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Network Effects and QoS as Determining Factors in Selection of Mobile Operator: A Case Study from Higher Learning Institution in Dodoma Municipality in Tanzania

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***Abstract*—**The use of mobile phones is growing tremendously all over the world. In Tanzania there are a number of operators licensed by Tanzania Communications Regulatory Authority (TCRA) aiming at attracting customers into their networks. So far telecommunications market competition has been very stiff. Various measures are being taken by mobile operators to survive in the market. Such measure include introducing of different air time bundles on daily, weekly and monthly at lower tariffs. Other measures include the introduction of normal tariff, tourist package and one network. Despite of all these strategies, there is a dynamic competition in the market which needs to be explored. Some influences which attract customers to choose a certain mobile operator are of particular interest. This paper is investigating if the network effects and Quality of Services (QoS) influence mobile customers in selection of their mobile network operators. Seventy seven students from high learning institutions in Dodoma Municipality in Tanzania participated in responding to prepared questionnaires. The data was analyzed using Statistical Package for Social Science (SPSS) Software. The results indicate that, network coverage does influence customers in selection of mobile operators. In addition, this paper proposes further research in some areas especially where the study came up with different findings from what the theory has in place.

***Keywords*—**Network effects, Quality of services, Consumer Buying, mobile operators.

I. Introduction

RECENT years telecommunication companies have accomplished a great deal in deploying different mobile technologies. These include Global System for Mobile communications (GSM) and Code Division Multiple Access (CDMA) operators. In Tanzania alone what has been done in the past ten years is incomparable to many years before. The emerging breakthrough in telecommunications will revolve around improving lives through more efficient communications, better delivery of information when and where it's necessary needed and improving lives away from work, as well as on the job. Companies that have succeeded in the past and that will continue to flourish in the era to come know that the future is brightest for companies that develop technologies that make the lives of customers easier and better. This means satisfying the needs and desires of people of all age groups, both in the work place and at home[1].

In telecommunication Industry we have witness a stiff competitions in Tanzania and other counties. The current mobile operators with at least a coverage in all Tanzania cities/town are Vodacom Tanzania [2], Tigo Tanzania [3], Airtel Tanzania [4], and Zantel [5]. Tanzania Telecommunications Company Ltd (TTCL) [6] has coverage in some of the regions in Tanzania mainland. Others mobile operators such as Sasatel [7], Smile [8] etc are operating in major cities such as Dar es Salaam [9]. All mobile operators are looking different alternative to attract customers to their networks. Various measures are being taken by different companies including, lowering tariff, and introduction of free short messages within and out of their networks, and free calls during off-peak periods. Others include introducing different bundles in daily, weekly and monthly at lower tariff. Also other companies are introducing normal tariff, tourist package and one network. In our previous studies in [10] we looked at if tariff is a determining factor in choosing mobile operators. The study was conducted on students in higher learning institutions in Dodoma municipal and it was revealed through descriptive analysis that, the tariff had 61%. This paper is extension of our previous study in [10] and is investigating if the network effects and QoS influence mobile customers in selection of their mobile network operators. For comparison purpose of the same area and group studied in [10] were used.

II. Empirical Framework

A. Network Effects as Determining Factors in Choosing Mobile Operators

Goolsbee and Klenow [11] used individual-level data to investigate the interactions between consumer's behaviour on network selection and the network effects. Their study revealed that, for networks like mobile telecommunications, it is rather an individual's social network that determines an adoption decision. They concluded that mobile networks are highly compatible with each other and that, the network effects that exist in the market are mainly induced by network operators in many countries through higher prices for calls to other networks (off-net calls) than for calls to the same

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network (on-net calls). These were discussed as tariff-mediated network effects but assumed that every subscriber to a network is of the same importance to the consumer [12].

Kim and Kwon [13], have also studied network effects on the consumer selection behaviour and used market level data in Korean mobile telephony market. They also revealed that network effects have significant impact on consumer's decision regarding selection of mobile operator. A survey conducted by Ericsson Company in Malaysia [14] revealed that, mobile consumers are mostly influenced by price, (that is tariffs), network coverage, and capacity. The study also revealed that, the more the coverage and the network capacity, the more likely the operator was to win more customers.

