Innovation in banking: fusion of artificial intelligence and blockchain

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Abstract

Purpose – This study aims to analyze the importance of disruptive technological innovations on qualitative service delivery and their impact on the investment banks' employee performance.

Design/methodology/approach – The cluster sampling method has been used to collect the primary data from the 250 respondents from foreign investment banks. Variables used are employee performance, service delivery, technology, security, operations, strategy and quality through chi-square, linear stepwise multiple regression analysis and correlation.

Findings – Storage network, operating cost, client reporting, cloud system and money laundering are the highest and most significant predictors of employee performance. Employee performance multiplies every unit with a strategic solution owing to positive and robust correlation (0.944). Fusion technology-based banks offer quality service to their clients.

Originality/value – A combination of artificial intelligence and blockchain ensures increasing automation to improve efficiency and reduce the operating cost creating a seamless integration in fraud detection, customer support, risk management, security, digitization and automation process, algorithmic trading, wealth management, etc.

Keywords Innovation, Blockchain, Initial coin offerings (ICO), Intelligent process automation (IPA), Robotic process automation (RPA)

Paper type Research paper

Introduction

The banking industry has been experiencing an impeccable transformation in technology over the past few years, resulting in an evolution of digitization focusing on a better customer experience and maintaining customer-relationship with optimal resource management to a more considerable extent (Vedapradha and Arockia, 2018). Artificial intelligence (AI) will focus on cognitive application in functional areas of business with the financial services industry's investment and compliance sectors (Tuya, 2017). Blockchain (BC) technology can curb almost 70% of the operating cost in investment banks' back-end operations by creating a cryptographic distributed ledger between the counterparties to execute the transactions (Shchukina and Tarasova, 2019).

Investment banks are vulnerable to criminal activities such as money laundering, fraud, intermediaries exploiting investors, false client information, risks, limited transparency, tracking the error-prone process, counterparty fails trades, etc. Such activities hamper their asset management the quality of services rendered (Wamba-Taguimdje *et al.*, 2020). Hence the merger of AI and BC can create an edge by enhancing scalability, security, efficiency and privacy. Therefore, this study's discussion revolves around examining disruptive technologies' three implications in determining quality-of-service delivery through employee performance among the Investment banks. First, the relationship between disruptive technologies with service delivery is assessed. Second, predicting service delivery based on service differentiation variables. Third, evaluation of the relationship between service differentiation variables with employee performance across these banks.

The purpose of the study is to examine the impact of innovative technological fusion (AI and BC) among investment banks. The disruptive technological theory proposed (Christensen's, 1997) and Business model with radical innovation (Markides) paved the way toward testing the proposed conceptual research model applying disruptive technologies currently considered in the study (AI and BC) toward qualitative service delivery through employee performance among the Investment banks based on service differentiation. The research questions are: Can the conceptual model developed based on service differentiation predict the qualitative service delivery among the investment banks? Is there any relationship between disruptive technologies and the level of service delivery? Is there any relationship between service differentiation and employee performance? The researcher argues and identifies the gap of service differentiation integrated with disruptive technologies never applied in investment banking to determine service delivery quality through employee performance.

The study's implications will benefit the investment banks and market regulators to ensure automated trade settlements using smart contracts and cloud technology. It also facilitates more transparency toward client reporting among these banks.

Literature review and hypothesis development
Tellis has quoted Christensen's (1997) introduced his fundamental theory primarily focused on the impact of disruptive technologies on firms and across the industries setting as a base that could be applied generously. Over time, the same thumb of rule based on his theory could not be used as different innovations have varied implications on the business when advancements in the technology and changing business environment. Markides (2006) emphasizes his work on business model innovations and product innovations. He argued that these innovations are different from technological innovations when considered the best way for an established company to embrace business innovations in discovering a business model from an existing model. Therefore, the first hypothesis framed is as follows:

H1. There is no relationship between service delivery based on disruptive technologies (AI, BC and fusion).

The current phase of this technology advancement has undergone many promising cycles of up-gradation for better output delivery when implemented. The technological changes as an innovation in internet banking were proposed and tested concerning strategic online banking management by conventional banks, resulting in a greater impact on the bank managers' environmental and strategic decisions (Callaway and Hamilton, 2008). There has been commendable contribution by various authors in AI and BC technology in the past few years. However, off late, it has been enjoying a significant resurgence because of varied advanced technologies inspired by the natural intelligence expecting the systems to combat

complex jobs more effectively and efficiently (Oh and Shong, 2017). Hence, the second
hypothesis designed is as follows:

H2. There is no impact of technological variables, operational variables, quality
management variables, strategic solutions variables and security variables in
forecasting employee performance.

