations on the expansion of financial inclusion and financial services. Let us start the analysis of the role of innovations in disruption of market equilibrium.

Innovations and disruption of market equilibrium

Financial innovation is not a new subject because Schumpeter (1934) was the first economist who suggested a link between an economy's innovative performance and the operation of its credit and capital markets. His theory of innovation sparked a debate on financial innovation and its impact on growth. Now, research is continued on this topic all over the world. Silber (1983) was of the view that strict regulations are the main hurdle in introduction of limited innovations in banking sector. The strict regulations prevent the bank from experimenting new financial innovations, and it also reduce the efficiency of banking sector for a long time. He argued that underlying objectives of financial innovations are to remove strong regulatory restrictions. However, he pleaded that COVID-19 pandemic, which caused locked down throughout world in 2020, paved the way for quick removal of these restrictions and introduction of innovations in banking sector to provide financial services to their customers and Central Banks almost in all countries supported these efforts and lift those regulations which restrict the introduction of e-banking services. Roger (1995) discussed the diffusion of technology in any organization by saying that it takes sometime due to resistance from old and unskilled employees. He argued that different factors such as comparative benefit, compatibility, trialability, complexity and adequacy influence the diffusion of innovation because these factors are interlinked, and due to this reason, it is impossible to forecast the speed of innovation diffusion in any organizational system. Ansari (2006) analyzed cost efficiency of commercial banks working in Pakistan. He took panel data of 37 commercial banks and applied

transcendental logarithm model. He disclosed that almost all sampling banks have different cost efficiency ratio from 87 to 49% and the banks operating in public sector are least efficient while majority of foreign and private commercial banks are found to be efficient. He revealed that technologies comprising automation and computerization of financial transactions has substantially reduced cost of banking sector. The banking industry widely used automation and upgradation of their system by introducing ATMs, telebanking, internet banking, credit and debit card. These innovative modes of banking also facilitated banks to provide financial services to their customers at cheaper cost and both customers and banks benefited from these financial innovations. Banking profitability increase due to reduction in cost as a result of introduction of innovative banking services. Beccalli (2007) analyzed the impact of investment in various tools of information technology (ICT) and their possible effect on the performance of banks by taking a sample of 737 European Banks. The study was spread over a period of five years from 1995 to 2000, and it used both accounting and profit efficiency ratios to measure the possible effect. The findings of this study reveal that there was insignificant relationship between IT investment and profit improvement or efficiency, which means the improvement in profitability and efficiency of the sampling banks was nominal in spite of heavy investment in ICT. The effect of investment in hardware, software and services on banks' performance was heterogeneous. However, outsourcing has significant impact on banks' profitability and efficiency.

Financial innovations and banks' performance

Makur (2014) analyzed the effect of financial innovations on the performance of banks. They used data from January 2009–2013, which was taken from the database of Sudan Central bank and 16 scheduled commercial banks, included into the sample of study. The objective of study was to analyze the impact of technologies on the performance of banks. The results revealed that daily ATMs transactions were 156,547 and its standard deviation was 20.51. The findings show that there was a strong effect of financial innovation on the performance of commercial banks because Sudanese Commercial Banks recorded highest profit during this period. Malik (2013) stated that innovations have vital impact on organizational performance. This study shows that relationship between employees and managers brings positive result on organizational performance. The study shows that managers' motivation has positive effect on the creativity and passion of employees. Positive relationship between employee and organization increases innovation capability. Mirpuri and Nigari (2014) explored the impact of financial innovation on commercial banks by taking a sample of 44 commercial banks, operating in Kenya. They examined the volume of mobile banking, online banking and retail banking. They found that private banks were more active in opting technology than public banks and as such their efficiency and financial performance was far better than public sector banks, which were very slow in automation of their systems. Akhisar and Tunay (2015) analyzed the effects of electronic banking products on the performance of banks by using panel data and taking a sample of 23 developed and developing countries. GMM approach was applied to draw the results, while return on assets (ROA) and return on equity (ROE) were opted as measures of the profitability of the banks. The findings show that about all banking services had positive effect on their profitability, while number of POS terminals and the customers using internet banking had negative effect on their profitability. This difference was due to difference in sample of electronic banking and socio-cultural behavior of customers in developed and developing countries. The most effective ratio was the number of branches to number of ATMs which affected profitability as compared to other variables. The overall impact of banking services on the performance of banks was found positive both in developed and developing countries. Safdar (2018) determined the relationship between financial innovations and efficiency ratio and found that there is non-significant impact of ATM and mobile banking on efficiency of banks. However, financial innovations have significant effect on the value of transactions. They suggested to redesign innovative methods to enable customer to use all banking services at low cost. The results reveal that there is a significant relationship between digital transactions and performance of banks. But the results relating to automated teller machines (ATMs), point of sale (POS) and mobile banking (MOB) were found non-significant statistically. Mensah, et al. (2019) explored relationship between financial innovation and their impact on the performance of selected banks in Ghana. They measured the impact of innovation in terms of total income, efficiency, liquidity, profitability and expansion of banking services. They noted that Ghanaian banks developed a mechanism to check the execution of financial innovative banking products and their prices to enable the customers to use them conveniently at large scale. Zaleskasgh and Przemyshaw (2019) argued that division of innovations according to the "Oslo Manual" (i.e., product, process, organizational or marketing-oriented innovations) could be applied in banking industry because we found that banks have been using some of them. Recently, banks have opted digital technologies in order to divert their income from their core business of lending loans to generate income from innovative financial services. The shifting of business from traditional banking to digital banking enhances the efficiency of banks, reduce their cost and increase their profitability, in addition to increase their range

of products and marketing network. The banks were forced to engage in digital transformations during COVID-19 pandemic. Butt and Khan (2019) stated that financial technology at preliminary stage in Pakistan's banking sector, which prefer to outsource innovative technologies, software maintenance and financial consultants to reduce cost and to satisfy customers who do not accept innovative products or services immediately due to lack of awareness, high level of poverty and low financial literacy. It is disclosed that they preferred to visit Banks's branches for maintaining security and privacy of their accounts rather than using internet banking.