Hrovan et al. [15] analyzed the subscription behaviour of mobile users in Slovenia with a special emphasis on network effects. In their comments they said that network effects also represent a disadvantage for small operators and have a tendency towards a higher market concentration. This is what was observed in Slovenian mobile market, where a battle for new subscribers was then causing a continuous fall in prices in conjunction with the continuous growth of penetration. On the other hand, Slovenian mobile market remained highly concentrated. They came up with a conclusion that, the numbers of subscribers and market share have a positive correlation with the probability of choosing a mobile operator and therefore an indication that network coverage is the determining factor for consumers in selecting a mobile operator [15].

Researchers like Doganoglu and Grzybowski [16], studied network effects on the customer selection behaviour and used market level data in analyzing the mobile market in German. They believed that the network effect operating at the firm level leads to intense competition in the market. In their findings, they observed that, network coverage in mobile telephony had many origins. First, an increase in the number of users raises communications possibilities than in fixed telephony. Second, in addition to voice telephony, mobile firms can offer several other services, such as short messaging services (SMS), mobile banking (M-banking), Multimedia services (MMS), mobile payments (M-payments), Wide Access Protocol (WAP), and emails, which may themselves be subject to network coverage. Finally, the researchers realized that, the spread of mobile services within an individual's social circle may exert pressure inducing them to subscribe into the same mobile network [16].

Research by Matej and Hrovatin Svigelj of the University of Ljubljana-Slovenia [17] revealed that, the network effect operating at the firm level leads to more intense competition in the market. However, it was learned that, network effects represented a disadvantage for small operators and have a tendency towards a higher market concentration. It was noted in Slovenia that, the battle for new customers was causing a continuous growth of penetration. Their research did not explore the source of these network effects which could be a consequence of difference between the on-net and off-net prices, the bandwidth effect or signaling effects. However, when they compared the variables that described the characteristics of users, none of the different variables among advertising or off-net prices proved to have a significant impact on the probability of choosing a mobile operator. The results of this research indicated that, the number of subscribers and market share have a positive impact on the probability of choosing a mobile operator [17].

Birke and Swann [18] on their research on the impact of network effects in choosing mobile operator revealed that the network effects in mobile telecommunications are local (among friends), which militates against the tendency of network markets to be highly concentrated. This study considered network effects as the extent of network coverage only, although in totality, network effects comprise of coverage, number of customers within the network and the network capacity or network size. It is the intention of this paper to find out whether the extent of the network effects can also influence customers in selecting a mobile operator since some operator's networks in Tanzania have a low coverage with much concentration in urban areas only while others extend to the very remote areas with extensive coverage in almost all major roads. Due to the recommendations from Peighambari [19] on further research on factors determining the choice of mobile operator, and based on the reviewed literature on consumer buying behaviour, the current paper also investigate through respondent's recommendations whether network effects and quality of services influence mobile customers in their choices of a mobile operator.

B. Quality of Service as a Determining Factor in Selection of Mobile Operator

Researchers in the marketing have studied most areas of consumer behaviour including the impact of everything from music to lighting on how people behave and how they consume products. This is not surprising considering the fact that we live in a consumption-driven culture. This paper focus on the basic constructs accepted today in buying behaviour. As mentioned in [10], consumer's decision making process is as follows: Problem recognition, information search, alternative identification and evaluation, choice and purchase, and post-purchase evaluation. The quality of service rendered is an essential item to be measured before a consumer makes up a final decision to purchase the product or service. According to Dalkin [20], should the product or service fail to meet or exceed the consumer's expectations, the service or product is unlikely to be purchased at the first place, or re-purchased on post purchase evaluation or even at the post purchase learning experience [20].

