BUSINESS INTELLIGENCE AND PERFORMANCE OF THE STANDARD BANK OF SOUTH AFRICA LIMITED

YONNEY ATSU AHLIJAH [a≡*]

[a] Faculty of Computer Science & Engineering, Kings University College, Accra, Ghana.

AUTHOR'S CONTRIBUTION

The sole author designed, analyzed, interpreted and prepared the manuscript.

Original Research Article

ABSTRACT

As the need to quantify the contribution of business intelligence deployment on the optimization of firms in general (and banks in particular) continues to take critical dimension among business and policy makers, this parametric quantitative research investigates the association between business intelligence and performance using 2010 – 2019 (10 years) audited data of the Standard Banks of South Africa Limited. The theoretical underpin of the work is the famous Technology-Organisation-Environment (TOE) theory. The net book values of computer hardware and software measured the technological dimension of the TOE framework). The size (total assets) of Standard Bank of South Africa measured the organisational dimension of the TOE framework. Finally, employees (total personnel cost) measured the environmental dimension of the TOE framework. Profitability and Shareholder value measured the performance of the bank within the period under study. Descriptive and inferential quantitative research analyses were carried out with the aid of the Statistical Package for Social Sciences (SPSS); and the Pearson correlation analysis established that; (i) software investment, bank size, and employee cost have significant positive association with profitability and shareholder value; (ii) hardware investment has significant negative association with profitability and shareholder value; and (iii) Employee quality (staff cost) has the highest significant positive effect on both profitability and shareholder value. The relevance of the TOE theory is established in this study; and the need for banks to optimize their TOE investment mix in order to maximize their profitability and shareholder value was stressed. The study recommends that further comparative studies within and across industries and countries to be carried out for better generalization of the findings of this work or vice versa.

Keywords: Business intelligence; bank size; employee cost; hardware cost; profitability; shareholder value; software cost.

1. INTRODUCTION

Standard Bank of South Africa Limited is the largest Bank in South Africa in terms of size or total assets (R1,550 billion) with market share of 24.0% as recorded by the Prudential Authority of South Africa for March 2021 [1]. As at close of business in December 2019, Standard Bank of South Africa Limited technology – organization - environment indicators stood as R2,164,000,000 for hardware investment; R16,112,000,000 for software investment; R1,480,746,000,000 for total assets; R106,717,000,000 for shareholder value; R22,817,000,000 for staff cost; and R16,860,000,000 for profit for the year [2].

The quantification of business intelligence studies has remained at infant stage due to multiplicity of factors (majority of the reviewed works are exploratory, qualitative, and lack specific theoretical frameworks); firms and business intelligence practitioners are at real lost on the actual role of business intelligence on firm performance [3]. This does not negate the established facts that business intelligence has improved data gathering, storing, accessing, analysing and decision-making in exponential terms [4,5]. It is equally important to add that Business Intelligence (BI) plays salient role in detecting, mitigating and managing banking risks across global banking sectors [6]. Despite the numerous merits of BI enumerated by Popovič, Turk and Jaklič [3], Fink, Yogev and Even [7], Brynjolfsson, Hitt and Kim [8] and Rama, Zhangb and Koroniosc [9], the demand by Lyke-Ho-Gland [11] that the role of business intelligence on firm performance indicators (such as profitability, shareholder value, value added, revenue, cost, and customer retention) is not fully answered. While Wahua and Ahlijah [11] and Ahlijah [12] have studied profitability, bank size, value added, and revenue, there is still much ground to cover in terms of cost and shareholder value. This quantitative study is an attempt to narrow the gap in literature by using the biggest bank in South Africa as a case study. The study wonders if investment in BI technology really worth it in terms of banking maximization of profit and shareholder value.

This parametric research primarily aimed at investigating the association between the TOE theoretical framework with performance of Standard Bank of South Africa with emphasize on profitability and shareholder value using data from the banks' audited annual financials from 2010 – 2019. Operationally, the study answered the following salient questions:

R1: Does computer hardware Investment have significant association with profitability and shareholder value of Standard Bank of South Africa Limited?

R2: What kind of association exists between computer software investment with profitability and shareholder value of Standard Bank of South Africa Limited?

R3: How does the size of Standard Bank of South Africa Limited associate with its profitability and shareholder value?

R4: Does staff cost have significant association with profitability and shareholder value of Standard Bank of South Africa Limited?

2. LITERATURE REVIEW

2.1 Theoretical Framework

The TOE (technology-organization-environment) of Tornatzky and Fleischer (1990) anchors this study. Lautenbach, Johnston and Adeniran-Ogundipe [13], Lebied [14] and Micheni [15] also adopted the TOE framework in their studies. Ahlijah [12] defined business intelligence as an integrated concept covering computer hardware, computer software applications, organisational factors, and environmental factors.

The theoretical framework guiding this study (Fig. 1) is TOE theory; and its three subsets (technology, organization, environmental) were empirically linked with bank performance (measured by profitability, and shareholder value). Technological factors are hardware and software investments; organisational factor is bank size; and environmental factor is corporate social responsibility investment.
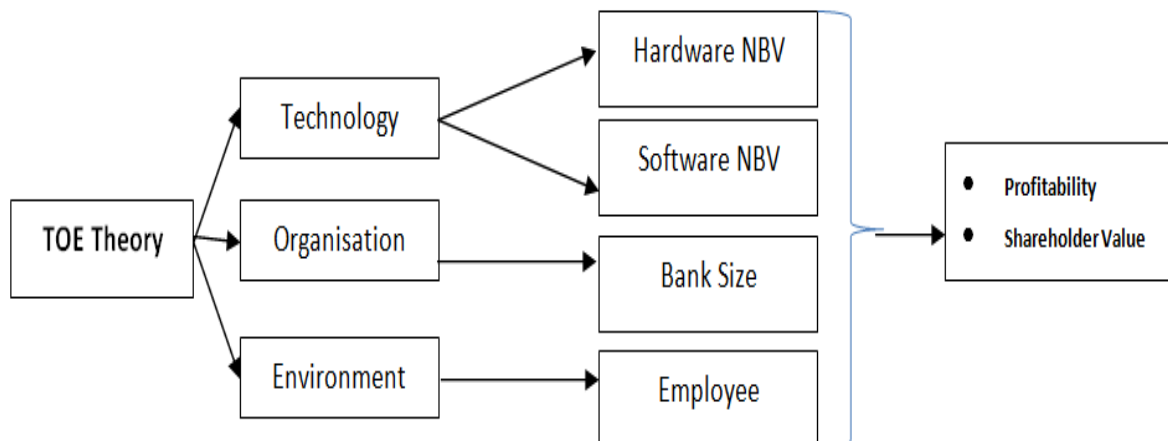