Innovations and financial services

Feyen et al (2021) argue that digital innovation has brought major positive changes in connectivity of systems, in computing power and cost, and in newly created and usable data. These changes have reduced transaction costs and helped devise a new business models and new entrants. Fast information exchange due to introduction of technology has not only reduced transaction speed and cost, but also disaggregated production of financial services. Specialized banks have widened the range of financial services, permitting the customers to find their most suitable products. In this way, the scope of financial services and options of customers have expanded. Despite digital transformation of financial services, consumers' search and assembly costs remain significant, in addition to creating a set of policy issues regarding completion, regulatory parameters and providing level playing field for large and small banks. The regulatory bodies have to face the challenges to manage trade-offs between stability and integrity, competition and efficiency, consumer protection and privacy. KPMG (2021) analyzed banking performance during COVID-19 pandemic in Pakistan and noted that the banking sector performed well in the year 2020, and its overall profitability was increased by 30%, while growth in total assets and deposit was 14 16%, respectively, as compared to previous year. The growth in assets was due to increase in government securities, whereas loans to private sector was declined due to slow economic activity. Deposit growth was due to low consumer spending. Although interest rate was lower but customers were reluctant to borrow money due high risk, it was the major cause of low demand of credit. Banks efficiently manage their expenses which resulted an increase of only 5%, while banking spread was also decreased to 13%. Overall capital adequacy ratio of banking sector was around 18.6% in 2020 which is considered above required 11.5% level. COVID-19 expedited the adoption of mobile and internet banking, yielding extra return for banks and lower their cost. The report further added that rapid increasing use of innovative financial products by the customers will continue to rise, and there is need to introduce more innovate product is to widen the range of customers' requirements. Ashiru et al (2023) has contended that financial innovations and their impact on financial services industry has been a hot topic of debate among researchers since 2008 financial crisis because they are more beneficial for real economy. He suggested that financial innovations can significantly contribute to the outreach of financial services, and it needs the development of branchless banking and technological adoption. He builds the foundation of his study on Schumpeter's theory of innovation diffusion and analyzed the impact of ATM, credit card, mobile banking, and internet on the financial performance of banking industry in Nigeria during the period of 2012–2021. He applied ARDL model and Granger causality test to determine short-run and long-run relationship between financial innovations and the performance of 24 selected banks. He concluded that mobile banking and e-banking services have significant impact on banks' performance in the short run and long run and, therefore, these services must be expanded.

Overall, it has been proved from the above analysis of literature that basic innovations disrupt market equilibrium and have close association with financial performance and profitability of banks, in addition to the expansion of financial services.

Research methodology

In order to measure the impact of innovation on the financial performance of banks in Pakistan, six years data from 2013 to 2019 were collected from the databases of State Bank of Pakistan, Pakistan Stock Exchange, Pakistan Economic Survey and annual financial statements of selected banks. 12 out of total 44 commercial banks were selected as a sample of the study and they are: Habib Bank Ltd, United Bank Ltd, MCB Bank Ltd, National Bank of Pakistan Ltd, Allied Bank Ltd, Bank Al Habib Ltd, Bank Alfalah Lted, Standard Chartered Bank Ltd Faisal Bank Ltd, Habib Metrobank Ltd, Askari Bank Ltd and The Bank of Punjab Ltd. Financial performance of the banks was taken as dependent variable, and it was measured through three profitability indicators: return on assets (ROA), return on equity (ROE) and earning per share (EPS). The independent variables include ATM use, credit card use, debit card use and internet banking. Three econometric models were developed to measure the individual impact of these independent variables on return on assets (ROA), return on equity (ROE) and earning per share (EPS). These models are specified in the following equations:

Model I: impact of financial innovation on return on assets (ROA)

$$\mathrm{ROA} = \beta_o + \beta_1 \mathrm{ATM} + \beta_2 \mathrm{CRCA} + \beta_3 \mathrm{DECA} + \beta_4 \mathrm{INB} + u_i \quad (1)$$

where ROA = Return on Assets, ATM = Number of ATMs, CRCA = Number of Credit Cards, DECA = Number of Debit Cards, INB = Internet Banking.

Model II: impact of financial innovation on return on equity (ROE)

$$\mathrm{ROE} = \beta_o + \beta_1 \mathrm{ATM} + \beta_2 \mathrm{CRCA} + \beta_3 \mathrm{DECA} + \beta_4 \mathrm{INB} + u_i \quad (2)$$

where ROE = Return on Equity, ATM = Number of ATMs, CRCA = Number of Credit Cards, DECA = Number of Debit Cards, INB = Internet Banking.

