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Development of a Quantitative Model to Integrate the Network KPIs and Commercial KPIs to Evaluate the Financial Performance of MTN Ghana.

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Abstract

The aim of this paper is to design a parsimonious model for measuring financial performance of MTN Ghana Ltd. The Three-stage least square(TSLS) regression models was deployed to incorporate the network KPIs and commercial KPIs of MTN Ghana for evaluating their financial performance. The paper first examined the complex relationship between the network and the commercial KPIs using correlation and cluster analysis with data from 2009 to 2016 on seven commercial KPIs and eleven network KPIs. The paper finds a strong statistical interconnectedness between the network KPIs and the Commercial KPIs to drive financial performance. The paper concludes that, any attempt to measure financial performance of MTN Ghana must deploy a model that capture an interaction term between the commercial and network KPIs.

Keywords: Commercial KPIs, Network KPIs, correlation analysis, cluster analysis, TSLS regression model, MTN Ghana

1.0 INTRODUCTION

1.1 Background and problem statement

Globalization has made the competitive landscape in the contemporary business environment very challenging, therefore making performance evaluation and management for the companies to become more famous (KriVKA and STONKUTĖ, 2015). Performance management has become a vital ingredient within the management information systems concept-wise. The practice comprises of functions such as measurement of return, profitability, and development.According to Yildiz et al., following the performance of corporates to the performance of individual units, one can derive the importance regarding power and sustainability under the conditions of competition. Thus, the managers of the enterprises (firms) give greater importance to performance management systems today than ever before (YILDIZ et al., 2011).Performance evaluation is regarded as one of the best methods of employing an accountability approach (Reza et al., 2012). Performance evaluation is itself in need of some indexes and models through which corporate performance can be evaluated. Performance evaluation models are therefore becoming an action guide to management and decision makers. Producing a comprehensive model for the performance management of firms, therefore, becomes a guideline that paves the way for future decisions concerning investment, development, and, most importantly, control and supervision (Tehrani & Rahnama, 2012).Due to the accelerated growth of commercial activities, there is no doubt on the inevitability of existence of performance evaluation systems in all organizations. This necessity is so evident that the lack of an evaluation system or model is regarded as a symptom of the organization's un-healthiness.Financial evaluation encourage companies to attain higher levels of performance by depicting the organizations current state of health and exposing areas of weakness (Abdoli et al., 2011). Such evaluations are also useful in reforming and improving weaknesses which are done through recognition of the strengths of performed activities. Mostly, obtaining a performance model to be used to exceed the goals previously achieved is an obligation to the managers of any organization.In their search of a viable performance management tool, different authors who are relatively interested in the telecommunications sector have researched into how to develop quantitative models to proxy performance. Some have practically developed some quantitative models that integrated different levels of KPI measures in the Telco's to evaluate their financial performance.

1.2 Objective and justification

From the foregoing, it can be ascertained that developing a quantitative model as a performance measurement tool for MTN Ghana will be useful to management, in the face of aggressive competition in the Ghanaian telecom sector. Thus this paper empirically engaged various mathematical and statistical tools to define the model solutions required by managers and actors in the Telco sector in Ghana for decision-making. The study developed models which incorporated the network KPIs and commercial KPIs of MTN Ghana for evaluating their financial performance. The study earlier explored the impact of commercial KPIs on the financial performance of MTN Ghana Ltd. The paper further investigated the relationship between the network and commercial KPIs of MTN Ghana.The designed model is predicated on the empirically examined interrelatedness between these two levels of KPIs. This work is expected to facilitate efficient network infrastructure planning and prioritization for improved revenue performance in the telecom sector, specifically MTN Ghana.

2.0 LITERATURE REVIEW

In their study into statistical model development, Tehrani et al (2012) developed a model to evaluate corporate performance through data envelopment analysis. The model employed liquidity, activity, leverage, and economic added value as input indices and profitability ratios as output index. The model was used to rank 36 companies and 9 were found to be efficient. The 27 remaining companies were rated as inefficient. Those found to be efficient were subjected to further ranking using Anderson Peterson Model. In concluding, the causes of, and extent of weaknesses of the companies were expressed using auxiliary variables and reference units.