Fig. 1. Theoretical framework diagram
(Source: Author)
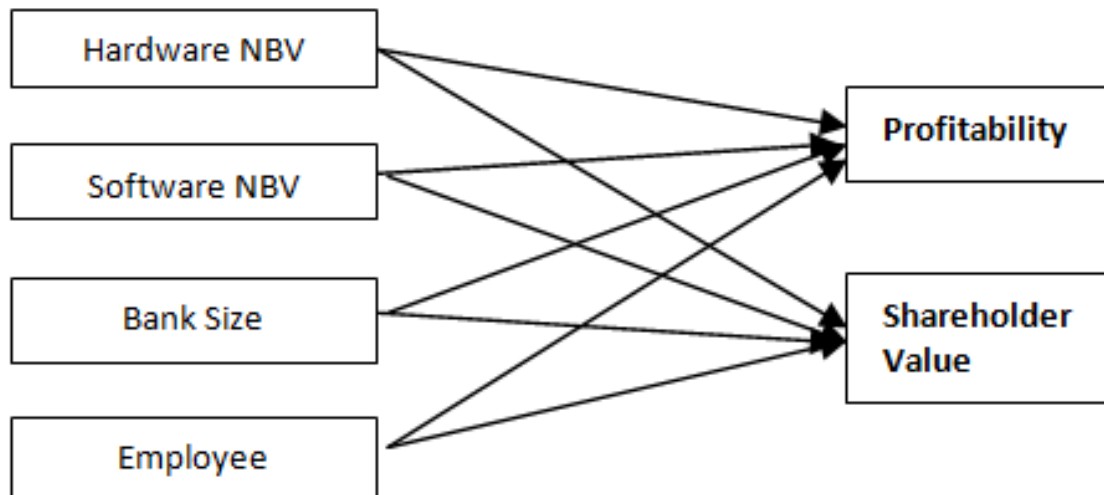
2.2 Conceptual Framework

Fig. 2. Conceptual framework diagram
(Source: Author)

The conceptual framework (Fig. 2) is in sync with the TOE framework: net book values of computer hardware and software, bank size, and employee quality are the independent variables. Profitability and shareholder value are the dependent variable. Net book values of computer hardware and software represent the technological dimension of the TOE framework. Bank size represents the organizational dimension of the TOE framework. Finally, employee represents the environmental dimension of the TOE framework. Profitability and shareholder value represent the performance indicators captured in this study. In a nutshell therefore, Fig. 2 (Conceptual framework) x-rays the impacts of the elements of the TOE framework on the performance of Standard Bank of South Africa Limited using overall measure of efficiency (profitability), and major aim of businesses (maximization of shareholders' interests). Sub-sections 2.2.1 to 2.2.4 explains the concepts captured in Fig. 2 in details.

2.2.1 BI technology (hardware and software)

Wahua and Ahlijah [12] measured business intelligence technology with computer hardware and software. Fink, Yogev and Even (2016) stated that business intelligence infrastructure represents the physical aspect of BI assets; and the deployment of business intelligence hardware and software helps organisations to make optimize strategic decision-making with the aid of analytics. The combination of these infrastructural technologies and tools creates a technological environment that enables organizations to develop business intelligence capabilities, leading to better decision making and improved organizational performance [7].

2.2.2 Bank size

The size of an organisation constitutes an integral part of organizational dimension of TOE [16]. Idowu and Osofisan [17] are of the view that the size of an organisation acts as a slack resource in their adoption and implementation of business intelligence technology. Oracle White Paper [18] asserted that larger firms possess more influencing authority to urge partners to adopt/implement business intelligence technology. Jain and Pandey [19] added that bigger firms have more capacities than smaller firms in achieving economies of scale derivable from business intelligence, and bearing the high risk associated with early stage investment in BI projects.

2.2.3 Firm environment

According to Ahmad [20], corporate social responsibility and sustainability concepts have little or no relevance on the environment if they do not improve the quality of human lives; and one way businesses better human dignity is by promoting the dignity of labour with appropriate pay. Firms shape and reshape their operating environments through policies, programs and practices aimed at improving the aggregate environmental climate as well as human population [21].

2.2.4 Bank performance – profitability and shareholder value

The performance of banks (just like other firms) could be measured with numerous indicators including profitability and shareholder values [22]. While profitability is a measure of overall efficiency of a business entity [23], shareholder value is the bottom-line interest shareholders have in their firms [24]. In the words of Hayes [25], profitability and shareholder are economic value that a business adds to its products/services. Fink, Yogev and Even [7] concluded that profit and shareholder-value maximization are among the indicators of measuring business intelligence value creation.

2.3 Empirical Review

Namisiko, Munialo and Nyongesa [26] stated that the technology dimension of TOE covers the cost of technology as well those of technological competence. The technology resources at the disposal of organisations reflect how competent they are technologically; these include the technical infrastructure, the technically-competent employees, internet connections, and bandwidth [15]. The capability of an organisation to adopt and execute business intelligence architecture depends on the availability of computers with adequate physical memory, processors, middleware, and integrated tools for data gathering, processing, warehousing and dissemination [27]. Business intelligence in internet based, as such, firms considering deploying BI technology should factor in internet connections with adequate bandwidth [28]. The external technologies are made up of BI software, internet service providers, power supplies and security [15]. Awa, Ukoha and Emecheta [16] stated that the organizational dimension of Technology Organization Environment (TOE) theory includes the innovation, top-managerial assistance, human resource capacity/quality, culture and size of an organisation. Micheni [15] stated that the environmental dimension of Technology Organization Environment (TOE) theory includes those factors that are related or inherent to an organizations' operating environment and consists of its stakeholders such as shareholders, government, the community, the press, the employees, the customers, the creditors, and other categories of stakeholders. Angeles [29] stated that the environmental dimension of Technology Organization Environment (TOE) theory has the capacity to engineer and re-engineer an organizations' interpretation of business innovation; the organizations' capacity to deploy the wherewithal needed for innovative purposes; and the organizations' strong-will to implement innovations based on business intelligence best practices.