Customer satisfaction plays a pivotal role in improving the customer experience with
innovative business strategies that facilitate a competitive advantage in the industry,
ultimately resulting in the companies' financial performance (Basari and Shamsudin, 2020).
Technology plays a significant role in delivering perceived service quality to their
customers in the banking industry through innovative strategies focused on cost reduction
and removes the barriers of uncertainties (Joseph *et al.*, 1999). Human resources are the key
players in the service sector who promise to build value proposition and brand loyalty
among the customers. However, evidence (Bowra *et al.*, 2012) reflects a positive and
significant correlation between employee's perceived performances and human resources
practices in terms of performance evaluation influence in the company's overall
performance. The proposed conceptual research model of service differentiation is
developed on the grounds of theory building mechanism extracted from the combination of
disruptive technological innovation (Danneels, 2004). The Service Quality model 8 is
designed on technology to deliver perceived service quality explaining cost reduction.
Service Quality model 9 is designed on banking service quality measurement (Bahia and
Nantel, 2000). Service Quality model 10 (Sureshchandar *et al.*, 2001) is focused on the human
element of service delivery. Service Quality model 12 (Al-Hawari *et al.*, 2005) projecting the
importance of banking automated services. Service Quality model 13 (Ehigie, 2006) is on
attempting to scale for banking which was quoted. The literature reviews were on Service
Quality analysis models in banking (Sangeetha and Mahalingam, 2011). Hence, our third
hypothesis in the study is:

H3. There is no association between service differentiation variables and employee
performance.

The theoretical framework facilitates that these banks use Service differentiation as their
"Input," Employee Performance integrated with disruptive technologies tends to be
"Process," and finally, the Service delivery results to be the "output." This system approach
helps in converting the avenue into long-term sustainability for the banks. The proposed
model explains the contribution of five sets of service differential variables: security,
strategic solutions, quality management, operations and technology promoting the adoption
and application of disruptive technologies (AI, BC) toward enhancement of employee
performance qualitative service delivery among these investment banks.

The proposed conceptual research model based on service differentiation has been
demonstrated in Figure 1.

Methodology
Questionnaire and measures
The research study is empirical and is restricted to the geographical area of urban districts
of Bangalore, Chennai, Pune, Mumbai and Hyderabad, considering the fact of availability of
various foreign-based Investment banks functioning at different levels of operations. A
structured questionnaire was administered to collect the respondents' primary data,
employees of the leading Foreign-based Investment banks operating in urban localities.
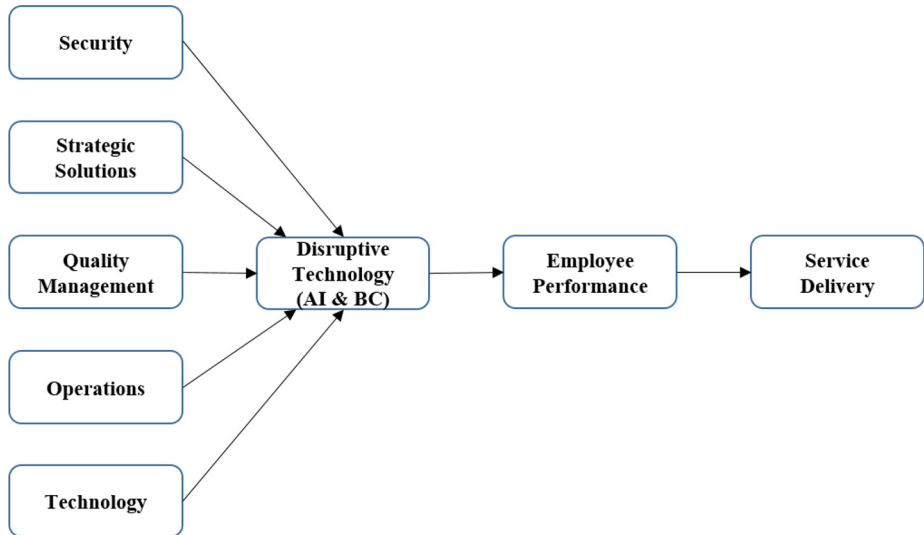
The researcher categorized the first section of a questionnaire comprising the respondents' demographic profile. The second section consisted of statements based on service differentiation, disruptive technologies and employee performance using a Likert scale.