Kim et al. (2009) developed a structural model to examine user demand for voice and SMS services. The study precisely measured the cross-price and own elasticities of these services. Exhaustive individual consumption data of 6000 and more customers was employed. The study found that voice and SMS services were small substitutes. Thus, a 10% upsurge in the price of voice minutes will prompt about 0.8% rise in SMS demand. The own price elasticity of voice is also low, approximately -0.1. It also found that the demand of younger customers' was far less elastic than those of older customers. The study further conducted counterfactual policy trials that fully captured how key parameter variations affect the firm's revenues. Lastly, the research discussed how the developed framework can be generalized.

KRIVKA (2015) analysed the financial state and performance of large construction enterprises using financial indicators. The study deployed multi-criteria decision making (MCDM) technique. Profitability, liquidity, solvency and asset turnover were used as the criteria for evaluation. The multi-criteria assessment resulted in the ranking of the construction enterprises by performance and state of their finances. The findings were considered useful for potential investors, business owners, customers and other likely stakeholders.

YILDIZ et al. (2011) tested a performance centred model that employs a modified methodology in the measurement of firms' performance. The innovative performance model deployed in the paper is based on how firms with multiple dimensions can measure and evaluate performance. Contrary to traditional gap models, this research used "Performance Measurement Method Based on Gap Percentages" (Eleren, 2009). The technique permits the use of both qualitative and qualitative data collectively. Model verification was achieved by testing data gathered from 42 firms operating in the marble business sector in Turkey.

Bordoloi et al (2008) examined key performance metrics for the processes of customer relationship management units in the call centre sector. Data Envelopment Analysis (DEA) was deployed to compare the performances of some selected call centres. The results provide several managerial learnings that will considerably support CRM managers in making effective decisions, specifically with enhancing customer service efficiencies. Generally, the research is a contribution to efficient management of processes and resources that facilitates firms' acquisition and support of information technology.

Deshpande1 & Narahari (2014) developed a model to predict the future trends of average revenues per subscriber to enable telecommunications service providers to engineer new propositions to increase a mobile subscriber's average usage. This study considers different factors that affect the ARPU of the TSP. Multiple linear regression equation has been formulated to explain the factors that determine the ARPU. Results of the model developed show that ARPU depends on subscriber base, number of operators and percentage of new users added periodically. This study considers Karnataka Region Telecom services for constructing model for ARPU prediction.

Bititci et al (2001). This paper is based on previous works on performance measurement and on quantification of relationships between factors which affect performance. It demonstrates how tools and techniques developed can be used to evaluate the performance of alternative strategic choices through a quantitative approach to modelling of performance measurement systems. The paper provides a brief background to the research problem and preceding works. The tools and techniques used were briefly introduced. Use of these tools and techniques to evaluate the performance of alternative manufacturing strategies was demonstrated. Finally, the capability of the approach to deal with dynamic environments is demonstrated using sensitivity analysis.

3. METHODOLOGY

3.1 The Empirical Review

Regression models have the strength to present a more generalized situation in which the effect on revenue of a change in the commercial KPIs depends on the network KPIs. The interaction between the commercial KPIs and the network KPIs is imperative to ascertain the financial performance of Telecom service providers. Technically, three different cases can be considered to develop a quantitative model to capture such interaction: (1) When both independent variables are binary (2) when one independent variable is binary and the other is continuous and (3) when both independent variables are continuous (Stock and Watson, 2012). The model is premised on the assumption that, the commercial KPIs would influence the financial performance the Telecom companies significantly if network KPIs are very effective and efficient.

That is, a change in financial performance due to a change in commercial KPIs might depend on the network KPIs.

More generally; $\frac{\Delta\, Financial\ Performance}{\Delta\ \ Commercial\ KPI}$ depends on Δ network KPI.