Lautenbach, et al. [13] examined the factors influencing the use of business intelligence and data-driven decisions (analytics) within organisations in South Africa. The study adopted a positivist paradigm and quantitative research methodology. They used survey (questionnaire) in gathering data and the study applied technology-organisation-environment (TOE) theoretical framework. The independent variables are data infrastructure, data management, talent management, external market, and regulatory compliance while the dependent variables are business intelligence and analytics usage extent. The result established that data infrastructure, top management support, and external market have significant influence on South African organizations' adoption of business intelligence in data driven decision making. They recommended that further studies should empirically test the impacts of data Infrastructure, top management support, and external market influence on organisational performance.

Fink, Yogev and Even [7] attempted to bridge the gap between Information Technology (IT) value creation and Business Intelligence (BI) using three (3) Israeli firms. The research was an exploratory-quantitative research and based on resourced-based theoretical framework. Data was collected using survey questionnaire and interview. The independent variables are general information technology asset and specific business intelligence assets (hardware, software, business intelligence employees) while the dependent variable is value creation. The study established that business intelligence (hardware, software, and BI employees) create business value for Israeli firms. It is the recommendation of the authors that further studies should be objective and use longitudinal data, specific industry/firm factors, and more sample size. Přikrylová [30] analyzed selected scientific research papers related to business intelligence framework in order to establish the role of BI in marketing decision-making processes in Czech Republic. The study was a qualitative research; had no theoretical underpin; and applied content analysis as a data gathering technique. The independent variable is business intelligence models while marketing decisions is the dependent variable. The research found out that well-structured business intelligence models support effective marketing decision-making processes in Czech Republic firms. The author is of the view that further studies should incorporate external variables in studying business intelligence implementation for effective decision-making. Rama, et al. [9] examined the role and implication of Big Data analytics on business intelligence among selected Chinese firms using questionnaire as a data collection tool. The study was an exploratory-qualitative one but has no specific

theoretical framework. Big data analytics is the independent variable while business intelligence is the dependent variable. They researchers found out that Big Data analytics offers multitude of opportunities to enhance business value and productivity for Chinese firms. They suggested that further studies should apply quantitative approach to this study using longitudinal data.

Micheni [15] examined the adoption of business intelligence in teaching/learning technique among institutions of higher learning in Kenya using exploratory-qualitative research approach. The study applied the technology-organisation-environment (TOE) theoretical model and based on extensive review of literature. The author established that the TOE framework is appropriate for the technological adoption of cloud computing in institutions of higher learning in Kenya, and recommended that further studies should combine the TOE framework with other existing theories on technology adoption. Oei [31] sought to find out the factors that determine acceptance of operational business intelligence by organisations in Netherlands using qualitative research approach and the Unified Theory of Acceptance and Use of Technology (UTAUT). The results of the investigation revealed that operational core, techno-structure and middle management are the key influencers of operational business intelligence acceptance among firms in Netherlands. The author advised that further studies should empirically apply the UTAUT model in order to establish generalization from its results.

Johansson and Nilsson [32] assessed business intelligence practices in large Swedish organizations using qualitative research method with interviews. The study was not theoretically grounded. The authors developed a Business Intelligence Assessment Framework (BIAF); and used it to establish that large Swedish organisations are generally at fair in implementing business intelligence best practices. They recommended that there is need to empirically establish business intelligence values and tangible benefits while integration external variables. They observed that many business intelligence publications are linked to institutions with commercial interest in BI (example BI consultancy firms or vendors); as such, these biased publications majorly focus on the description and promotion of business intelligence applications, and they summed up that business intelligence research is still at its developing phase. Amoako [33] investigated if the adaptation of business intelligence systems can help the Electricity Company of Ghana (ECG) in its strategic decision-making. It was a qualitative research and based on no

specific theoretical framework. Data was collected using interviews. The independent variable is business intelligence adoption while strategic decision making is the dependent variable. The study revealed that business intelligence or any similar system is not adopted by the Electricity Company of Ghana though the company creates huge data through its operations. It is the considered opinion of the author that business intelligence implementation at the Electricity Company of Ghana and its influence on decision-making and work culture of users should be studied.

3. RESEARCH METHODOLOGY

3.1 Research Design and Method

Descriptive quantitative research design was applied in this study in order to establish the association between different proxies of TOE framework used in this study and bank performance (as measured with profitability and shareholder value). This is in sync with the position paper presented by USC Libraries [34]. Babbie [35] and Kefas [36] are of the view that pure quantitative research (such as this one) seek correlation, relationships and attempt to control the environment in which the data is collected (in order to avoid the risk of non-studied variables accounting for the relationships identified).

3.2 Population and Sampling Procedures

This research covers all branches of the Standard Bank South Africa Limited; and the audited annual data from its 2010 – 2019 annual reports is for all the branches of the bank in South Africa. Therefore, the study covered the entire population (application of census sampling method). Ankomah [37], Wahua [11], Wahua and Ahlijah [12] and Ahlijah (2021) adopted this approach.

3.3 Data Collection Process and Analysis Technique

Data were collected from the audited annual reports of the bank within the period 2010 – 2019; and documented in a Checklist for completeness. Audited annual reports imply that the validity and reliability of the data is confirmed by the external auditors, who placed seals of independence on the annual reports. Wahua and Yonney [12], Roozitalab and Sayadi [38] and Lautenbach, et al. [13] followed this method. Pearson correlation analysis was used in testing the research questions.

3.4 Operationalization of Research Variables

The independent and dependent variables used in this study were quantitatively measured as summarised in Table 1 (Summary of research variables operationalization). Computer hardware and software were measured by their yearly net book balances; bank size was measured by total assets; personnel cost was measured by annual staff cost; profitability was measured by annual profit for the year; and shareholder value was measured by annual share capital plus reserves.