The study comprises three objectives: first, to analyze the relationship between the adoption of disruptive technologies and the level of service delivery in the investment banks. Second, to predict the impact of service differentiation on the investment banks' employee performance and finally assess the importance of service differentiation enabled workflow in the investment banks.

The cluster sampling technique is a non-probability type based on the referential contacts prevailing in a subject area, which refers to the next set of prospective respondents among their acquaintances to facilitate the study. The respondents were part of a very confidential and critical segment of the banking industry. The sample size arrived to perform the research involves 250 respondents, employees of the leading Investment banks.

Five sets of service differentiation variables (independent variables) comprise security, strategic solutions, quality management, operations and technology. Each set of the independent variable includes sub-set variables that are deployed to test the hypothesis. Security includes variables, namely, Privacy (SE1), Information (SE2), Money laundering (SE4) and Nodes (SE5). Strategic solutions variables considered are Agents (SS2), Auditing (SS3) and Cloud system (SS4). Quality management variables consist of Client reporting (QM1), Transparency (QM2), Counterparty (QM3) and Data Usage (QM4). Operations variables include Operating cost (OP1), Reliability (OP2), Validation (OP3), Decentralization (OP4) and Customer cost (OP5). Technological variables consist of Integration (TE1), Storage network (TE2) and Smart contracts (T5). Employee performance is the dependent variable considered for the study.

Statistical Package for Social Science (SPSS V. 21) is the statistical tool applied to examine Chi-square, linear stepwise multiple regression analysis and Pearson correlation to validate the hypothesis and evaluate the research's chosen variables.

Results
Chi-square test
A test of independence was computed comparing the level of service delivery in the Investment banks based on the type of technology implemented. A significant relation was found (X^2 (4) = 27.62, $p < 0.01$). Table 1 shows that the level of service delivery by the banks is very high. It has a significant difference when there is a merger of BC and AI technology with 94.59% when BC is applied. Service delivery is high at 90%, and when AI is applied, and service delivery is 83.33%. There is a moderate level of service delivery when AI shows with 0.24%, and merger resulted in 0.74%. There is a low level of service delivery only when BC gets implemented with 10%. Hence the null hypothesis is rejected and alternative accepted, confirming a robust relationship between Service delivery based on disruptive technologies (AI, BC and fusion).

Reliability analysis
Cronbach's alpha resulted as ($\alpha = 0.913$) for 250 items, which confirmed high reliability on the investment banks' qualitative service delivery based on the study conducted. This test measures internal consistency, reflecting the data's validity, confirming proceeding with further statistical analysis.

Correlation analysis
The relationship between the employee performance and service differentiating variables that facilitates in betterment owing to technological innovation in Investment banks. Based on the results of the output correlations significant at $0.000 < 0.05$, it can be concluded that there is strong relationship between the employee performance and the service differentiation generated on the application of the fusion technology. Table 2 projects the Pearson correlation value obtained is 0.770 between operations and quality, 0.846 (operations and strategy), 0.908 (operations and security), 0.746 (operations and technology), 0.866 (quality and strategy), 0.828 (quality and security), 0.871 (quality and technology), 0.834 (strategy and security), 0.843 (strategy and technology), 0.798 (security and technology). It indicates there was significant highly positive relationship between the operations and employee performance ($r = 0.911$, $p < 0.01$), quality and employee performance ($r = 0.937$, $p < 0.01$), strategy and employee performance ($r = 0.944$, $p < 0.01$), security and employee performance ($r = 0.935$, $p < 0.01$) and technology and employee

Technology	Count/percents	Level of service delivery			
		High	Moderate	Low	Total
BC	Count	9	0	1	10
	Percent	90.00	0	10.00	100
AI	Count	10	2	0	12
	Percent	83.33	16.67	0	100
BC and AI	Count	35	2	0	37
	Percent	94.59	5.41	0	100
Total	Count	45	4	1	50
	Percent	90	8	2	100
Pearson chi-square (df = 4)					27.62
Sig.					0.000**
Note: **Significant at 1% level					

Table 1.
Relationship between the type of technology applied and level of service delivery in investment banks

performance ($r = 0.923$, $p < 0.01$). Therefore, the null hypothesis is rejected and alternative accepted reflecting a significant association between service differentiation variables and employee performance.