To model the interaction between the commercial KPIs(X_1)and the Network KPI(X_2), this study first considers a binary to continuous interaction between X1 and X2. In this case, three different population regression functions are produced. (1) A regression function that allows for different intercept but has the same slope (2) The regression function that allows for different intercept and different slopes and (3) A regression function that has the same intercept but with different slopes.For instance, given a population regression function as:

$$Y = \beta_0 + \beta_1 Di + \beta_2 X_i + u_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [1]$$

Where D_i is a binary variable and X_i is a continuous variable. The specification in [1] estimates the effect of X on Y holding constant D. To allow for the effect of X on y to depend on D, we include an interaction term; $D_{i\ x}\ X_1$ as a regressor. Thus the general population regression becomes:

$$Y = \beta_0 + \beta_1 Di + \beta_2 X_i + \beta_3\ (D_1 x X_i) + u_i \ldots\ldots\ldots\ldots\ldots.. [2]$$

We modify the equations [1] above to incorporate two continuous variables, in which case, X_1 and X_2 are continuous. The interaction term, X_1 and X_2 are included as regressors. The population regression n becomes

$$Y = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 (X_{1i}\ x\ X_{2i}) + u_i \ldots\ldots\ldots..[3]$$

To this end, interpreting the coefficients from the model requires some little technicality other than the conventional interpretation. As a general rule, we compare the various scenarios:

$$Y = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 (X_{1i}\ x\ X_{2i}) \ldots\ldots\ldots[4]$$

Now, when we change $X_{1,}$ which in this study represents the commercial KPIs, the population regression becomes:

$$Y + \Delta Y = \beta_0 + \beta 1(X_1 + \Delta X_1) + \beta_2 X_2 + \beta_3 (X_1 + \Delta X_1) x\ X_2] \ldots.. [5]$$

By subtracting equation [5] from [4], we obtain;

$$\Delta Y = \beta_1 (X_1 + \Delta X_1) + \beta_3 X_2 \Delta X1 \quad \text{or} \quad \frac{\Delta Y}{\Delta X} = \beta 1 + \beta 3X2\ldots.. [6]$$

From the above model it can be deduced that:

1. The effect of X_1 which in this study represents the commercial KPIs on Y (financial performance) depends on X_2, the network KPIs.
2. B_3 is the increment to the effect of commercial KPI on financial performance from a unit change in network KPIs.

To test the above model, we run a regression of financial performance on commercial KPI and network KPIs as follows:

General model:

Financial performance= $\beta_0 + \beta_1$(com KPI_i) + β_2(net KPI_i) + β_3(com KPI_i x net KPI_i) + u_i

To ascertain which network KPIs statistically relate to a selected commercial KPI, a correlation analysis is undertaken. The interaction term is then constructed depending on the degree of interrelation among the two KPIs.

3.2 Data

A monthly frequency data is obtained from MTN Ghana database on selected commercial KPIs and network KPIs. The data spans from 2009 month 1 to 2016 month 3. The variables used in this study include the commercial KPIs that comprises; RGS30, Data volume, sms count, minute of use (MOU), net additions, gross additions, and revenue. The network KPI used in this study comprises: 2G traffic, 2G availability, 2G drop speech call, 2G busy hour traffic, 3G traffic, 3G availability, 3G busy hour traffic, TCH Congestion, Busy Hour Voice Traffic, Busy hour radio network utilization, and 3G drop speech call. A continuous data was obtained for all the variables of interest. An index of commercial and network KPIs is constructed using the Paasche method to clarify the general interaction between the commercial and network KPIs.

4. EMPIRICAL RESULT AND INTERPRETATION

4.1 Correlation Analysis

The study presents a statistical comparison of the degree of interrelatedness of the commercial and network KPIs. To identify which network KPI has the highest or least correlation to which particular commercial KPI, the study run the correlation analysis between each of the seven (7) commercial KPI and each of the eleven (11) network KPIs. The use of this method is motivated by the assumption that, correlation analysis is an important statistical evaluation of the strength of the relationship between two numerically measured continuous variables. The result is presented in table 1 below:

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Table 1: Correlation between the Network KPIs and the Commercial KPIs