Model III: impact of financial innovation on earning per share (EPS)

$$\mathrm{EPS} = \beta_o + \beta_1 \mathrm{ATM} + \beta_2 \mathrm{CRCA} + \beta_3 \mathrm{DECA} + \beta_4 \mathrm{INB} + u_i \quad (3)$$

where EPS = Earnings Per Share, ATM = Number of ATMs, CRCA = Number of Credit Cards, DECA = Number of Debit Cards, INB = Internet Banking

Different statistician techniques such as descriptive statistics, correlation Matrix, ADF's unit root test, ARDL approach, Bound test and Error Correction Model were used to analyze data and determine short-run and long-run relationship between dependent and independent variables.

Hypotheses development

Hypotheses related to the impact of various independent variables on the financial performance indicators (ROA, ROE, and EPS) of selected commercial banks are listed below:

H1: ATM usage has a positive impact on ROA, ROE, and EPS of the banking sector.

This hypothesis assumes that increased usage of ATMs by customers leads to improved operational efficiency and cost savings for banks, resulting in higher profitability and earnings.

H2: Credit card usage has a positive impact on ROA, ROE, and EPS of the banking sector.

This hypothesis suggests that increased credit card usage by customers generates additional revenue streams for banks, including interest income and transaction fees, thereby positively influencing profitability and earnings.

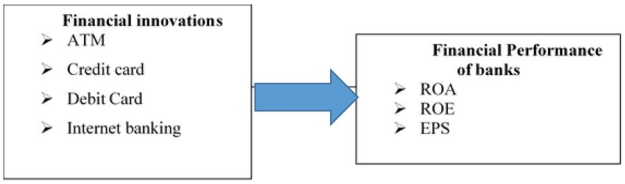

Fig. 1 Hypothesized conceptual model

H3: Debit card usage has a positive impact on ROA, ROE, and EPS of the banking sector.

This hypothesis assumes that increased debit card usage by customers promotes higher transaction volumes, which can result in increased fee income and reduced operational costs, leading to improved financial performance for banks.

H4: Internet banking usage has a positive impact on ROA, ROE, and EPS of the banking sector.

This hypothesis posits that higher adoption of internet banking services enables banks to reach a larger customer base, reduce branch infrastructure costs, and streamline operations, which can contribute to enhanced profitability and earnings.

H5: There is a combined effect of ATM, credit card use, debit card use and internet banking on ROA, ROE, and EPS of 12 selected commercial banks.

These hypotheses suggest that the simultaneous use of various digital banking services (ATM, Credit cards, Debit cards and internet banking) by customers amplifies the positive impact on financial performance indicators due to synergistic effects, such as increased customer engagement, cost savings, and revenue diversification.

Conceptual model

Based on the above hypotheses and the findings of Ashiru et al (2023), KPMG (2021), Feyen et al (2021) and Safdar, et al. (2018), we can develop a theoretically-based conceptual model to illustrate the relationships between the independent variables (ATM, Credit card users, Debit card users and internet banking) and the dependent variables (ROA, ROE and EPS) in the banking sector. Here is a conceptual model that represents these relationships: the independent variables (ATM, Credit card users, Debit card users and internet banking) are represented as separate entities. Each independent variable has the potential to influence

Table 2 Descriptive statistics *Source:* Author's calculations

	ROA	ROE	EPS	ATM	DECA	CRCA	INB
Mean	1.2764	16.557	0.150	1064.290	933,496.10	118,519	322,973.10
Median	1.049	16.734	0.090	1173.25	409,514	156,878.9	354,676.8
Max	5.7	31.76	410	2156	55,185,000	190,000	1,157,000
Min	−0.17	−2.43	0.003	245.10	103,568.5	7190	18,197
S.D.	0.8764	6.075	0.077	513.100	1,299,960	62,076.56	2,423,100
Skew	2.153	−0.536	0.409	0.080	2.602194	−1.107	1.410
Kurt	11.35	3.140	0.920	2.385	8.348780	2.300	4.984
JB-Test	202.52	2.241	0.090	0.970	129.9553	12.367	27.3101
Pro	.000	0.432	0.090	0.620	0.00000	0.004	0.000
um	1.61	922.60	0.911	59,431.20	52,270,203	6,636,501	17,527,070
S. Dev.	2.35	2665.35	0.430	14,527,380	9.29E+15	2.12E+17	3.23E+17
N	56	56	56	56	56	56	56

Table 3 Results of correlation analysis *Source:* Author's Calculations

Variables	ROA	ROE	EPS	ATM	DECA	CRCA	INB
ROA	1.002						
ROE	0.520	1.002					
EPS	0.513	0.520	1.002				
ATM	0.154	0.008	0.520	1.002			
DECA	0.183	0.248	0.196	0.580	1.002		
CRCA	0.046	0.321	0.085	0.350	0.049	1.002	
INB	0.078	0.029	0.038	0.500	0.324	0.455	1.002

the dependent variables (ROA, ROE and EPS) as shown in Fig. 1

The arrow in the model represents the hypothesized relationships between the variables. Based on the hypotheses, we assume that there is a positive relationship between the independent variables and the dependent variables. The model suggests that increased usage of ATMs, Credit cards, Debit cards and internet banking services will have a positive impact on ROA, ROE and EPS.