Table 1. Summary of research variables operationalization

Variable	Proxies	Measurement	Sources
Independent	Hardware	yearly net book balance	Lasi and Tessin (2012)
	Software	yearly net book balance	Wehner [39]
	Bank Size	total assets of the bank	Beridze. 2016
	Personnel	annual staff cost	Wahua and Ezeilo [40]
Dependent	Profitability	annual profit for the year	Borad (2018)
	Shareholder Value	share capital plus reserves	Ajide and Aderemi (2014)

Source: Compiled by the Author

3.4.1 Test of Normality Assumption

Table 2. Test of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Hardware	.207	10	.200[*]	.901	10	**.227**
Software	.256	10	.062	.851	10	**.060**
Size	.204	10	.200[*]	.949	10	**.661**
Staff Cost	.192	10	.200[*]	.906	10	**.254**
Shareholder Value	.147	10	.200[*]	.936	10	**.505**
Profitability	.168	10	.200[*]	.977	10	**.947**

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Source: Author (2021)

This descriptive quantitative research requires parametric test (example, Pearson correlation analysis); as such, the dependent variables should be drawn from a normal distribution (Laerd Statistics, n.d.; Wahua, [39]). The Shapiro-Wilk Tests is the normality test that fits into this study as it is the most appropriate when the sample size is not more than 2000 [41].

Table 2 contains the results of the Shapiro-Wilk Normality test carried out; and it shows that all the variables have nonsignificant p-values (all the significance values are greater than 0.05). Therefore, the basic parametric assumption is met [22].

4. DATA ANALYSIS

4.1 Descriptive Statistics

The descriptive statistics of all the variables covered in this study are contained in Table 3. The Standard Bank South Africa Limited operated under a healthy environment (positive risk management) as the mean

(benefits derived from) of all the variables surpassed their risk returns (standard deviation). The percentage change in range indicates that software investment witnessed the highest increase within 2010 – 2019 (341%), followed by shareholder value and profitability (124% and 122% respectively). Computer hardware investment was the least (25%).

4.2 Test of Research Specific Research Questions

R1: Does computer hardware Investment have significant association with profitability and shareholder value of Standard Bank of South Africa Limited?

R2: What kind of association exists between computer software investment with profitability and shareholder value of Standard Bank of South Africa Limited?

R3: How does the size of Standard Bank of South Africa Limited associate with its profitability and shareholder value?

Table 3. Descriptive statistics of the variables

	N	Minimum	Maximum	Range	Range	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	%Δ	Statistic	Statistic
Hardware	10	2,164,000,000.00	2,698,000,000.00	534,000,000.00	**24.68**	2,404,400,000.00	193,228,247.30
Software	10	4,372,000,000.00	19,262,000,000.00	14,890,000,000.00	**340.58**	14,012,500,000.00	5,220,724,923.06
Size	10	820,701,000,000.00	1,480,746,000,000.00	660,045,000,000.00	**80.42**	1,152,214,400,000.00	218,578,390,224.55
Staff Cost	10	10,920,000,000.00	22,817,000,000.00	11,897,000,000.00	**108.95**	17,174,700,000.00	4,588,585,258.85
Shareholder Value	10	47,614,000,000.00	106,717,000,000.00	59,103,000,000.00	**124.13**	81,906,200,000.00	20,049,732,017.05
Profitability	10	7,611,000,000.00	16,860,000,000.00	9,249,000,000.00	**121.52**	12,335,800,000.00	2,847,942,836.50

Source: Author (2020)

Table 4. Pearson correlation analysis

		Hardware	Software	Size	Staff Cost	Shareholder Value	Profitability
Hardware	Pearson Correlation	1	-.706*	-.904**	-.891**	**-.818****	**-.845****
	Sig. (2-tailed)		.023	.001	.001	**.004**	**.002**
Software	Pearson Correlation		1	.848**	.835**	**.907****	**.746***
	Sig. (2-tailed)			.002	.003	**.001**	**.013**
Size	Pearson Correlation			1	.973**	**.968****	**.945****
	Sig. (2-tailed)				.001	**.001**	**.001**
Staff Cost	Pearson Correlation				1	**.971****	**.947****
	Sig. (2-tailed)					**.001**	**.001**
Shareholder Value	Pearson Correlation					**1**	**.942****
	Sig. (2-tailed)						**.001**
Profitability	Pearson Correlation						1
	Sig. (2-tailed)						

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Source: Author (2021)

R4: Does staff cost have significant association with profitability and shareholder value of Standard Bank of South Africa Limited?

Research Questions 1 – 4 were tested simultaneously with the aid of Pearson correlation analysis (a parametric quantitative test); and the results are contained in Table 4.

Table 4 contains the results of the Pearson correlation analysis carried out to test the research questions put forward in this study. Research Questions 1 – 4 were tested simultaneously; and the findings reveal that:

i. Computer hardware investment has 82% and 85% significant negative association with profitability and shareholder value of Standard Bank of South Africa Limited respectively at 99% confidence level (1% error margin). The statistical import of this is that as investment in computer hardware increases, profitability and shareholder value of Standard Bank of South Africa Limited decrease.

ii. Computer software investment has 91% and 75% significant positive association with profitability and shareholder value of Standard Bank of South Africa Limited respectively at 99% and 95% confidence levels respectively (1% and 5% error margins respectively). The statistical import of this is that as investment in computer software increases, profitability and

shareholder value of Standard Bank of South Africa Limited increase.

iii. The size of Standard Bank of South Africa Limited has 97% and 95% significant positive association with its profitability and shareholder value at 99% confidence levels (1% error margins). The statistical import of this is that as size of Standard Bank of South Africa Limited increases, its profitability and shareholder value increase.

iv. The Staff cost of Standard Bank of South Africa Limited has 97% and 95% significant positive association with its profitability and shareholder value at 99% confidence levels (1% error margins). The statistical import of this is that as staff quality of Standard Bank of South Africa Limited increases, its profitability and shareholder value increase.

5. DISCUSSION AND CONCLUSION

5.1 Discussion of the Findings

This study holds that net book value of computer hardware has significant negative association with the performance of Standard Bank of South Africa. This is in agreement with the work of Wahua and Ahlijah [12] who also established that computer hardware cost (measured by annual depreciation cost) had significant negative effect on the performance of top banks in the Economic Community of West African

States (ECOWAS). This finding also aligns with that of Owusu [42] who empirically established that computer hardware cost has significant negative impact on the performance of firms in Ghana. Conversely, the finding of Ahlijah (2021) negates this findings as it revealed that computer hardware cost (measured by net book value) has significant positive effect on the performance of GCB Bank (Ghana) Limited.

Ahlijah (2021) and Wahua and Ahlijah [12] agree that computer software cost/investment, organisational size, and organisational environmental variables do have significant positive effects on firm performance. This position also holds in this study as it has been empirically established that computer software investment, bank size, and bank personnel quality (environmental variable) do have significant positive effects on the performance of Standard Bank of South Africa Limited. In conclusion, Kaplan and Norton [43] specifically established that business intelligence helps firms in significantly optimizing their operating efficiencies; and this is This is strongly supported by Lyke-Ho-Gland [10] and Sclater, Webb and Danson [44].

