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The impact of IT-technological innovation on the productivity of a bank's employee

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Abstract: Banks discretionary devise technology-driven core strategies to leverage trends in information technology to pursue technological innovation in order to improve the productivity of employees. Employee productivity is a considerable unit of measure of a firm's performance and a source of sustaining competition. A logistic regression analysis was conducted using dependent variables of *employee_productivity, innovation_impact* and *innovation_satisfaction*, and 12 predictors. The highest positive effect of innovation was on *process* (improved 39 times more than other predictors), *newOrimproved_process* was more likely to contribute the highest (34.9) to *innovation_satisfaction*, and high *innovation_impact* factor was more likely to contribute the highest (28.7) to *employee_productivity* among the banks. Exploring and understanding the interrelationships and effects among these variables can provide managers with more reliable and actionable insights to embark on innovation activities that would improve the competence, operational efficiency, productivity of employees, and ultimately their performance.

Subjects: Information & Communication Technology (ICT); Banking; Strategic Management; Management of Technology

Keywords: Bank; employee productivity; Ghana; innovation impact; innovation satisfaction; technological innovation

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ABOUT THE AUTHOR

Asare Yaw Obeng (PhD) has published peer-reviewed articles in the areas of IS-facilitated technological innovation, effects of IS-strategic alignment on firm performance, and employee and customer satisfaction of technological innovation. He has conducted interviews and assessments with customers and employees who use IT-enabled banking technological innovation. The information in this article is important for embarking on specific innovation activities to improve the productivity of employees. IT-facilitated technological innovation affects the competence and operational efficiency of employees. Information in this article can provide management of banks with reliable and actionable insights to improve service offering responsiveness and customer satisfaction.

PUBLIC INTEREST STATEMENT

Banks discretionary devise technology-driven core strategies to leverage trends in information technology to pursue technological innovation (new or significantly improved product and process) in order to improve the productivity of employees. This article describes some effects of information technology facilitated technological innovation on employee productivity and other related factors. Using survey data from seven universal banks in Ghana, the interrelationships among employee productivity, innovation impact and innovation satisfaction are examined to illustrate the impact of technological innovation. It was found that the highest positive effect of innovation was on *process* (improved 39 times more than other predictors) in the banks. Clearly, high innovation impact was more likely to contribute the highest to employee productivity whiles new or significantly improved process was more likely to contribute the highest (34.9 times more than other predictors) to innovation satisfaction.

1. Introduction

In the Ghanaian banking industry, competition is keen and the market environment is volatile. To survive in such a competitive market, the banks should focus on improving the productivity through operational efficiency, adopting efficient banking system, and efficient resource generation and allocation. This could eventually contribute positively to financial performance. Banks that sustain continuous improvements in performance show better ratio of human capital efficacy (Singh & Kamlesh, 2013). Employees are directly related to banking activities and are crucial in the development, productivity enhancement, and success of banking institutions. Devising technology-driven strategies that facilitate knowledge discovery and enhance the skill sets of employees is vital because the success of banking institutions and the realization of their objectives depend largely on human resources. Improvements in the skills and competence of employees influence employee productivity that manifests in service offering responsiveness and customer satisfaction (Singh & Kaur, 2011).

Banks are leveraging trends in information technology to pursue technological innovation (product and process innovation) to address the major concerns of their employees including improvements in service delivery methods, enhancing operational efficiency, and reducing the time to perform transactions. However, pursing this strategy does not guarantee realization of a strategic goal unless the initiatives are end user centric that effectively address the needs of end users. Employees cope with the demands of innovative technologies to perform efficient operations in response to service offering that contributes to customers' satisfaction. In the Ghanaian banking industry, whilst some universal banks are improving their productivity through technological innovations, others are yet to realize the expected benefits of such innovations (Ameme & Wireko, 2016). The productivity of an employee is a considerable factor while measuring the performance of an organization. Employees are more interested in products and processes to provide services to customers. Our major objective of the study then becomes:

Exploring the impact of information technology (IT)-technological innovation on the productivity of banking employees.

2. Research questions

In an attempt to identify and understand the impact of IT-technological innovation on the productivity of banking employees and the specific factors that influence banking employee' productivity at the branch level of seven (7) universal banks in Ghana, the researchers sought answers to questions provided below.

The participants were asked three dependent questions below to reflect how they perceive the impact of IT-technological innovation on their productivity, other areas in their banks, and innovation satisfaction.

(1) As a bank employee, do you think technological innovation has impacted positively on your productivity?