Empirical results

The results drawn through different statistical techniques are discussed in the following:

Descriptive analysis

The results of descriptive statistics of all the variables of the study are given in Table 2. The mean value of return on assets (ROA) is 1.2763, the median value is 1.035, the maximum value is 5.7, the minimum value is −0.17, the standard deviation is 0.8764, skewness is 2.153, kurtosis is 11.35, Jarque–Bera value is 202.53, and it shows the normal distribution of the variable. The mean value of return on equity (ROE) is 16.557, the median value is 16.734, the maximum value is 30.76, the minimum value is −2.43, the standard deviation is 6.075, skewness is −0.536, kurtosis is 3.094 and Jarque–Bera value is 2. 741. The mean value of earnings per share (EPS) is 0.150, the median value is 0.090, the maximum value is 0.410, the minimum value is 0.003, the standard deviation is 0.077, skewness is 0.409, kurtosis is 0.368 and Jarque–Bera value is 4.090. The results show that data are normally distributed.

Correlation analysis

Correlation analysis is used to check strength of relationship between variables. Its value lies between −1 and +1. The value of zero means that there is no correlation between two variables and +1 means that there is perfect relationship between variables, while −1 means there is no association between variables. The correlation results shown in Table 3 indicate that there is positive correlation between ATM, Debit card, Credit card and internet banking and return on assets (ROA), return on equity (ROE) and earning per share (EPS). All variables have positive and significant correlation with one another.

Table 4 Result of ADF test
Source: Author's calculations

Variables	Level				First difference				Conclusion
	Intercept		Intercept and trend		Intercept		Intercept and trend		
	al.	rob.	al.	rob.	al.	rob.	al.	rob.	
ROA	4.970	007	–	–	–	–	–		I(0)
ROE	3.164	031	–	–	–	–	–	–	I(0)
EPS	–	–	–	–	7.689	001	–	–	I(1)
ATM	–	–	–	–	7.957	003	–	–	I(1)
CRCA	–	–	–	–	7.365	010	–	–	I(1)
DECA	–	–	–	–	7.793	009	–	–	I(1)
INB	–	–	4.536	010			–	–	I(0)

Table 5 Results of ARDL model *Source:* Author's calculations

Dependent variable:				
Selected model: ARDL (1, 2, 3, 2, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	0.5570	0.2723	2.0455	0.0056
CRCA	0.1263	0.0436	2.8969	0.0490
DECA	0.0378	0.0452	0.8362	0.0943
INB	0.0493	0.0160	0.8081	0.0496
C	0.4802	0.4406	1.0899	0.0736

ADF's unit root test

ADF's unit root test is used to check the stationarity among variables. Table 4 shows the result of unit root test. Variables such as return on assets, return on equity and online banking stand at a level (1(0)), while earning per share, numbers of ATMs and numbers of credit card users are stationers at first level (1(1)). It means that the selected variables of this study are stationers at different levels, and, thus, we can apply auto-regressive distributed lag (ARDL) model to examine the impact of financial innovations on the financial performance of commercial banks in Pakistan.

ARDL approach

The ARDL approach is used to determine relationship between dependent and independent variables in the long run. The results of this estimation are shown in Table 5.

The coefficient value of number of ATMs in Table 5 is 0.55.70, which reveals one unit increases in number of ATMs will likely to increase the performance of banks by 55.7%. The t-statistic value is (2.0455) and the probability value is (0.0456), which suggest that the relationship is significant at 5% significant level. It means the performance of banks will increase with the increase in the number of ATMs as it facilitates the customers to withdraw cash through ATMs with one click. As per report of the State Bank of Pakistan, (2022) around 16,355 ATMs are operating all over Pakistan, and their number are rising rapidly. These results are consistent with the finding of Ansari (2006), Akhisar and Tunay (2015) and Gündoğdu and Taşkin (2017).

The number of credit card and debit cards users is also found to be positively related to return on assets. The t-statistic value is (2.8969) and probability value is (0.0390) which suggest that the association between credit and debit card using and performance of banks is significant at the 5% level. The coefficient value of credit card shows if one unit increases in the number of credit users, the financial performance of the banks will likely to increase by 12.63% in the long run. In the same way, the relationship between debit card users and financial performance of banks is also positive and the coefficient value of debit card is 0.0378 which means if one unit increases in debit card users the financial performance of banks will likely to be increased by 3.78%. According to the key statistics of the State Bank of Pakistan (2022), daily payments through credit and debit cards is around Rs. 42.8 million. These results support the finding of and Ansari (2006) and Gündoğdu and Taşkin (2017).

The independent variable, internet banking (INB), is found to be positively and significantly associated with the financial performance of banks. The t-statistic score is (0.8081), and the probability value is (0.0496), and they suggest that relationship between variables is significant at 5 percent level. The coefficient value of internet banking shows if one unit increases in the internet banking will likely to increase the financial performance of the banks by 4.73% in the long run. The data of the State Bank of Pakistan (2022) shows that mobile phone banking users are around 8.9 million. These results are similar to the findings of Ansari (2006). Akani and Tony-Obiosa, (2020) and KPMG (2021).