5.2 Implications of the Findings

Theoretically, the technological dimension of the TOE framework has both positive (software) and negative (hardware) associations with the performance of Standard Bank of South Africa Limited for the period 2010 – 2019. The organizational and environmental dimensions have significant associations with the performance of the bank within the time under study. It is apt therefore to conclude that the TOE theory is relevant in this study as all the variables have significant association with the performance of the bank.

Practically, the bank should monitor its hardware investment for optimum maximization of its profitability and shareholder value. This is very important as hardware investment/cost has significant negative association with its performance. Since software, size, and personnel quality has significant positive associations with the performance indicators used here, the bank should remain focus in sustaining its strategy on these three variables.

The policy implication of this study demands that Standard Bank of South Africa Limited should improve on its data-driven decision making process for the purpose of optimizing its investments on computer hardware, software, and people for the puspose of increasing its performance indicators like profitability, shareholder value and total assets (size).

5.3 Conclusion

As the need to quantify the contribution of business intelligence deployment on the optimization of firms in general (and banks in particular) continues to take critical dimension among business and policy makers, this parametric quantitative research investigates the association between business intelligence and performance using 2010 – 2019 (10 years) audited data of the Standard Banks of South Africa Limited. The theoretical underpin of the work is the famous technology-organisation-environment (TOE) theory. The net book values of computer hardware and software measured the technological dimension of the TOE framework). The size (total assets) of Standard Bank of South Africa measured the organisational dimension of the TOE framework. Finally, employees (total personnel cost) measured the environmental dimension of the TOE framework. Profitability and Shareholder value measured the performance of the bank within the period under study. Descriptive and inferential quantitative research analyses were carried out with the aid of the statistical package for social sciences (SPSS); and the Pearson correlation analysis established that; (i) software investment, bank size, and employee cost have significant positive association with profitability and shareholder value; (ii) hardware investment has significant negative association with profitability and shareholder value; and (iii) Employee quality (staff cost) has the highest significant positive effect on both profitability and shareholder value. The relevance of the TOE theory is established in this study; and the need for banks to optimize their TOE investment mix in order to maximize their profitability and shareholder value was stressed. The study recommends that further comparative studies within and across industries and countries to be carried out for better generalization of the findings of this work or vice versa.

5.4 Further Research

The study recommends comparative studies within and across industries and countries to be carried out for the purpose of validating the findings herein. This study centred on a single bank; as such, there is need for a comparative study using other big players in African banking industry.

5.5 Disclaimer

Ethically, the results of the study are true reflection of the data analysed with the aid of statistical package for social sciences (SPSS). No data manipulation was carried out. The Author has declared that no competing interests exist. The secondary data used in this research are commonly and predominantly used

in Author's area of research and country. There is absolutely no conflict of interest between the Author and Standard Bank of South Africa Limited to warrant any litigation as the data is purely used for the advancement of knowledge. Also, the research was not funded by Standard Bank of South Africa Limited; but, by personal effort of the Author.

ACKNOWLEDGEMENT

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Businesstech How South Africa's 5 biggest banks continue to dominate; 2021.
Available:fhttps://businesstech.co.za/news/ban king/506740/how-south-africas-5-biggest-banks-continue-to-dominate/

2. Standard Bank of South Africa Limited. The standard bank of South Africa annual report 2019; 2020.
Available: https:// reporting.standardbank.com/

3. Popovič A, Turk T, Jaklič J. Conceptual model of business intelligence systems. Management Journal. 2015;15(1):5-30.

4. Wixom B, Watson H. The BI-based organisation. International Journal of Business Intelligence Research. 2010;1(1):13-28.

5. Davenport TH. BI and organizational decisions. International Journal of Business Intelligence Research. 2010;1(1):1-12.

6. Lorenzetti C.(2010) Business intelligence systems in the financial industry. Available:https://www.politesi.polimi.it/bitstre am/10589/6123/1/2010_12_Lorenzetti.pdf

7. Fink L, Yogev N, Even A. Business intelligence and organizational learning: An empirical investigation of value creation processes. Information and Management. 2017;54(1):38-56.

8. Brynjolfsson E, Hitt LM, Kim HH. Strength in numbers: how does data-driven decision-making affect firm performance?; 2011.
Available:http://ssrn.com/abstract=1819486

9. Rama J, Zhangb C, Koroniosc A. The implications of big data analytics on business intelligence: A qualitative study in China. Procedia Computer Science. 2016;86(1):221-226.

10. Lyke-Ho-Gland. Three measures for capturing the value of data-driven decisions; 2017.
Available:https://searcherp.techtarget.com/tip/ Three-measures-for-capturing-the-value-ofdatadriven-decisions.

11. Wahua L. Banks' governance, country institutions, and capital adequacy in Nigeria. Asian Journal of Arts, Humanities and Social Studies. 2020;3(1):1-14.

12. Wahua L, Ahlijah Y. Business intelligence costs and firm performance: Evidence from top selected ECOWAS' banks. Journal of Economics and Trade. 2020;5(1):1-17.

13. Lautenbach P, Johnston K, Adeniran-Ogundipe T. Factors influencing business intelligence and analytics usage extent in South African organisations. South African Journal of Business Management. 2017;48(3):23–33.

14. Lebied M. Why data driven decision making is your path to business success; 2017.
Available:
https://www.datapine.com/blog/data-driven-decision-making-in-businesses/

15. Micheni EM. Diffusion of big data and analytics in developing countries; 2015. Corpus ID: 167872804.
DOI: 10.6084/M9.FIGSHARE.1517092.V1.

16. Awa HO, Ukoha O, Emecheta BC. Integrating TAM and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. Informing Science & IT Education Conference (InSITE). Informing Science Institute; 2012.

17. Idowu SA, Osofisan AO. Cloud computing and sustainable development in higher education. Journal of Emerging Trends in Computing and Information Sciences. 2012;3(11).

18. Oracle White Paper. Oracle's cloud solutions for higher education and research; 2011.

19. Jain A, Pandey US. Role of cloud computing in higher education. International Journal of Advanced Research in Computer Science and Software Engineering. 2013;3(7):966-972.