Walid [21], in his study on factors influencing mobile consumers in choosing operators, said: "New growth markets take off very quickly to become more sophisticated about their expectations about handsets and services than some people might immediately think. Price and cost were issues but they were influencing consumers in subtle ways next to equally powerful factors like network reception strength, handset brand value, design, and year 2010. In the survey, over 8000 urban mobile phone users and non-users were surveyed in Ukraine, Russia, India, Indonesia and Argentina. The research

was done by independent market researcher Synovate between September and November, 2004. Among current mobile users in these new growth markets, the research revealed how local operators were building strong businesses based on high levels of customer satisfaction, with an average of 86 percent of surveyed users satisfied with their service. In some markets like India and Indonesia, satisfaction rates were even higher at 90 and 91 percent, respectively. These figures added weight because one-third of respondents said they have used a different operator before. The research found that across all the markets surveyed good reception quality was the main reason for operator choice. When asked why they decided to subscribe to their current operator, network reception quality was the top reason (48%), compared to the second ranked factor - a low priced tariff plan (at 41%). In some markets like Indonesia, reception quality was the reason for more than 70% of respondents. When those who have switched operators were asked why they had done so, price was more important for most, (44%), followed by reception quality at 32% [22], [23].

Fluss [24] revealed that mobile phone service is viewed as a commodity by customers all over the world. As is often the case for a new market, cell phone providers have concentrated on customer acquisition at the expense of service quality and retention. This has created a buyer's market where customers are motivated to get the best deal as possible during the sign-up or contract phase of their relationship with a carrier. The majority of customers are open to changing carriers to reduce fees, increase their number of minutes, or to receive a better mobile phone [24].

III. Research Methodology

A. Research Design

The study on how the network effect and quality of service affect mobile telephone consumers in selecting their mobile operators combined both quantitative and qualitative approach, based on cross-sectional survey design. This is a survey in which observation of sample is done at one point in time and the data collected provides the description of population feature. Normally cross-sectional survey studies focus on the relationship between different variables and relates to how they affect each other at the same time [10], [25]. This type of design was chosen because it enables to describe the different factors that influence mobile phone subscribers in selecting their mobile operators, and make predictions based on the correlational survey data. Other advantages of cross-sectional survey design include that it gives the opportunity to see the reality more closely; inferences are not based on theory or dogma, but on facts as observed from the collected data. It is more objective and it helps to know the social situation around the target population. It is a practical way of collecting information such as attitudes, opinions, experiences and expectations from the population and it sensitizes the researcher to unanticipated or unknown problems. It facilitates to draw generalizations about population on the basis of data from representative sample. It is useful in verifying theories. Finally, it is for these advantages that the current research opted for it [10].

B. Area of Study and Its Characteristics

Dodoma Region is located at Latitude 6°10´60S and Longitude 35°45´0E, and at an Altitude of 1,148 meters above sea level. This region is located at the centre of Tanzania. Dodoma region has a population of over 1.7 million, out of which, more than 823,504 or 48.4 percent are males and more than 875,492 or 51.6 percent are females [10]. The region has a land area of 41,311 square kilometers and a population of 1,692,025 according to National Census, 2002. Dodoma region is selected as a case for this study to represent all other regions in Tanzania due to the fact that, all of the giant mobile operators conducting mobile phone business in Tanzania are found in Dodoma[10]. The other main reason for selection of Dodoma is for the convenience of the researcher who are living in and working in Dodoma Municipality [10].

C. Target Population

In the current study students from institutions of higher learning were picked to represent a segment of all mobile users in Tanzania. Having four colleges of the kind, namely, The University of Dodoma, College of Business Education, St. John's University College of Tanzania, and The Institute of Rural Planning and Development, two colleges have been picked to represent the rest. UDOM and the CBE were the picked institutions as in [10].

D. Sampling Techniques and Sample Size

The current study used both non-probability and purposive sampling techniques to get the required information from the study population. Purposive sampling technique was used to select Dodoma Municipality, and specifically UDOM and CBE. While non-probability sampling techniques, particularly quota sampling and straw ball sampling method was used to get the respondents [10].