(2) How has IT-innovation affected your bank in each of the following areas?
   - Products
   - Processes
   - Service delivery time
   - Operational flexibility
   - Risks management
   - Employee productivity
   - Customer service

(3) How satisfied are you with your bank's current IT-enabled product(s)/services and process(s) in performing your role?

Additional questions that employees were asked are found at Appendix A.

3. Review of related literature

Presently, there are 33 licensed universal banks in Ghana (BoG, 2016). This saturation has resulted in intensified competition where products/services offered are increasingly becoming difficult to differentiate (Baba, 2012). These universal banks are constantly seeking unique ways of differentiating their offerings by devising technology-driven strategies to support business operations and achieve sustainable competitive advantages (Asante, Agyapong, & Adam, 2011). Among such technology-driven strategies is IT-innovation.

3.1. IS-Technological innovation in the Ghanaian banking sector

In the Ghanaian banking sector, recent developments include leveraging the advancements in information technology to develop new or significantly improved products and/or processes (IT-technological innovation) (OECD, 2005). Other goals include driving human capital development (Obeng & Mkhize, 2017a), attaining operational efficiency and service quality (Parasuraman, 2010), and improving customer expectations (Chen, 2005). In contemporary service organizations, innovation is a core competency (Kandampully, 2002). Damanpour (2010) and OECD (2005) classify process and product innovations as technical. For product innovation, new or significantly improved products is developed to improve customer service and capture new markets (Damanpour, 2010). Process innovation focuses on new or significantly improved method of production or method of delivering a service including significant changes in techniques, equipment, and/or software (OECD, 2005). Process innovation is pursued to decrease operational cost (Damanpour, 2010), increase product/service quality (OECD, 2005), reduce service delivery time, and increase operational flexibility (Walker, 2007). Process innovation has been a transformational force for the banking industry and complementing it with product innovations has been one of the indispensable business strategies (Damanpour, 2010) that contribute to long-term success sustainability of a firm (Kandampully, 2002).

In the Ghanaian banking industry, IS-technological innovations mainly consist of IT-facilitated processes and intangible products. These products or services include automated teller machines, personal computer banking, telephone banking, electronic funds transfer, branch networking, electronic data interchange, mobile and internet banking, electronic wallets, electronic platform, and eAlerts. IT-facilitated processes include digital delivery channels and banking processes. Technology solution can support a bank to innovate on processes such as electronic dissemination of banking communication, direct banking, accepting electronic documentation from customers (Kanayi, 2012), improving employee performance, and reducing inefficiencies (Obeng & Mkhize, 2017a).

3.2. Employee productivity

The human intellectual resource (e.g. training, experience, intelligence, and skills of individuals) is the most important internal organizational resource and acts as the principal driver of profitability, delivery of new products, efficient use of innovative technology, and provision of varied customer preferences (Bettis & Hitt, 1995). In the banking industry, banks that sustain continuous improvements in performance (mainly, growth and profitability) show better ratio of human capital efficacy (Singh & Kamlesh, 2013). Thus, banks are committed to increase knowledge and enhance the skill sets of their employees since their productivity is crucial in their overall efficiency (Yadav & Garima, 2015).

Productivity is generally defined as the output (amount of goods and services produced per person or system) per unit of input (resources) used during a given period (Murdick, Render, & Russell, 1990). It is measured by the ratio of output to input (*total quantity of products and services produced* divided by *total amount of resource used*). A high ratio indicates high productivity. Determining productivity in say manufacturing industry is different from financial services industry. In banking, output is defined using the *national accounts approach* where profits and income measures are used (O'Mahony, Oulton, & Vass, 1998), the *production approach*—financial services

are provided using both physical and human capital inputs (Colwell & Davis, 1992), and the *intermediation approach* that considers banks as intermediators between lenders and borrowers (Berger & Humphrey, 1992). The production approach to measure output in the banking industry using efficiency and employee productivity is crucial since employee productivity is an important factor to consider while measuring the performance of a bank (Kaur & Bhatia, 2016). Moreover, employees are directly related to banking activities and are crucial in the development and success of every organization (Yadav & Garima, 2015).

3.3. Impact of IT-technological innovation on employee productivity

In the service sector, labour productivity is measured as value added and Masso and Vahter (2012) find a positive relationship between innovation output and employee (labour) productivity. According to Mairesse and Robin (2010), product innovation significantly affects the productivity of employees. Process innovation positively impacts employee productivity (Huergo & Jaumandreu, 2004). However, the impact of process innovation on productivity is greater than product innovation (Hall, Lotti, & Mairesse, 2008). Where employees are trained and empowered to undertake creative initiatives, innovation improves productivity (Chang, Gong, & Shum, 2011). In the banking industry, providing high-quality innovative outputs improve the satisfaction level of employees that eventually increases the productivity of these employees (Obeng & Mkhize, 2017a). Efficient use of information technologies increases labour productivity levels (Sabherwal & Chan, 2001). Complementing information technology and innovation activities could lead to higher improvements in employee productivity than applying them individually since technology can only contribute to increased productivity when used with other resources effectively (Dauda & Akingbade, 2011).