Now, we analyze the impact of financial innovation on return on assets, return on equity and earning per shares of

Table 6 Impact of financial innovation on return on assets (ROA)

Co-integrating form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ATM)	1.0263	0.4069	2.5222	0.0169
D (ATM (−1))	−1.1312	0.4210	−2.6869	0.0100
D(CRCA)	−1.1024	0.5001	−2.2044	0.0347
D (CRCA (−1))	−0.0646	0.6689	−0.0966	0.0324
D (CRCA (−2))	−0.8125	0.5147	−1.5786	0.1276
D(DECA)	−0.0534	0.0213	−2.5070	0.0103
D (DECA (−1))	0.0301	0.0215	1.4000	0.1723
D(INB)	0.0341	0.0701	0.4864	0.6656
CointEq (−1)	−0.7015	0.1367	−5.1317	0.0001

Table 7 Impact of financial innovations on (ROE) *Source:* Author's calculations

Dependent variable: ROE				
Selected model: ARDL (1, 0, 0, 1, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	1.1906	5.5207	0.2167	0.8512
CRCA	9.6419	4.4269	2.1780	0.0378
DECA	0.0748	0.2197	0.3405	0.7507
INB	1.9906	1.0147	1.9618	0.0493
C	10.7601	5.2178	2.0622	0.0489

12 selected commercial banks. For this purpose, we have developed three separate models to analyze short-run and long-run relationship between financial innovations and financial performance of banks.

Model 1: impact of financial innovation on return on assets

The results of ARDL model are shown in Table 6.

Table 6 shows the relationships between financial innovation and return on assets. The ATM and internet banking show positive relationship with return on assets, while credit and debit cards show negative relationship with return on assets. It means with the increase in the use of ATMs and internet banking will enhance the profitability of the banks, and reduce their cost in the long run.

Now, we check the impact of financial innovations on return on equity. The calculated results are shown in Table 7.

The results in Table 7 show that variable numbers of ATMs is found to be directly associated with the ROE. The t-statistic value is (0.2167) and probability value is (0.8518) which suggest that this association is statistically insignificant. The coefficient value of ATM shows if one unit increases in the number of ATMs, it will likely to increase the performance of bank by 11.9%. Similarly, the variable, number of credit card users (CRCA), has positive and significant relationship with return on equity. The t-statistic value is (2.1780) and probability value is (0.0378), and these values suggest that this association is significant at the 5% on level. The coefficient value of credit card reveals if one unit increases in the number of credit card users, it will likely to increase the performance of the bank by 96.4%. It means that the impact of credit card users is the most significant as compared to other banking services because the credit card users have full freedom to shop more as compared to debit card users who can shop only if their credit balance is available in their accounts. These results are also confirmed by the findings of Gündoğdu and Taşkin (2017) and Feyen et al. (2021) The variable, numbers of debit card users (DECA), is also found to be positively related to the return on equity. The t-statistic value is (0.3405) and probability value is (0.7507) which suggest that this association is statistically insignificant. The coefficient value of debit card shows if one unit increases in the number of debit card users, the performance of the bank will likely to be increased by 7.4% as calculated by return on equity. It is insignificant effect. The variable, internet banking (INB), is found to be positively and significantly related to return on equity. The t-statistic value is (1.9618) and probability value is (0.0444) which indicate that this association is significant at 5 percent level. The coefficient value of internet banking reveals if one unit increases in the internet banking, it will likely to increase the performance of the bank by 19.9 percent as measured by return on equity. These results are also confirmed by the findings of Akani &Tony-Obiosa (2020).

Table 8 Impact of financial innovation on (EPS)

Dependent variable: ROE				
Selected model: ARDL (1, 0, 0, 1, 0)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	0.1994	0.0991	2.0121	0.0347
CRCA	0.1436	0.0710	2.0225	0.0479
DECA	0.0150	0.0056	2.6786	0.0134
INB	0.0079	0.0179	0.4413	0.6810
C	0.0384	0.0868	0.4424	0.6645

Model III: impact of financial innovations on return on earning per share

The long-run results of Model III relating to the impact of financial innovation on earning per share (EPS) are shown in Table 8.

The results in Table 8 show that the variable, number of ATMs, has positive and significant relationship with earnings per share. The t-statistic value is (2.0121) and

probability value is (0.0347) suggest there is statistically significant relationship between two variables at 5% significance level. The coefficient value of ATM shows that if one unit increases in the numbers of ATMs, the performance of the banks will likely to be increased by 19.94%. The variable, number of credit card users (CRCA), is found to be positively and significantly related to the earnings per share. The t-statistic value is (2.0225) and probability value is (0.0479 which suggest that this association is significant at the 5 percent significance level. The coefficient value of credit card shows if one unit increases in the number of credit card users, it will likely to increases the performance of bank by 14.36%. The variable, number of debit card users (DECA), is also found to be positively and significantly related to the earnings per share. The t-statistic value is (2.6786) and probability value is (0.0134) which suggest that this association is statistically insignificant. The coefficient value of debit card reveals that if one unit increases in the number of debit card users the performance of the bank will likely to be increased by 1.5%. The effect of debit card is weak as compared to credit card. The variable, internet banking (INB), has positive relationship with earnings per share. The t-statistic value is (0.4413) and probability value is (0.6810), which reveal that this association is statistically insignificant. The coefficient value of internet banking shows if one unit increases in internet banking the performance of the banks will likely to be increased by 0.07%. This is also weak relationship due to low use of internet banking by banking customers in Pakistan. Thus, two variables such as ATM and Credit card users have significant and positive impact on the financial performance of banks in Pakistan in the long run. However, the impact of internet banking is low because of low financial literacy, lack of privacy and cyber security issues. The ratio of the use of Debit card user is also very low because of the restriction of availability of cash in the accounts of the users. These results are confirmed by the findings of Akhisar and Tunay (2015), Safdar et al. 2018, Butt and Khan (2019) and Feyen et al. (2021).