Regression analysis
The stepwise multiple linear regression equation was designed to predict the banks' employee performance (dependent variable), indicating independent variables comprising technology, operations, quality management, strategic solutions and security.

Employee performance and technology. The employee performance in the banks is predicted based on the technological variables comprising of storage networks (TE2), smart contracts (TE5) and Integration (TE1). Y represents the employee performance of the investment banks. 22.3017 is the constant value. A significant regression equation was found (F $(1, 46) = 16.976$, ($p < 0.000$), with an R^2 of 0.901. Hence predicted employee performance is equal to $22.307 + 7.173$ (storage network) $+ 7.794$ (smart contracts) $+ 4.151$ (Integration). The banks' employee performance enhances for every 7.173 unit increase in the storage network's capacity, 7.794 unit in smart contracts being floated by the buy and sell-side fund managers and 4.151 unit of integration connecting all the parties on the distributed ledger. Table 3 reflects the significant impact of technology in predicting the banks' employee performance based on TE1, TE2 and TE5. Hence, the null hypothesis is rejected and alternative accepted, reflecting a significant impact of technological variables in forecasting employee performance.

Employee performance and operations. Operational efficiency plays a pivotal role in forecasting the employee performance of the banks considering the independent variables, namely, Reliability (OP2), Customer cost (OP5), Decentralization (OP4), Validation (OP3) and Operating cost (OP1). Y represents the employee performance of the investment banks. 8.719

Table 2.
Association between the service differentiating variables and employee performance

Variables	Operation	Quality	Strategy	Security	Technology	Employee performance
Operation	1	–	–	–	–	–
Quality	0.770**	1	–	–	–	–
Strategy	0.846**	0.866**	1	–	–	–
Security	0.908**	0.828**	0.834**	1	–	–
Technology	0.746**	0.871**	0.843**	0.798**	1	–
Employee performance	0.911**	0.937**	0.944**	0.935**	0.923**	1

Note: **Significant at 1%

Table 3.
Regression analysis to predict service delivery in banks based on technological variables

Model	Variables	TE2	TE5	TE1	R	R2	F change	Sig.
1	B	12.663	–	–	0.848	0.719	123.077	0.000**
	SE	1.141	–	–				
2	B	9.742	8.089	–	0.930	0.864	50.031	0.000**
	SE	0.903	1.144					
3	B	7.173	7.794	4.151	0.949	0.901	16.976	0.000**
	SE	0.999	0.991	1.007				

Note: **Significant at 0.001% level

is the constant value of OP1, OP2, OP3, OP4 and OP5 as indicating independent variables. A significant regression equation was found (F (1, 44) = 8.504, ($p < 0.000$), with an R^2 of 0.867. Table 4 shows a significant impact of operational efficiency in predicting the banks' employee performance based on the variables OP1, OP2, OP3, OP4 and OP5. Hence predicted employee performance is equal to $8.719 + 8.124$ (Reliability) $+ 3.338$ (Customer cost) $+ 4.223$ (Decentralization) $+ 4.618$ (Validation) $+ 3.059$ (Operating cost). The banks' employee performance improves for every 8.124 unit increase on the reliability of data and reports generated, 3.338 unit in customer cost-effectiveness, 4.223 unit in the specialization of the operations, and 4.618 unit of authentic validity of documents and strategies, and 3.059 unit of operating cost efficiency. Therefore, the null hypothesis is rejected and alternative accepted, reflecting a significant impact of operational variables in forecasting employee performance.

Employee performance and quality management. The variables indicating the employee performance of the banks based on the quality management consists of Client reporting (QM1), Transparency (QM2), Counterparty (QM3) and Data Usage (QM4). Y represents the employee performance of the investment banks. 13.798 is the constant value of QM1, QM2, QM3 and QM4, indicating independent variables. A significant regression equation was found (F (1, 44) = 4.518, ($p < 0.000$), with an R^2 of 0.879. Hence predicted employee performance is equal to $13.798 + 7.389$ (client reporting) $+ 5.822$ (transparency) $+ 5.757$ (counterparty) $+ 2.184$ (data usage). The employee performance of the banks accelerates for every 7.389 unit increase in the customized client reporting, 5.822 unit in the transparency of the transactions approved and accessed by all the parties simultaneously, 5.757 unit in sophisticated measures undertaken to prevent failed settlements at a counterparty and 2.184 unit of tracking ability of their data and prices for the sustainability.