4. Methods

4.1. Data collection and preparation

The study was limited to seven first quartile universal banks in Ghana. For a reasonable comparison and analysis, all seven (7) banks were selected from the consistently rated first quartile[1] universal banks in Ghana between 2010 and 2015 (see PricewaterhouseCoopers, 2016). Participants were selected from major cities in different regions to cover extensive area and include diversity of employees. To achieve validity of the findings, employees who use IT-facilitated banking products or services and processes for different purposes were randomly selected at the branch levels. These employees may exhibit efficiency and flexibility due to new/improved operational role-related processes and products making their contribution more appropriate to the study. Data for the study were collected using survey approach. Initially, a questionnaire consisting both closed and open-ended questions were tested and fine-tuned (see Appendix A) and subsequently administered to respondents with the help of trained research assistants between March and May 2015. In total, 120 questionnaires were distributed to 7 banks with 165 employees. Ninety-eight representing 82% of the questionnaires were received (a response rate of 59.39%).

In selected banks, Jani and Raval (2012) used financial ratio of business per employee and profit per employee to analyse the productivity of employees, while Yadav (2012) used staff productivity, cost effectiveness, profitability, and financial management to measure their productivity. In this study, descriptive statistic is used to capture the productivity of employees. The intent was to summarize the information mainly to get the underlying contributions of technological innovation to employee productivity. Participants were asked to indicate how technological innovation has affected certain areas/activities of their banks, how technological innovation has impacted their productivity as employees, and the main advantages they consider technological innovation has brought to their professional daily activity.

Table 1 describes respondents' characteristics of the sample used in this study. Fifteen independent variables and three dependent variables shown in Table 2 were used to model the productivity of employees.

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Table 1. Characteristics of respondents

Characteristics	Frequency & percentage							
Gender	***N***	**%**	**Age**	***N***	**%**	**Education**	***N***	**%**
Male	67	68	18–29	21	21.4	University	79	81
Female	31	32	30–39	63	64.3	Polytechnic	3	3
MV	0	0	40+	14	14.3	College	13	13
			MV	0	0	Other	1	1
						MV	2	2

MV: missing values.

Table 2. The definition of variables used in the analysis

Innovation impact	
Name	Definition
Innovation_impact (Dependent) Product Process Service_Delivery_Time Operational_Flexibility Risks_Management Employee_Productivity Customer_Service	Innovation effect on bank products Innovation effect on bank process Innovation effect on customer service delivery time Innovation effect on operational activities Innovation effect on bank risk management activities Innovation effect on employees' productivity Innovation effect on customer service delivery
Innovation satisfaction	
Name	Definition
Innovation_satisfaction (Dependent) Innovation_Service_Consistency NewOrImproved_Product NewOrImproved_Process	Innovation services offered is consistent with latest innovation Product innovation Process innovation
Employee productivity	
Name	Definition
Employee_Productivity (Dependent) Innovation_Impact Innovation_Satisfaction	Impact of innovation on the banks Level of innovation satisfaction among bank employees