Bound test

The bound test is used to determine long-run relationship between variables. The dependent variable is performance of bank, while independent variables are ATM, Credit card numbers (CRCA), the number of debit card (DECA) and online banking (INB). The results show that number of ATMs, the numbers of credit card users, the numbers of debit card users and online banking have positive impact on bank performance in the long run.

Null hypothesis shows that there is no long-run relationship between variables while alternate hypothesis shows that there is long-run association between variables. The statistical value of F is 5.6408, and it is largest than critical values, and it shows that there is long-run relationship between financial innovations and the performance of banks. Thus, we reject null hypothesis and accept alternate hypothesis which states that there is significant positive relationship between financial innovations and the financial performance of banks in the long run. The results of Bound test are shown in Table 9.

Table 9 Result of bound test *Source:* Author's calculations

Null hypothesis: no long-run relationships exist		
Test statistic	Value	*K*
F-statistic	5.6408	4
Critical value bounds		
Significance	I0 bound	I1 bound
10%	2.57	3.36
5%	2.89	4.25
2.5%	3.32	4.57
1%	3.71	5.09

Table 10 Impact of financial innovation on (ROE) Source: Author's Calculations

Co-integrating form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ATM)	−0.3493	1.7357	−0.2012	0.8423
D(CRCA)	3.0761	1.1926	2.5793	0.0147
D(DECA)	−0.3017	0.0936	−3.3223	0.0026
D(INB)	−0.5886	0.3445	−1.7086	0.0978
CointEq (−1)	−0.3197	0.0994	−3.2163	0.0054

Error Correction Model

The Error Correction Model (ECM) shows the speed of adjustment from the short-run to the long-run equilibrium. The CointEq (−1) value in Table 10 is −0.3189, and it suggests that any error in the short run is adjusted about 31.89 percent when moving from the short run to long run. The short-run results of the impact of financial innovation on return on equity (ROE) show that ATM card users, number of debit card users and internet banking have negative relationship with banks performance as measured by return on equity while Credit card has positive relationship with bank performance in the short run. The reason for negative association between independent and dependent variables except Credit card is that initially banks have to invest heavily on automation of their system and it takes long time to realize cost. However, Credit card impact on return on equity is quick in the short run because the users immediately start

Table 11 Impact of financial innovation on (EPS)

Co-integrating form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ATM)	0.0567	0.0247	2.2955	0.0263
D(CRCA)	−0.0659	0.0316	−2.0854	0.0379
D(DECA)	−0.0025	0.0014	−1.7857	0.1851
D(INB)	−0.0045	0.0068	−0.6618	0.6793
CointEq (−1)	−0.1978	0.0947	−2.0887	0.0394

shopping within the given limit, and it has positive impact on return on equity of the banks because they attain quick gain from its immediate use.

The impact of financial innovation on earning per share (EPS) in the short run is calculated through Error Correction Model (ECM). The results of this analysis are shown in Table 11. It was noted that except ATM, all other variables such as Credit card, Debit card and internet banking have negative association with earning per share in the short run. The reason behind this negative relationship is that ATM is an alternate to cash withdrawal through checks which was a cumbersome process. The banking customers can withdraw cash from ATM machine 24 h easily without paying any cost. The customers use this facility on large scale. In contrast, the use of debit card is restricted by the availability of cash in the account of banking customers, who can use this card if required cash is available. Similarly, internet banking is used through downloading banking application, and it involves multiple stages which are difficult to understand by low literate persons. The chance of error and loss of money is high and, therefore, the banking customers avoid to use it and prefer to avail banking services physically. Another cause of the aversion of internet banking is cybercrimes and hacking of password. The banking customer does not use internet banking until he/she has full confidence in its security. Thus, the impact of credit card, debit card and internet banking except ATMs on earning per share (EPS) is not substantial in the short run due to their limited use. These results are also confirmed by the findings of Gündoğdu and Taşkin (2017) and Feyen et al. (2021).

Discussions

The objective of this study was to analyze the impact of innovation on the financial performance of banks. The commercial banks included into the sample of this study were 12 and they were: Habib bank limited, Allied Bank limited, United bank limited, Bank Al Habib Ltd, Bank Alflah Limited, Faisal Bank Limited, MCB Bank Ltd, National Bank of Pakistan Ltd, The Bank of Punjab Ltd, Habib Metropolitan Bank Ltd and Askari Bank Ltd. The dependent variable was the financial performance of banks and independent variables were the number of ATM card users, the number credit card users, the number of debit card users and internet banking. Descriptive statistics were used to describe characteristics of variables. The ADF unit root test was applied to check stationarity among variables and to justify the use of ARDL model. The results ADF test show that the variables of the study were stationers at different levels, so we could use ARDL model to determine long-run relationship between financial innovations and financial performance of banks. We used Correlation Matrix to check strength of relationship between variables. Error Correction Model (ECM) was applied to ascertain short-run relationship between financial innovations and financial performance of banks. The financial performance of banks was measured by three profitability indicators such as return on assets (RAO), return on equity (ROE) and earning per share (EPS). Three separate models were developed to measures the impact of innovations on return on assets (RAO), return on equity (ROE) and earning per share (EPS). Five hypotheses were developed which assumed that the usage of ATM card, Credit card, Debit card and internet banking would likely to have a positive impact on financial indicators: ROA, ROE and EPS of the selected banks. The individual and combined effects of these four independent variables were measured on three financial performance indicators of commercial banks. In the context of these hypotheses, it was assumed that the simultaneous use of various digital banking services (ATM, Credit cards, Debit cards and internet banking) by customers amplifies the positive impact on financial performance indicators of banks due to synergistic effects, such as increased customer engagement, cost savings and revenue diversification.