20. Ahmad Z. Business intelligence for sustainable competitive advantage: The case of telecommunications companies in Malaysia. This thesis is presented for the Degree of Doctor of Philosophy of Curtin University of Technology; 2011.

21. Petrini M, Pozzebon M. Managing sustainability with the support of business intelligence: Integrating socio-environmental indicators and organizational context. Journal of Strategic Information System. 2009;18(2009):178-191.

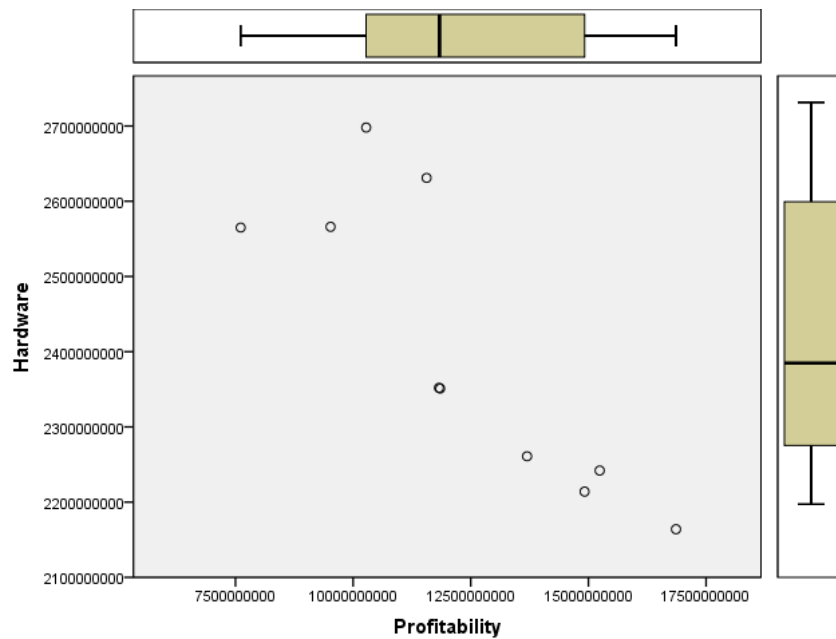22. Wahua L, Tsekpo S, Anyamele J. Governance and employee productivity of selected Nigerian

banks: does gender diversity matter? Asian Journal of Arts, Humanities and Social Studies. 2018;1(1):19-39.

23. Wahua L. Corporate governance, financial soundness and economic development: empirical evidence from Malaysia, Indonesia, and Turkey. Text of paper presented at the 2nd Annual International Conference on Accounting and Finance, ICAF 2015, At Colombo, Sri Lanka; 2015.

24. Velnampy T. Value added, productivity and performance of few selected companies in Sri Lanka, Indian Journal of Commerce and Management. 2011;2(6).

25. Hayes A. Valued added; 2020.
Available:https://www.investopedia.com/terms/v/valueadded.asp

26. Namisiko P, Munialo C, Nyongesa S. Towards an optimization framework for e-learning in developing countries: a case of private universities in Kenya. Journal of Computer Science and Information Technology. 2014;2(2):131-148.

27. Kebande VR, Sigar KO, Odongo GY. Meta-modeling cloud computing architecture in distance learning. International Journal of Computer Science Issues. 2013;10(3):66-72.

28. Laisheng X, Zhengxia W. Cloud computing: a new business paradigm for e-learning. Third International Conference on Measuring Technology and Mechatronics Automation. 2011;716-719.

29. Angeles R. Using the technology-organization-environment framework and Zuboff's concepts for understanding environmental sustainability and RFID: Two case studies. International Journal of Social, Education, Economics and Management Engineering. 2013;7 (11):1599-1608.

30. Přikrylová D. Business intelligence models for capturing and analysis of enterprise marketing data. Master thesis submitted to Masaryk University, Faculty of Informatics; 2016.

31. Oei MHH. Acceptance of operational business intelligence in organisations developing a framework describing the context and powers at play involved in achieving OpBI acceptance in organisations; 2014. Corpus ID: 166647261

32. Johansson S, Nilsson M. The intelligent business: an assessment of business intelligence practices in large Swedish organisations. Master Thesis submitted to Lund University; 2013.

33. Amoako BT. The importance of business intelligence as a decision-making tool: Case study electricity company of Ghana; 2013. Corpus ID: 166940121

34. USC Libraries Organizing your social sciences research paper: Quantitative methods. The University of Southern Califonia Library; 2018.
Available: https://libguides.usc.edu/writingguide

35. Babbie ER. The Practice of Social Research. 12th ed. Belmont, CA: Wadsworth Cengage, Brians; 2010.

36. Kefas NN. An evaluation of corporate governance practices on board member selection and recruitment in Namibian state owned enterprises. A Research Project submitted for the degree of Masters in Leadership and Change Management in the Harold Pupkewitz Graduate School of Business, Polytechnic of Namibia; 2014.

37. Ankomah ET. The impact of covid-19 pandemic on the overall performance of fidelity bank (Ghana) in 2020. Being a thesis submitted to Accra Business School in partial fulfillment of the requirements for the award of Master of Business Administration (MBA) by Accra Business School, Ghana; 2020.

38. Roozitalab M, Sayadi MK. Investigating the effect of business intelligence on business value creation. Journal of Soft Computing and Decision Support System. 2018;5(5):43-48.

39. Wehner C. Accounting for computer software costs; 2020.
Available:https://www.gma-cpa.com/blog/accounting-for-computer-software-costs

40. Wahua L, Ezeilo FI. Effects of environmental, social and governance imperatives on the performance of selected listed mortgage banks in Nigeria. International Journal of Economics. Business and Management. 2021;13(4):34-48.

41. Garsonm GD. Hierarchical linear modeling: Guide and applications. Thousand Oaks, CA: Sage Publications, Inc; 2012.

42. Owusu A. Business intelligence systems and bank performance in Ghana: The balanced scorecard approach. Cogent Business & Management. 2017;4:1364056.
Available:https://doi.org/10.1080/23311975.2017.1364056

43. Kaplan RS, Norton DP. The balanced scorecard— Measures that drive performance. Harvard Business Review. 1992;70(1):71–79.