Correlation t-Statistic	DATAVOLUME	GROSSADD	MOU	NETADDS	REVENUE	RGS30	SMSCOUNT
TCHCONGESTION	-0.408401	-0.436104	-0.411051	-0.079817	-0.480083	-0.564903	-0.227071
	-4.001793	-4.334532	-4.033021	-0.716194	-4.894989	-6.123246	-2.085463
THREEGAVAILABILITY	0.263952	0.356797	0.336508	-0.120069	0.293889	0.400039	0.116481
	2.447660	3.416130	3.196222	-1.081756	2.750071	3.904058	1.048980
THREEGBHRTRAFFIC	0.979408	0.910133	0.897439	0.376742	0.896107	0.824424	0.168629
	43.39040	19.64799	18.19594	3.637718	18.05846	13.02868	1.530174
THREEGDROPCALL	-0.753009	-0.628345	-0.594203	-0.231907	-0.585372	-0.508179	-0.137204
	-10.23559	-7.224368	-6.607754	-2.132376	-6.457768	-5.277537	-1.238904
THREEGTRAFFIC	0.693122	0.675109	0.672202	0.181514	0.653266	0.654404	0.169039
	8.600585	8.185186	8.120768	1.650934	7.717310	7.740809	1.534003
TWOAVAILABILITY	0.559717	0.697440	0.671919	0.117652	0.680784	0.767368	0.320576
	6.041219	8.704599	8.114532	1.059668	8.312974	10.70409	3.027084
TWOGBHRTRAFFIC	0.693341	0.873572	0.845925	0.283298	0.832558	0.848310	0.292673
	8.605805	16.05411	14.18746	2.642136	13.44309	14.32956	2.737624
TWOGDROPCALL	-0.871346	-0.752363	-0.725052	-0.170840	-0.781279	-0.755332	-0.137104
	-15.88356	-10.21534	-9.416453	-1.550840	-11.19542	-10.30895	-1.237990
TWOGTRAFFIC	0.559535	0.785341	0.740908	0.240447	0.708554	0.729145	0.266937
	6.038363	11.34667	9.867198	2.215623	8.980993	9.529607	2.477455
BHRVOICETRAFFIC	0.755272	0.905456	0.879068	0.305122	0.867004	0.870830	0.283882
	10.30706	19.08076	16.49398	2.865749	15.56234	15.84459	2.648060
BHRRADIONETUTILIZATI	-0.386436	-0.058861	-0.044052	0.105206	-0.193263	-0.197733	0.034749
	-3.747515	-0.527384	-0.394398	0.946247	-1.761816	-1.804201	0.310995

Source: Author's own computation.

It can be deduced form the result above that, there is a general correlation between the network KPIs and the commercial KPI. 2G drop call, 3G drop call, and TCH congestion are generally negatively correlated withall the commercial KPIs. The rest of the network KPIs are generally positively correlated with all the commercial KPIs. This implies that the more technical inconveniences posed by the network KPIs, commercial KPIs becomes significantly affected. For the purposes of designing the model, the study variables with high correlation are chosen. The threshold correlation coefficient is

0.5 and must be statistically significant at 1% and 5% significant levels. Table 2 below presents the summary of the selected variables and their degree of interrelatedness.

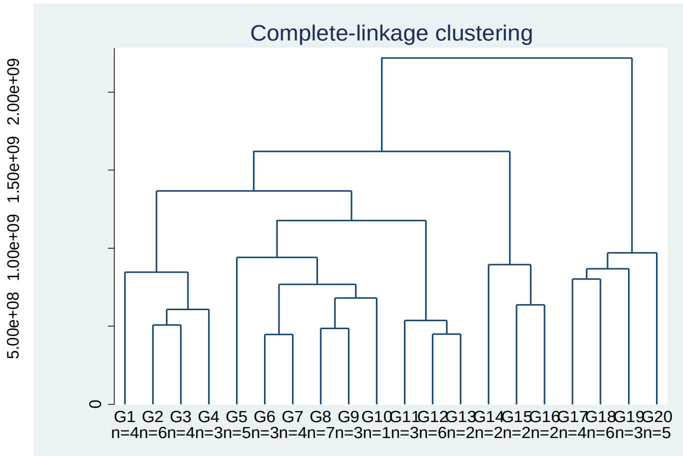
Table 2: Summary of interrelatedness between the commercial KPIs and the Network KPIs

Commercial KPI	Network KPIs with high degree of Correlation
Data Volume	3G busy hour traffic, 3G drop call, 3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, and busy hour voice traffic
Gross Add	3G busy hour traffic, 3G drop call, 3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, busy hour voice traffic and busy hour radio network utilization
Minute of Use(MOU)	3G busy hour traffic, 3G drop call, 3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, busy hour voice traffic
Net adds	None
Revenue	3G busy hour traffic, 3G drop call, 3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, busy hour voice traffic
RGS30	TCH congestion, 3G busy hour traffic, 3G drop call,3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, busy hour voice traffic
SMS count	None