Table 5 reflects a significant impact of quality management in predicting the banks' employee performance based on the variables QM1, QM2, QM3 and QM4. Therefore, the null hypothesis is rejected and alternative accepted, reflecting a significant impact of quality management variables in forecasting employee performance.

Employee performance and strategic solutions. Strategic solutions constitute independent variables adopted, namely, cloud system (SS4), Agents (SS2) and Auditing (SS3) to forecast the employee performance of the banks. Y represents the employee performance of the investment banks. 24.725 is the constant value consisting of SS2, SS3 and SS4 as the indicating independent variables. A significant regression equation was found (F (1, 46) = 6.908, ($p < 0.000$), with an R^2 of 0.815. Hence predicted employee

Model	Variables	OP2	OP5	OP4	OP3	OP1	R	R2	F change	Sig.
1	B	13.541	–	–	–	–	0.723	0.523	52.590	0.000**
	SE	1.867	–	–	–	–				
2	B	11.285	5.685	–	–	–	0.856	0.733	36.869	0.000**
	SE	1.461	0.936	–	–	–				
3	B	10.296	3.889	4.432	–	–	0.897	0.805	16.993	0.000**
	SE	1.284	0.918	1.075	–	–				
4	B	9.250	2.931	4.462	2.967	–	0.917	0.842	10.517	0.002**
	SE	1.213	0.887	0.979	0.320	–				
5	B	8.124	3.338	4.223	4.618	3.059	0.931	0.867	8.504	0.006**
	SE	1.187	0.833	0.910	1.019	1.049				

Note: **Significant at 0.001% level

Table 4.
Regression analysis to predict service delivery in banks based on operational variables

performance is equal to 24.725 + 7.624 (Cloud system) + 8.923 (Agents) + 3.002 (Auditing). The banks' employee performance improves for every 7.624 unit increase in the decentralized transaction based on the cloud system, 8.923 unit in revenue owing to the removal of agents and 3.002 unit in strengthening the risk management measures money laundering frauds and protect customers. The results from Table 6 confirm a significant impact of strategic solutions in predicting the banks' employee performance based on the variables SS2, SS3 and SS4. It implies a significant impact of strategic solutions in predicting the banks' employee performance based on the variables SS2, SS3 and SS4. Therefore, the null hypothesis is rejected and alternative accepted, reflecting a significant impact of strategic solution variables in forecasting employee performance.

Employee performance and security. Investment banks are always thriving toward data protection with confidentiality and safety. The considered variables reflecting the security are money laundering (SE4), information (SE2), nodes (SE5) and privacy (SE1) to estimate the employee performance of the banks. Y represents the employee performance of the investment banks. 10.531 is the constant value of SE1, SE2, SE4 and SE5 as the indicating independent variables. A significant regression equation was found (F $(1, 45)$ = 5.753, ($p < 0.000$), with an R^2 of 0.918. Hence, predicted employee performance is equal to 10.531 + 8.272 (money laundering) + 5.665 (information) + 6.210 (nodes) + 2.442 (privacy). The employee performance of the banks progresses for every 8.272 unit increase in the anti-money laundering measures to curb money laundering, 5.665 unit in the credibility of reliable market information, 6.210 unit in better dependency on the impact of the transactions and 2.442 unit of securing the data maintaining the privacy of the authorized users. Table 7 presents the analysis that confirmed a significant impact of technology-enabled security measures undertaken in predicting the bank's employee performance with security indicating variables SE4, SE2, SE5 and SE1. Therefore, the

Model	Variables	QM1	QM2	QM3	QM4	R	R2	F change	Sig.
1	B	13.735	–	–	–	0.726	0.527	53.577	0.000**
	SE	1.876	–	–	–				
2	B	10.089	8.562	–	–	0.874	0.764	47.095	0.000**
	SE	1.442	1.248	–	–				
3	B	8.446	6.700	5.941	–	0.931	0.866	35.276	0.000**
	SE	1.131	0.999	1.000	–				
4	B	7.389	5.822	5.757	2.184	0.937	0.879	4.518	0.039**
	SE	1.198	1.048	0.968	1.027				

Note: **Significant at 0.001% level

Table 5.
Regression analysis to predict service delivery in banks based on quality management variables

Model	Variables	SS4	SS2	SS3	R	R2	F change	Sig.
1	B	10.930	–	–	0.761	0.580	66.232	0.000**
	SE	1.343	–	–				
2	B	8.010	9.430	–	0.887	0.787	45.742	0.000**
	SE	1.058	1.394	–				
3	B	7.624	8.923	3.002	0.903	0.815	6.908	0.012**
	SE	1.008	1.328	1.142				

Note: **Significant at 0.001% level

Table 6.
Regression analysis to predict service delivery in banks based on strategic solutions variables

null hypothesis is rejected and alternative accepted, reflecting a significant impact of security variables in forecasting employee performance.