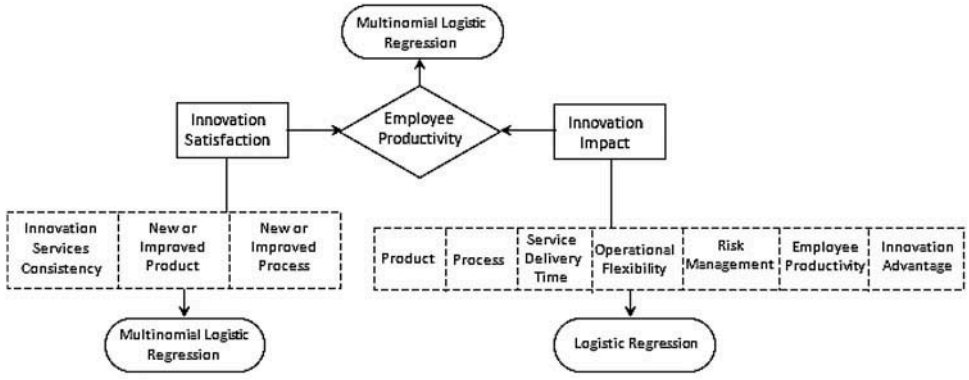
4.2. Data analysis framework

Since the goal of our study is to explore the impact of IT-technological innovation on the productivity of banking employees and specific factors that influence banking employee' productivity, it is appropriate to use the most parsimonious model. To accomplish this goal, models that include all predicting variables and knowledge of the relationships and strengths among the variables were observed using multinomial and logistic regression. Given a set of independent variables, the probabilities of varied possible outcomes of a categorical distributed dependent variable are predicted using a multinomial logistic regression. Using a logistic regression model, the conditional distribution of response Y is estimated given X as the input variables. $Pr\ (Y = 1 \mid X = x)$ denotes a binary output from the input variables. For the multinomial logistic regression model, a random variable Y_i is estimated as one of several discrete values of 1,2,. . .,J. $\pi_{ij} = \Pr\{Y_i = j\}$ denotes output from the input variables. Figure 1 summarizes the data analysis procedure.

5. Data analysis results

A logistic regression analysis was conducted using statistical package for social sciences to assess the productivity of an employee of a bank. Three main factors (dependent variables) including *employee_productivity* (two predictors), *innovation_impact* (seven predictors), and *innovation_satisfaction* (there predictors) were identified as input to the analysis (see Figure 1; Table 2). To improve the outcome of the regression models, correlation matrix using provisional variables was performed to identify

Figure 1. Data analysis framework.



significant variables. The correlation between dependent variables did contribute significantly: innovation_impact and employee_productivity (.001), innovation_impact and innovation_satisfaction (.033), employee_productivity and innovation_satisfaction (.047) (see Table 3). The casewise list did not produce any outlier making the models reasonably sound.

5.1. Logistic regression (model 1)

Banks pursue IT-technological innovation to reduce inefficiencies, improve employee productivity, reduce costs, and manage risks among others. Three significant variables in the best-fitting logistic regression model (see Table 4) were used. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between Yes and No of innovation impact (chi-square = 19.344, $p < .007$ with df = 7) (see Table 5).

Table 4 presents the statistical significance of individual regression coefficients (βs) tested using the Wald Chi-square statistic. The Wald criterion demonstrated that *process* was a significant predictor for event ($p < .05$). The slope coefficient 3.663 represents the change in the log odds for a one-unit increase in *process*. The test of the intercept ($p < .05$) was significant suggesting that the intercept should be included in the model. Odd ratio 38.978 indicates that the odds for an event increase 39 times when the level of the *process* is increased by one unit. Thus, employee will indicate the impact of innovation on *process* is 39 more times than other predictors (see Table 4). *Risk_management* and *employee_productivity* were significant predictors for events ($p < .028$,

Table 3. Pearson correlations

Correlations

		I-I	I-S	E-P
I-I	Pearson correlation	1		
	Sig. (two-tailed)			
	N	96		
I-S	Pearson correlation	−.218*	1	
	Sig. (two-tailed)	.033		
	N	96	98	
E-P	Pearson correlation	−.329**	.201*	1
	Sig. (two-tailed)	.001	.047	
	N	96	98	98

*Correlation is significant at the 0.05 level (two-tailed).

**Correlation is significant at the 0.01 level (two-tailed).

I-I: Innovation_impact; I-S: Innovation_satisfaction, E-P: Employee_productivity

Table 4. Output from logistic regression: statistical tests of individual predictors (Innovation_impact)

Logistic regression

								95% CI for Exp(*B*)	
Predictors	**β**	**SE(β)**	**Wald χ^2**	**df**	**ρ**	**e^{β} (OR)**	**Sig. (two-tailed)**	**Lower**	**Upper**
Product	.498	1.689	.087	1	.768	1.645	.196[b]	.060	45.035
Process	3.663	1.651	4.925	1	<.026	38.978	<.040[b]	1.534	990.368
Service_Delivery_Time	.295	1.431	.043	1	.837	1.343	.404[b]	.081	22.210
Operational_Flexibility	.172	1.232	.019	1	.889	1.188	.578[b]	.106	13.297
Risk_Management	3.470	1.576	4.851	1	<.028	32.137	<.040[b]	1.465	704.837
Employee_Productivity	−4.303	1.598	7.248	1	<.007	.014	<.002[b]	.001	.310
Customer_Service	.221	.981	.051	1	.822	1.247	.518[b]	.182	8.528
Constant	−1.486	3.011	.244	1	.622	.226	.125[b]		

CI: confidence interval; df: degree of freedom; OR: odds ratio; SE: standard error