Source: Author's own computation

4.2. Cluster Analysis

Cluster analysis comprises of a variety of method that divides observations into groups or cluster based on their dissimilarities across a number of variables (Lawrence Hamilton, 2006). It is usually deployed as an exploratory approach for developing empirical typologies rather than being a means of testing pre-specified hypothesis. The hierarchical method is used and the output presented on fig 1 below;



Source: Author's own computation

From the diagram above, most of the fusion or linkage takes place at dissimilarity levels below 10 and then forms a three variable group entirely different from the rest. Most of the commercial and network KPIs demonstrated a strong linkage at the outset of the formation and completely homogenous. This implies that a model that integrated the commercial and network KPI s is plausible in assessing the financial performance of MTN Ghana.

4.3. The TSLS Regression Model

Having established the relationship between the various commercial KPIs and the network KPIs, the study further examines the incremental effect of the network KPIs on the commercial KPIs to affect the financial performance of MTN Ghana. The study applied the Three-stage Least Square regression to ensure robust estimates. The use of the Three-stage least square is motivated by the fact that time series data is characterized by autocorrelation and also to address the simultaneous causality bias inherent in the OLS regression. Applying the Three-stage least square, a reduced form or version of the regression model is used (Stock and Watson, 2012).The endogenous variable in the model is revenue. The commercial KPI and their interaction term with the network KPI forms the exogenous variables. The result is presented in table below

Table 3: Result from the TSLS regression

	Coefficient	Z-statistics
Data Volume	-0.54	1.72
Data Volume x network KPI	0.47	1.52
Gross addition	-0.99	1.26
Gross addition x network KPIs	1.43*	2.17
Minute of Use	1.90***	4.79
Minute of use x network KPIs	-1.75***	4.49
Net addition	-0.12***	5.97
SMS count	-0.27***	5.02
RGS30	2.62***	12.40
RGS30 x network KPI	-0.06	1.55
Constant	16.06***	2.79
R-square	0.9800	
Endogenous Variable	L rev	
Exogenous variable	Logdatavolume ldatavol loggrossad lgrossad logmou lmou lnetad lsmscount logrgs30 lrgs30	

Source: Author's own computation. ** 5% significance level, *** 1% significance level

The model can then be specified as:

*Finperf= 16.06 +1.43(grossad*network KPI) + 1.9(mou) - 1.75(mou*network KPI) – 0.12(netadd) – 0.27(smscount) + 2.62 (rgs30) +*u_i

From the result, the following can be deduced;

(a) The incremental effect of gross addition on financial performance resulting from a unit change in 3G busy hour traffic, 3G drop call, 3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, busy hour voice traffic and busy hour radio network utilization is 1.43units .
(b) The incremental effect minute of use on financial performance resulting from a unit change in 3G busy hour traffic, 3G drop call, 3G traffic, 2G availability, 2G busy hour traffic, 2G drop call, 2G traffic, busy hour voice traffic is 1.75 units
(c) Network KPIs have no incremental effect to net adds and sms count on financial performance
(d) The effect of revenue generating subscriber has the highest effect on financial performance than the remaining commercial KPIs. Though it has a relationship with network KPIs, there is no causal incremental effect from network KPI.

5. CONCLUSION AND RECOMMENDATION

The need to design a model that integrates the various performance measurement indicators for telecom companies cannot be over emphasized. MTN Ghana for instance have a number of performance measurement threshold for both the commercial and network departments, which may be deemed too fragmented to aid decision- making by corporate management. The availability of a parsimonious model that captures the interaction of commercial and network KPIs could facilitate efficient network infrastructure planning and prioritization for improved revenue performance in the telecom sector, specifically MTN Ghana. This study attempted to examine the interrelatedness between the commercial and network KPIs to come out with a model for measuring financial performance of MTN Ghana. Using data from MTN database on the commercial and network KPIs from 2009 to 2016 to test the TSLS regression model, the paper concludes in general that, network KPIs significantly influences the commercial KPIs to impact of the overall financial performance of MTN Ghana. It is therefore recommended that, an attempt to measure the overall financial performance of MTN Ghana must deploy a model that captures the interaction term between the two KPIs.

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