44. Sclater N, Webb M, Danson M. The future of data-driven decision-making; 2017.
Available:https://www.jisc.ac.uk/reports/the-future-of-data-driven-decision-making
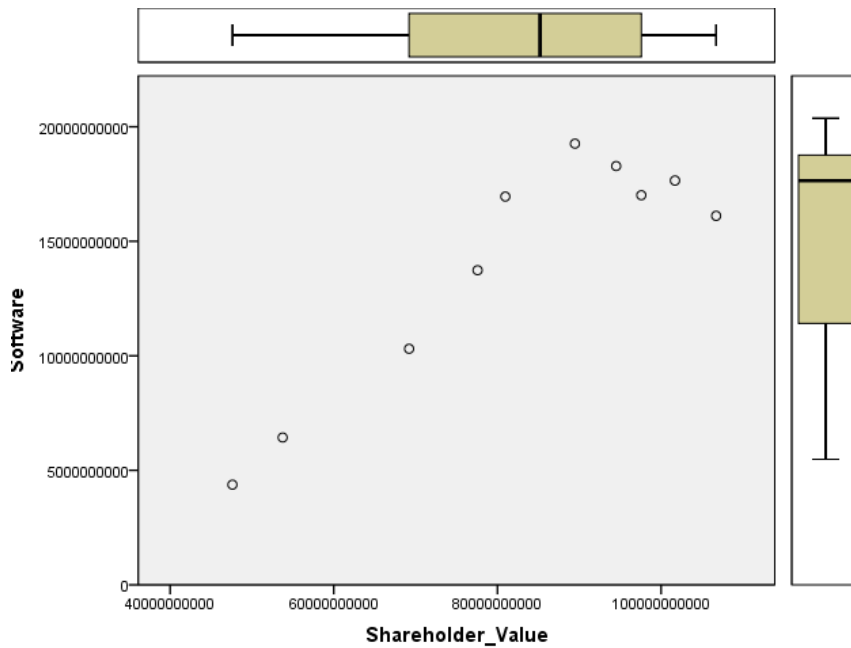
APPENDIX

Appendix 1. Graph of Hardware NBV and Shareholder Value

Appendix 1 indicates an inverse (negative) association between Net Book Value of Computer Hardware and Shareholder Value. As one increases, the other decreases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.
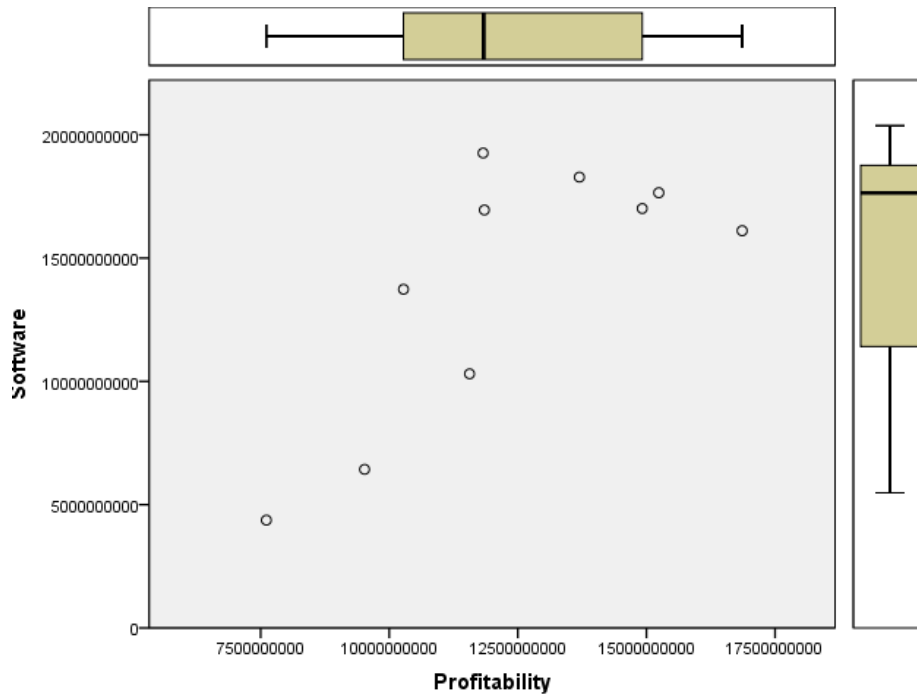

Appendix 2. Graph of hardware NBV and profitability

Appendix 2 indicates an inverse (negative) association between Net Book Value of Computer Hardware and Profitability. As one increases, the other decreases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.
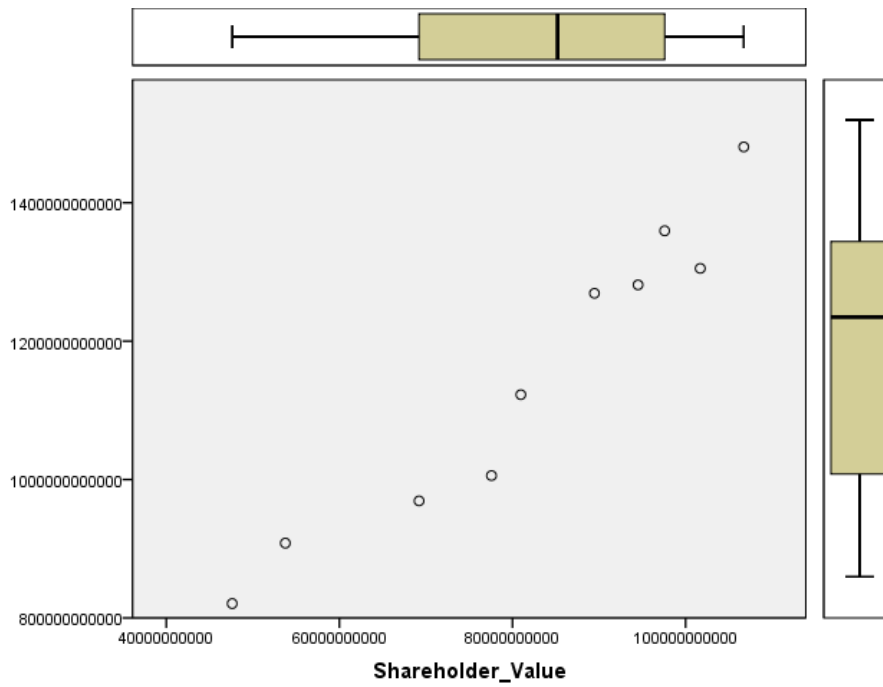
Appendix 3. Graph of software NBV and shareholder value