Table 5. Overall model evaluation & goodness-of-fit statistics

Goodness-of-fit statistics

Test	Categories	χ^2	df	*p*
Overall model evaluation	Score test	19.344	7	.007
	Wald test	41.958	1	.000
Goodness-of-fit test	Hosmer & Lemeshow	3.533	7	.832

<.007) respectively. The test of the intercepts ($p < .05$) were significant suggesting that the intercepts should be included in the model. The model explained 44.9% (Nagelkerke R^2) of the variance in innovation impact. The *overall model evaluation* and *goodness-of-fit statistics* tests show similar conclusions for the given data set, such that given logistic model with independent variables was more effective than the null model (see Table 5). The inferential goodness-of-fit test, the Hosmer–Lemeshow test of .832 was insignificant ($p > .05$), suggesting that the model was fit to the data well.

Bootstrap was used to perform internal validation. The *p* values obtained for variables in the equation with Sig. 2-tailed values are at a very similar level of statistical significance (see Table 4). Bootstrapping facilitated a straightforward statistical inference by providing a means of accounting for the distortions that might have arisen from small data sample. Clearly, the model reflects goodness-of-fit and is sound to predict effectively.

5.2. Multinomial logistic regression (models 2 & 3)

There is no multicollinearity between the independent variables for models 2 and 3. All numerical errors based on the standard errors on the *parameter estimates* are less than .2 for the two models. The *classification tables* for model 2 (see Table 6) accurately predicted 53.1% with *satisfied* showing the highest prediction of 82.9%. The *classification tables* for model 3 (see Table 7) accurately predicted 56.3% with *highly affected* showing the highest prediction of 84.3%.

The computation of—2 *log likelihood* and the *Akaike's Information Criterion* showed lower value for the final model compared with the intercept only model value, and $p < .05$ indicate statistically significant improvement in the model's fit (Tabatchnick & Fidell, 2007) and significant contribution of the independent variables to the outcome of model 2 (Table 8) and model 3 (Table 9).

The models adequately fit the data and do not duplicate the observed frequencies at any of the outcome levels (Tabatchnick & Fidell, 2007) since there is *goodness-of-fit* of the models with

Table 6. Predictions of the innovation satisfaction (Model 2)

Classification

	Predicted				
Observed	**Very satisfied**	**Satisfied**	**Neutral**	**Dissatisfied**	**Per cent correct (%)**
Very satisfied	34	6	0	1	82.9
Satisfied	20	16	0	0	44.4
Neutral	10	2	0	2	0.0
Dissatisfied	3	2	0	2	28.6
Overall percentage	68.4	26.5%	0.0	5.1	53.1

Table 7. Predictions of the employee productivity (Model 3)

Classification

	Predicted				
Observed	**Highly affected**	**Moderately affected**	**Less affected**	**Neutral**	**Per cent correct (%)**
High impact	43	7	0	1	84.3
Moderate impact	22	8	1	1	25.0
Less impact	2	3	1	0	16.7
Neutral	5	0	0	2	28.6
Overall percentage	75.0%	18.8%	2.1%	4.2%	56.3

Pearson and Deviance chi-squares statistics of p values > 0.05. The *effect size* of the models (see Table 10) that assesses their fitness explains 32% of the proportion of variation of model 2 and 29% for model 3 (see Table 10).

The *likelihood ratio tests* (Table 11) shows *innovation_service_consistency*, *NewOrImproved_Process*, and *NewOrImproved_Product* contribute significantly ($p < 0.05$) to model 2. *Innovation_impact* and *innovation_satisfaction* (Table 11) contribute significantly ($p < 0.05$) to model 3.

Based on the parameter estimates (see Table 12), *NewOrImproved_Process* is more likely to contribute the highest (34.9) to *innovation_satisfaction* than the rest for model 2. For model 3, high *innovation_impact* is more likely to contribute the highest (28.7) to *employee_productivity* (see Table 13).

5.3. Validation of the logistic regression

Bootstrap was performed to assess internal validity of the logistic regression analysis results to determine whether it can be extended to the population the sample has not been chosen from. The p values obtained for Variables in the Equation (innovation_impact) and Bootstrap for Variables in the Equation (innovation_impact) with Sig. two-tailed values are at a very similar level of statistical significance (see Table 4). Bootstrapping facilitated a straightforward statistical

Table 8. Model fitting information: innovation satisfaction (model 2)

	Model fitting criteria			Likelihood ratio tests		
Model	**AIC**	**BIC**	**−2 Log likelihood**	**Chi-square**	**df**	**Sig.**
Intercept only	93.518	101.273	87.518			
Final	77.361	108.381	53.361	34.157	9	.000