Discussion
Chi-square test proved that there is high-level service delivery owing to technological changes in the business, with fusion (BC and AI) being the highest at 95%, followed by only BC with 90% and least with AI of 83%. The storage network is the most influencing variable with a beta coefficient (0.480) in predicting performance owing to technology because a decentralized storage network is driven by Data Access Token (DAT). Operating cost is the most significant predictor of employee performance with the highest beta coefficient of 0.434, reflecting the independent variable's robust strength on the dependent variable. Removal or reduction of reporting errors had been the highest influencing predictor of employee performance with a beta coefficient of 0.391 and reducing agents with 0.531. This technology facilitates the betterment of anti-money laundering, which is the most crucial responsibility bothering the banks at a significant level expected to be cured as the beta value is 0.437, a significant security predictor. It has been proven that there is a positive and too high relationship between employee performance and different sets of service differentiation variables.

It facilitates increasing every unit of operations, quality, strategy, security and technology reflect a proportionate increase in employee performance by 0.911, 0.937, 0.944, 0.935 and 0.923, respectively. There is further research scope to perform the comparative study in detail pre and post-adoption of different types of technologies in Investment banks. Some of the areas to be focused on can be employee satisfaction and workload analysis owing to reduced work by using technology. Various models can be developed to reflect the changes in technological changes. AI can be applied in front office operations to deal with clients approaching advisory services.

Conclusion
This study concludes with framed research questions being addressed, fetching statistical shreds of evidence that the proposed conceptual model developed based on service differentiation can predict qualitative service delivery among the investment banks. There is a strong relationship between disruptive technologies and the level of service delivery and the relationship between service differentiation and employee performance. Thus, the proposed conceptual model based on five sets of service differential variables and application of disruptive technologies (AI, BC) promotes employee performance enhancement directing toward the qualitative service delivery among these investment

Model	Variables	SE4	SE2	SE5	SE1	R	$R2$	F change	Sig.
1	B	13.735	–	–	–	0.726	0.527	53.577	0.000**
	SE	1.876	–	–	–				
2	B	11.393	6.801	–	–	0.866	0.751	42.106	0.000**
	SE	1.424	1.048	–	–				
3	B	8.777	6.016	7.039	–	0.953	0.907	77.651	0.000**
	SE	0.927	0.652	0.799	–				
4	B	8.272	5.665	6.210	2.442	0.958	0.918	5.753	0.021**
	SE	0.907	0.638	0.835	1.018				

Note: **Significant at 0.001% level

Table 7.
Regression analysis
to predict service
delivery in banks
based on security
variables

banks. A storage network, smart contracts and integration of multiple functions such as marketing, finance, auditing helps forecast the trend with the application of AI and BC technologies resulted being the significant predictors of employee performance enabled with innovative technology. Reliability, customer cost, decentralization, validation and operating cost are the significant predictors of employee performance based on the operations enabled with technology. Technology promotes reducing the operating cost, improves the reliability of process eliminating intermediaries, curbs down the manual process of customer document verification and enhances anti-money laundering precautions.

It can reduce the human errors involved while preparing client reports, improving contractual performance with improved regulatory transparency. Partners can track their data and price performance and create an edge on data usage with enhanced information communication efficiency. Agents, auditing and transaction clouds are the significant predictors of banks' employee performance based on strategic solutions. Stock transfer by agents can be removed, strengthening the risk handling with better auditing methods based on the real-time settlement of transactions through clouds. Money laundering, information, nodes and privacy are the significant predictors of employee performance based on the security ecosystem backed up with types of technologies. Trading platforms verify traders' authenticity and credibility, offering secure access to market information at real-time effect through nodes created for better data security. Strategic solutions have the highest positive relationship with employee performance in the banks. Technological innovations in the banking industry have made storms that bring significant advancement in the operations, leaving an enormous impact in offering more real-time services to the customers.

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Further reading

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