The findings of ARDL model show that increase in the numbers of ATM users, the numbers of Credit card users, the numbers of Debit card users and online banking have a positive relationship with the performance indicators ROA, ROE and EPS of banks in the long run. However, when we analyze individual impact of independent variables on dependent variable, we found that Credit card users, ATM and internet banking usage show positive relationship with return on assets (ROA), while debit card user has negative relationship with it in the long run. But these relationships are weak empirically except the use of ATM card. It means the impact of almost all variables except ATM have insignificant on return on assets (ROA) because the use of fixed assets takes sufficient time to materialize the costs. These results support the findings of Mensah et al. (2019) and Ashiru et al (2023) who found that financial innovations have significant impact on the performance of banks. In this way, the results of this study in the long run are significant.

In contrast, all variables have positive and significant relationship with return on equity (ROE) and earning per share (EPS) in the long run. The impact of tow variables such as

ATM and Credit card was found significant on performance indicators (ROA, ROE and EPS) of banks as compared Debit card and internet banking because the banks started realizing income from these two sources immediately. However, the impact of internet banking on banks' ROE and EPS was found insignificant because of low financial literacy, lack of privacy and fear of loss due to cybercrimes. These results are consistent with the findings of Feyen et al. (2021), Butt and Khan (2019), Safdar et al. (2018) and Makur (2014) who found the similar results.

The short-run results of Error Correction Model (ECM) show that the impact of financial innovations such as ATM card users, number of Debit card users and internet banking have negative relationship with the performance indicators ROA, ROE and EPS of banks, while Credit card has positive relationship with them in the short run, whereas the number of ATM cards users also have positive relationship with the performance indicators of banks in the short run. The reason is that Pakistan is a country where financial literacy is low, financial transaction security is poor and legal mechanism for recovery of lost money is complex. The process of recovering lost money due to hacking of password takes a long time. The customers, who experienced such incidence, prefer to opt traditional method of banking services. However, the youth, which is well-acquainted with mobile banking applications, prefer to carry out internet transactions and are taking benefit from financial innovations. These findings are consistent with results of Safdar et al. (2018), Butt and Khan (2019) and Feyen et al. (2021) These results are also support the findings of Silber (1983) who found that COVID-19 pandemic force the Central banks all over the world to remove regulatory hurdles in the way of digital banking. He further found that the process of financial innovation was accelerated after lockdown in 2019–2020, and the customers were attracted to mobile banking that enhance the financial performance of banks. In short, the long run and short-run result of this study suggest that introduction of financial innovations and expansion of financial services will definitely increase the financial performance of banks in Pakistan as is evident in 2023 when the banking sector is best performer at Pakistan Stock Exchange in terms of high return on assets (RPA), return on equity (ROE) and earning per share (EPS) and dividend yields because almost all sampling banks declared handsome payouts for their shareholders from minimum 20% to maximum 200%. Thus, all hypotheses were proved that financial innovations have substantial impact on the performance of banks.

Theoretical contribution

This research study contributes to the existing body of literature by examining the relationship between financial innovations and performance of selected commercial banks in Pakistan. By drawing insights from Joseph Schumpeter (1934)'s theory of innovation, which emphasizes the disruptive nature of innovations, the study supports and validates this theory in the context of the banking industry. It adds empirical evidence to demonstrate that financial innovations implemented by banks in the sample have resulted in higher profits by reducing costs. This study also highlights the theoretical importance of introducing new financial products and services gradually. This finding aligns with the need to ensure that customers can easily understand and adopt these innovations, particularly in the country like Pakistan, where traditional banking methods are still prevalent. The study emphasizes that a gradual introduction of innovations helps maintain customer loyalty. However, the part of Schumpeter's theory of market disruption by innovation was not proved effective as financial innovations did not disrupt market equilibrium and did not destroy the products of traditional banking which are still in practice in Pakistan.

The study contributes to the financial literature by shedding light on the fee structure of digital products and its effect on customer behavior. The study reveals that the higher fees charged by banks for their digital products, in comparison with traditional products, act as a deterrent for customers to adopt internet banking. This finding highlights the importance of considering cost aversion among customers and adjusting fee structures accordingly to encourage greater adoption of digital banking services. The study also highlights the increasing prevalence of cybercrimes and the vulnerability of innocent customers. It emphasizes the need for a sound legal mechanism to compensate customers who have fallen victim to hacking or errors during online transactions. This contribution highlights the gaps in current systems and underscores the importance of further improving online banking applications and developing compensation packages for cybercrime victims. It calls for the development of a foolproof system to protect customers against cybercrimes.

Managerial contribution

As far managerial contribution is concerned, this study provides valuable insights for managers in the banking sector that introducing financial innovations can lead to substantial cost reductions. By automating branches and reducing the need for staff, banks can cut their labor costs and improve profitability. This finding suggests that managers should prioritize the implementation of financial innovations that have the potential to reduce costs and efficiency improvement. This study offers managerial implications by emphasizing the importance of gradually introducing new financial products and services to maintain customer loyalty. Managers should consider the readiness and understanding of customers while introducing innovations, particularly in contexts

where traditional banking methods are still prevalent. This approach ensures that customers can easily adopt and adapt to new offerings, strengthening their loyalty to the bank.