Table 9. Model fitting information: employee productivity (model 3)

	Model fitting criteria			Likelihood ratio tests		
Model	**AIC**	**BIC**	**−2 Log Likelihood**	**Chi-square**	**df**	**Sig.**
Intercept only	79.991	87.684	73.991			
Final	64.226	87.305	46.226	27.765	6	.000

Table 10. Innovation satisfaction (model 2) & employee productivity (model 3)

	Goodness-of-fit						Pseudo R-square		
	Chi-square	**df**	**Sig.**	**Chi-square**	**df**	**Sig.**		**Model 2**	**Model 3**
	Model 2	Model 2	Model 2	Model 3	Model 3	Model 3	Cox and Snell	.294	.251
Pearson	25.273	24	.391	21.288	15	.128	Nagelkerke	.324	.285
Deviance	23.856	24	.470	20.114	15	.168	McFadden	.145	.136

Table 11. Likelihood ratio tests of employee productivity & innovation satisfaction models

Likelihood ratio tests

Model 2					Model 3				
Effect	**−2 Log likelihood of reduced model**	**Chi-square**	**df**	**Sig.**	**Effect**	**−2 Log likelihood of reduced model**	**Chi-Square**	**df**	**Sig.**
Intercept	64.976	11.615	3	.009	Intercept	53.648	7.422	3	.060
Service_Consistency	71.052	17.691	3	.001	Innovation_impact	54.162	7.936	3	.047
NewOrImproved Process	63.812	10.451	3	.015	Innovation satisfaction	64.676	18.450	3	.000
NewOrImproved Product	68.354	14.993	3	.002					

Table 12. Parameter estimates of innovation satisfaction (Model 2)

Parameter estimates

								95% Confidence interval for Exp(*B*)	
Innovation satisfaction level		***B***	**Std. error**	**Wald**	**df**	**Sig.**	**Exp(*B*)**	**Lower bound**	**Upper bound**
Very satisfied	Intercept	4.439	1.843	5.798	1	.016			
	Service_Consistency	−1.836	.658	7.782	1	.005	.159	.044	.579
	NewOrImproved_Process	3.322	1.233	7.255	1	.007	27.721	2.471	310.965
	NewOrImproved_Product	−3.226	1.396	5.340	1	.021	.040	.003	.613
Satisfied	Intercept	.442	1.972	.050	1	.823			
	Service_Consistency	−.493	.565	.761	1	.383	.611	.202	1.849
	NewOrImproved_Process	3.553	1.334	7.092	1	.008	34.917	2.555	477.181
	NewOrImproved_Product	−1.034	1.372	.568	1	.451	.356	.024	5.236
Neutral	Intercept	3.317	2.069	2.569	1	.109			
	Service_Consistency	−1.799	.813	4.894	1	.027	.166	.034	.815
	NewOrImproved_Process	1.955	1.222	2.560	1	.110	7.061	.644	77.411
	NewOrImproved_Product	−1.592	1.521	1.096	1	.295	.203	.010	4.008

Note: The reference category is: Dissatisfied for split file (Model 2).

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Table 13. Parameter estimates of employee productivity (Model 3)

Parameter estimates

								95% Confidence interval for Exp(*B*)	
Innovation impact on employee productivity & satisfaction		***B***	**Std. error**	**Wald**	**df**	**Sig.**	**Exp(*B*)**	**Lower bound**	**Upper bound**
High impact	Intercept	−2.087	1.902	1.204	1	.273			
	Innovation_Impact	3.358	1.401	5.745	1	.017	28.727	1.844	447.472
	Satisfaction_Level	.724	.759	.909	1	.340	2.063	.466	9.140
Moderate impact	Intercept	−3.418	1.922	3.161	1	.075			
	Innovation_Impact	2.654	1.331	3.975	1	.046	14.204	1.046	192.923
	Satisfaction_Level	1.554	.769	4.080	1	.043	4.731	1.047	21.370
Less impact	Intercept	−5.607	2.422	5.358	1	.021			
	Innovation_Impact	1.087	1.537	.500	1	.479	2.964	.146	60.231
	Satisfaction_Level	2.259	.886	6.496	1	.011	9.571	1.685	54.362

Note: The reference category is: Neutral for split file (Model 3).