Appendix 3 indicates a direct (positive) association between Net Book Value of Computer Software and Shareholder Value. As one increases, the other also increases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.
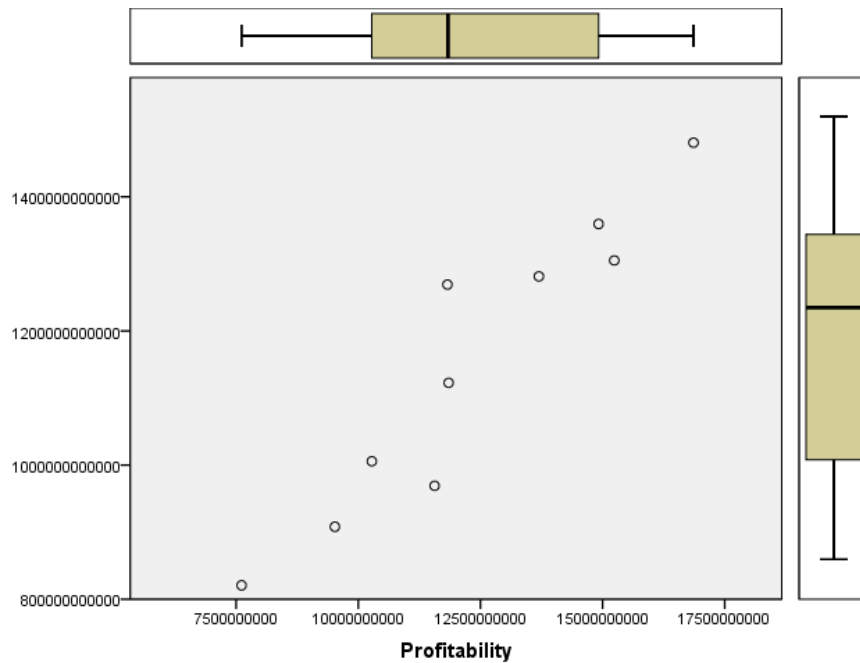

Appendix 4. Graph of software NBV and profitability

Appendix 4 indicates a direct (positive) association between Net Book Value of Computer Software and Profitability. As one increases, the other also increases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.
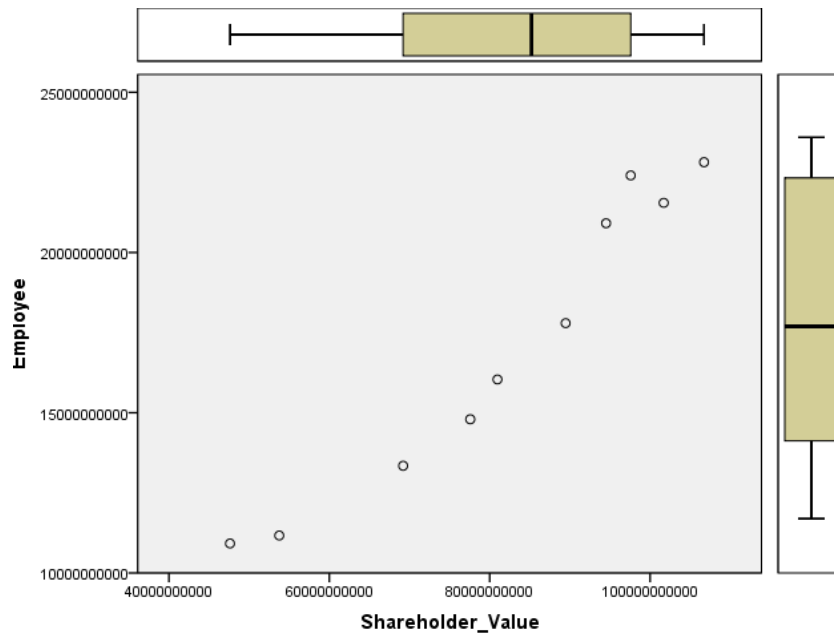
Appendix 5. Graph of bank size and shareholder value

Appendix 5 indicates a direct (positive) association between Bank Size and Shareholder Value. As one increases, the other also increases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.
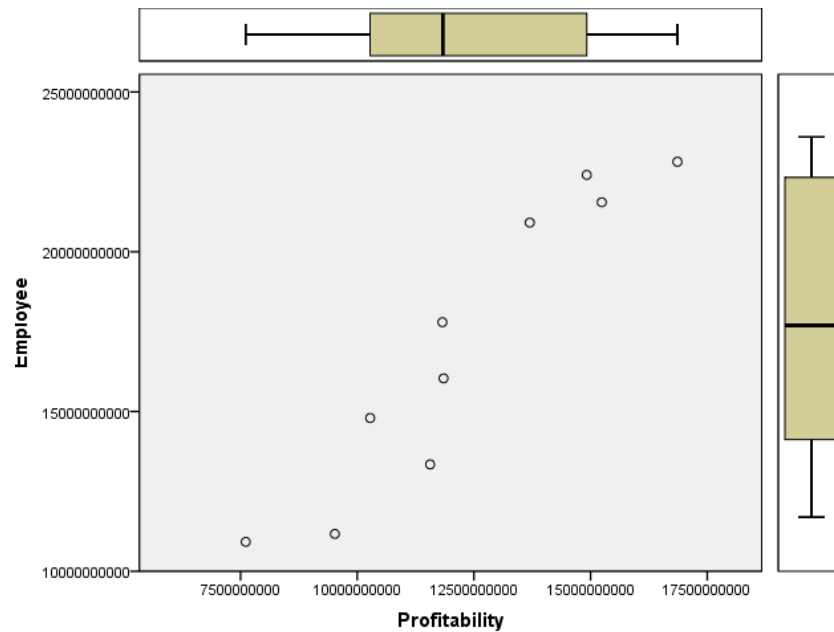

Appendix 6. Graph of bank size and profitability

Appendix 6 indicates a direct (positive) association between Bank Size and Profitability. As one increases, the other also increases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.

Appendix 7. **Graph of employee cost and shareholder value**

Appendix 7 indicates a direct (positive) association between Employee Cost and Shareholder Value. As one increases, the other also increases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.

Appendix 8. Graph of employee cost and profitability

Appendix 8 indicates a direct (positive) association between Employee Cost and Profitability. As one increases, the other also increases, and vice versa. This agrees with the findings of the Pearson Correlation analysis carried out.

_____