This research highlights the impact of fee structures on customer behavior and adoption of digital products. Managers in the banking sector should carefully evaluate and adjust their fee structures for digital services, taking into account customers' cost aversion and the need to encourage wider adoption. By aligning fees with customer preferences, banks can attract more customers to their digital platforms and drive usage of internet banking services. The study emphasizes the need for banks to prioritize cybersecurity measures and develop robust systems to protect customers from cybercrimes. Managers should allocate resources to improve online banking applications and establish compensation packages for customers affected by hacking or transaction errors. By proactively addressing cybersecurity concerns and providing effective customer protection, banks can enhance customer trust and confidence in their digital banking services.

Conclusions and policy implications

The objective of this study was to analyze relationship between financial innovations and the performance of banks in Pakistan. The independent variables were ATM use, credit card use, debit card use and internet banking while dependent variable was the financial performance of 12 selected banks. The performance of banks was measured through three financial indicators such as return on assets (ROA), return on equity (ROE) and earning per share (EPS). It was noted that the performance of commercial banks was improved in Pakistan tremendously during the study period in terms of number of accounts, branches, deposits, investment, return on assets, (RO) return on equity (ROE) and earning per share (EPS). According to State Bank's Financial Stability Report (2021), banking sector recorded a strong growth in 2020 almost in all segments such as investments, deposits, liquidity, advances, balance sheet expansion, earnings, dividend yield, the lower provisioning expenses and fee-based income and resilience against natural disasters like devastating floods in Pakistan in 2022 and fatal disease like COVID-19 pandemic. The high performance of banks can be attributed to introduction of financial innovations in this sector. Although introduction of financial innovations was in process since 2000s, yet its pace was accelerated during COVID-19 pandemic when digital banking was the only option before customers during lock down. The youth and skilled persons used mobile and internet banking widely and their numbers are increasing rapidly. This brought a significant impact on the profitability of commercial banks in Pakistan as their return on assets, equity and earning per share were increased. The major trigger in high profitability of banks was innovative financial services which did not only increase the income of banks, but also reduce their costs substantially as is noted by Ashiru et al (2023) who analyzed the impact of digital banking on profitability of banks in Nigeria.

The policy implications based on discussion and conclusions are as follows:

It is recommended to prioritize the expansion of internet banking services in remote areas of Pakistan. This expansion will not only increase access to banking services for people living in these areas but also enhance the competitiveness and quality of services provided by the banking sector. The government and relevant regulatory authorities should collaborate with banks to facilitate the infrastructure development required for internet banking in remote areas.

The State Bank of Pakistan (SBP) should take necessary measures to reduce fraudulent risks associated with electronic payments. This could include strengthening security protocols, implementing robust authentication mechanisms, and raising awareness among customers regarding safe online banking practices. By addressing these risks, customer confidence in using electronic payment modes will increase, fostering greater adoption of digital banking services.

The SBP should direct commercial banks to establish branches in remote areas that currently lack access to banking services. This initiative will not only provide banking facilities to underserved populations but also contribute to increasing savings and financial inclusion in the country. Collaborative efforts between the SBP, banks, and local authorities can help identify suitable locations and support the establishment of these branches.

The Banks should review and reduce the various fees charged to customers as service charges. High service charges can discourage people from keeping deposits in banks or availing banking services. Implementing low-cost financial innovations and revising fee structures will make banking services more affordable and attractive to customers, thus promoting increased usage of banking facilities.

The Banks should invest in improving their infrastructure to support online banking services effectively. This includes enhancing network capabilities, ensuring robust cybersecurity measures and providing user-friendly digital platforms. Simultaneously, banks should actively promote online banking to customers through awareness campaigns and incentives, encouraging the transition from traditional banking to digital channels. These efforts will reduce costs for banks, enhance convenience for customers and stimulate financial innovation in the banking sector.

Overall, implementing these policy implications will contribute to the development of a more inclusive, secure and efficient banking sector in Pakistan.

Limitations and suggestions for future research

The limitations of this study and direction for future research have been explained in the light of findings and conclusions of study.

Although this study is restricted to the banking sector of Pakistan, yet it has large scope for future research because it has provided a foundation for future research specifically examining the impact of working environment on the productivity of employees in banking sector. The researchers can expand the scope of their research studies by including more banks, variables, expand study period in their samples to obtain comprehensive and comparative results by conducting cross-country research to explore relationship between innovations and profitability.

This study has mainly focused on three indicators of profitability such as return on assets (ROA), return on equity (ROE) and earning per share (EPS). Future researchers may incorporate more indicators of profitability like bank size, number of branches, efficiency, tax rates and debt-to-equity ratio in order to provide a comprehensive analysis of profitability in banking sector.

The sample of this study was consisted of 12 out of total 44 commercial banks. Future researchers may include more commercial banks in their sample to enhance the generalizability and impact of their findings through a large representative sample. This study did not consider the impact of technology adoption and automation on unemployment in banking sector. Future researchers can focus on this variable in order to determine positive and negative impact of technology on unemployment rates on account of introduction of innovative products and services. It will highlight relationship between technology, profitability and societal implications. The economists give much importance to employment, while this study has primarily focused on profitability of banking sector due to introduction of financial innovations. Thus, the relationship between technology and employment can be explored by other researchers.

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