Table 14. Number of banks worked for * number of years worked for the bank

Crosstabulation

			Number of years worked for the bank			
			Less than 1 Year	1–3 Years	Over 3 Years	Total
Number of banks worked for	1	Count	3	29	35	67
		% of total	3.2%	30.5%	36.8%	70.5%
	2	Count	1	8	13	22
		% of total	1.1%	8.4%	13.7%	23.2%
	3	Count	0	1	4	5
		% of total	0.0%	1.1%	4.2%	5.3%
	4	Count	0	0	1	1
		% of total	0.0%	0.0%	1.1%	1.1%
Total		Count	4	38	53	95
		% of total	4.2%	40.0%	55.8%	100.0%

inference by providing a means of accounting for the distortions that might have arisen from small data sample. Clearly, the models reflect goodness-of-fit and are sound to predict effectively.

5.4. Descriptive statistics

Table 14 shows the number of banks respondents has worked for and years they were engaged in each employment. Table 15 shows the main advantages employees consider innovation has brought to their professional daily activity.

Table 14 shows that most of the employees have worked for their banks over 3 years, (55.8%) which might mean that they are conversant with the trend of innovation in their firms. Moreover, 70.5% of respondents have worked consistently for one particular bank. These would have helped them to decide how innovation has contributed to their daily professional roles. About 89.8% (see Table 15) indicated the range of services their banks offer are consistent with the latest innovations in banking services. In addition, 67.3% of respondents found *efficiency* as the main advantage that innovation has brought in performing their daily professional roles.

Efficiency that results from new or significantly improved product or process contributes to improved *employee productivity*. Table 12 confirms this as participants indicated very high satisfaction with product and process innovation. From Table 16, 82.7% of the respondents indicated technological innovation has impacted positively on their banks' profitability over the last 2 years.

Table 15. The range of services the bank offers is consistent with the latest innovations in banking services

Frequencies

		Frequency	Per cent	Valid Per cent	Cumulative %
Valid	Strongly agree	62	63.3	63.3	63.3
	Agree	26	26.5	26.5	89.8
	Neutral	7	7.1	7.1	96.9
	Disagree	3	3.1	3.1	100.0
	Total	98	100.0	100.0	

Table 16. Impact of technological innovation on profitability

Frequencies

		Frequency	Per cent	Valid per cent	Cumulative per cent
Valid	Positively	81	82.7	82.7	82.7
	Negatively	4	4.1	4.1	86.7
	Neutral	9	9.2	9.2	95.9
	Do not know	4	4.1	4.1	100.0
	Total	98	100.0	100.0	

6. Discussion and concluding remarks

Banks are maximizing their IT-technological innovation capabilities as unique and valuable resources to provide high-quality innovative outputs that drive efficiency, increase the satisfaction level of employees, improve employee productivity, and generate better returns on capital. Management of these banks discretionary devise technology-driven strategies as part of their core strategies to leverage trends in information technology to pursue technological innovation. Our study seems to be of great relevance since it focuses on the impact of IT-technological innovation on the productivity of banking employees and specific factors that influence banking employee' productivity.

Using Logistic Regression models, the effects of IT-technological innovation on the productivity of employee, innovation impact and satisfaction levels of employees with technological innovation were examined at the branch level of seven (7) universal banks in Ghana. Findings are not absolute fact, rather the broader opinions of banking employees with respect to the effects of IT-technological innovation on their productivity. Although, "opinions are subjective information which represents user's sentiments" (Mishra & Jha, 2012:1), however, a response rate of 59.39% would guarantee the result that reflects the views of respondents (Nulty, 2008).

6.1. Key findings

The correlation between dependent variables did contribute significantly: innovation_impact and employee_productivity (.001), innovation_impact and innovation_satisfaction (.033), employee_-productivity and innovation_satisfaction (.047). The casewise list did not produce any outlier making the models reasonably sound. The process (p = .026), risk_management (p = .028), and employee_productivity (p = .007) variables were statistically significant in *model 1* that tests the positive effects of innovation in certain areas of a bank. The highest positive effect of innovation in the banks is on *process* (p < .05). For one unit of innovation enhancement, process is 39 more times likely to improve. A unit increase in *NewOrImproved_Process* is more likely to result in *innovation_satisfaction* increasing 35 times. Where *innovation_impact* is very high, *employee_Productivity* is more likely to increase 29 times. In total, 84.3% of respondents indicated they were *highly affected* by innovation initiatives, and 82.7% indicated positive impact of IT-technological innovation on profitability. Among the employees, 55.8% have worked for their banks for over 3 years, while 70.5% have worked consistently for *one* particular bank. Most of the employees (67.3%) are of the view that IT-technological innovation has brought *efficiency* in performing their daily professional roles.

In Obeng and Mkhize (2017a), a survey on firm innovativeness of 542 customers from 7 universal banks was conducted. The same seven universal banks are used in this study. In that study, customers were asked to rate (high, medium, or low) the innovation level of products, channels, customer services, technologies, sales marketing, processes, and business model of their banks. In total, 291 representing 58% of respondents rated customer service as *high*, while 160 representing

32% of respondents rated customer service as *medium*. The rating affirmed a logistic regression odd ratio of service consistency (141.585, *ρ .000*) that influenced customer satisfaction. With such rating, it is presumed employees were efficient in performing their roles that eventually resulted in increased employee productivity.

Our findings suggest that, employees who agree or strongly agree that the range of services their banks offer are consistent with the latest technological innovations in banking industry, and their banks have introduced new or significantly improved product(s) and or process(es) are more likely to know innovation type that has a high positive impact on banking processes. In addition, they are more likely to use innovative product/process in performing their daily professional duties efficiently, are highly satisfied with the role innovation plays, innovation has high impact on their productivity, and work for one bank over a long period.

6.2. Contribution of the study

The major contribution of this study is identifying the effects and interrelationships among the impact of technological innovation, satisfaction level of technological innovation, and employee productivity. Academically, this contributes to the ongoing debate of sources of sustainable competitive advantage relative to the effects of specific resources in an industry (Rivard, Raymond, & Verreault, 2006). For practitioners, this could be beneficial to managers of banking institutions. These managers are provided with more reliable and actionable insights to focus on and delve more deeply into innovation strategies to embark on innovation activities that would improve the competence, operational efficiency, and productivity of their employees. This in turn could result in service offering responsiveness and customer satisfaction.

6.3. Limitations and future research directions

Studying the interrelationships and effects among technological innovation impact, satisfaction level of technological innovation, and employee productivity in banking firms is conceptually interesting. The findings of this study can serve as a guide towards further research in banking services by exploring other innovation options and dimensions of innovation satisfaction and employee productivity. It is recommended that more diversified and exhaustive variables that can address technological innovation, satisfaction level of technological innovation, and employee productivity in banking firms should be considered in the future study. Thus, other methods for collecting data, such as interviews and open-ended questions could be used in future research.

The study focused on the banking industry. This makes the identified dimensions of technological innovation, satisfaction level of technological innovation, and employee productivity not generalizable. Conducting the same study in other financial institutions where technology is utilized could make the findings generalizable across the financial service industries. Moreover, future researchers should use a more representative sampling strategy to generalize the findings.

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Note

1. Grouping of banks based on the book values of total operating assets such as cash and liquid assets – investments, net loans and advances as at 31 December

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Appendix A. Survey question

Financial sector employee productivity

This questionnaire is to establish the role technological innovation plays in the productivity of a bank's employee. *Technological innovation is the introduction of new or significantly improved processes (methods of delivering a service) and products.*

Please tick (√) or provide the appropriate responses in the boxes or spaces provided to each question.

Gender [ ] Male [ ] Female

Age [ ] 18–29 [ ] 30–39 [ ] 40–49 [ ] 50–59 [ ] 60 and above

Education [ ] University [ ] College [ ] Polytechnic Other

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(1) How many banks have you worked for? _____

(2) Please state your current position _____

(3) How long have you worked for this bank? [ ] Less than 1 yr [ ] 1–3 yrs [ ] Over 3 yrs

(4) The range of services your bank offers is consistent with the latest technological innovations in banking services. [ ] Strongly agree [ ] Agree [ ] Neutral [ ] Disagree

(5) Has your bank significantly improved the functionalities of its product(s) or introduced new product (s) since you joined as employee? [ ] YES [ ] NO

(6) Has your bank significantly improved or introduced new operational processes since you joined as employee? [ ] YES [ ] NO

(7) How satisfied are you with your bank's current product(s)/services and process(s) in performing your role?
[ ] Very satisfied [ ] Satisfied [ ] Neutral [ ] Not satisfied

(8) Indicate whether innovation has affected your bank positively in each of the following areas.

Areas	Highly affected	Moderately affected	Less affected	Neutral effect
Products				
Processes				
Service delivery time				
Operational flexibility				
Risks management				
Employee productivity				
Customer service				

(9) As a bank employee, do you think technological innovation has impacted positively on your productivity?
[ ] High impact [ ] Moderate impact [ ] Less impact [ ] Neutral

(10) As a bank employee, what **two** main advantages do you consider technological innovation has brought to your professional daily activity?
[ ] Efficiency
[ ] Motivation
[ ] Quality of output
[ ] Speed to perform role
[ ] Flexibility

(11) How has innovation impacted on your bank's profitability over the last two years?
[ ] Positively [ ] Negatively [ ] Neutral [ ] Don't know

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