In purposive sampling, a researcher selects respondents according to their convenience [10], [26]. It was sometimes necessary to pick some students well know to own mobile phones and request them to participate in responding to the questionnaire. Different sampling methods were used to minimize the effects of misrepresentation of the population that could have resulted from non probability sampling method employed in this study [10].

Under this method, individuals select themselves as participants. In this case, when one participant volunteer to answer the questionnaires, they were be asked if they knew any other students with mobile phones and who could also participate in responding to the questionnaires.

Questionnaires were distributed to about 80 students, out of which 50 were from UDOM and 30 from CBE. Equal number of females and males were given the questionnaires from each college.

IV. Data Collection Methods

To gather the primary data for this study, close-ended questionnaires were distributed to fifty UDOM students and thirty students from CBE. Close-ended questionnaire were preferred in this study because, such questions are easy to administer and usually evoke a rapid response. Since the respondents are higher learning institution students who are most of the time bombarded with workloads from their academic syllabuses, great care was taken to ensure that the type of questions asked to them do not consume a lot of their time in responding, lest they lose interest and give up.

Concert of the respondents was vital prior to data collection exercise. Therefore, students were persuaded to participate in responding to the questionnaires and asked if they knew some friends who owned mobile phones and who would also be willing to participate in the research. Where an approached student was not willing to participate, their decisions were humbly respected. The respondents were assigned anonymous numbers, (codes) instead of using their names, and even the institutions were also assigned codes. The dully filled questionnaires were locked under safe custody later after entering data into computer.

Reliability of a questionnaire is the ability of the questionnaire to give the same results when filled out by like-minded people in similar circumstances. Reliability is usually expressed on a numerical scale from zero (very unreliable) to one (extremely reliable). It is mainly concerned with whether the measure used in a research will yield the same results in different occasions, or if it can provide similar observations if done in different occasions [27]. Reliability of a research, according to Kirakowski [27] may suffer from various threats. To ensure validity of the collected data in the current study, the questionnaires were pre-tested to students of other high learning institutions and all ambiguous and unclear questions were corrected. The researcher ensured that respondents could understand the questions and answer them without assistance of the researcher. The recorded questionnaires were collected by the researcher to avoid any manipulation to the data already filled in the questionnaires. The same were kept under safe custody in a locked cabinet. To further ensure the reliability and validity of the measurements, this study used standard scales such as Likert scale for attitude test and well-structured close-ended questionnaires.

V. Methods of Data Analysis and Presentation

The study on weather network effects and QoS influence mobile phone customers in selecting their mobile operators' different statistical techniques that include descriptive analysis and multiple logistic regressions to test the relationships between dependent variable (selection of a mobile phone operator) and the independent variables namely: network coverage and quality of service. This information was analyzed using Statistical Package for Social Science (SPSS) Software.

Logistic regression was used in analyzing the data because it is among many statistical techniques that can establish relationships between a dependent variable and multiple independent variables. The independent variables are dichotomous and for this case, logistic regression is the best statistical analysis method that fits the type of data. The technique could also analyze any non-linear relationships between dependent and independent variables. Other advantages of logistic regression according to Statgun Statistic Consulting [28] are: It is more robust: the independent variables don't have to be normally distributed, or have equal variance in each group. It does not assume a linear relationship between the independent variables and dependent variable. The dependent variable need not be normally distributed. There is no homogeneity of variance assumption. Normally distributed error terms are not assumed. It does not require that the independents be interval. It does not require that the independents be unbounded [29]. Regression analysis is used to produce an equation that predicts a dependent of QoS and network effects.

VI. Results Discussion

A. Relationship between Selection of Mobile Network Operator and Network Effects

Among the interviewed respondents, some were found to be subscribed to one, two, three or even more different mobile operators as indicated on Table I. This paper wanted to know whether the extent of coverage of one operator's network could be a major influencing factor into selection of the particular mobile operator. The paper also wanted to understand whether customer's subscription to multiple mobile networks could be triggered by the limited coverage of some operators despite their other advantages, and hence subscribers are forced to acquire extra lines to be assured of connectivity wherever they go. The percentage of respondents who agreed that network coverage was one of the influencing factors in their selection of mobile operator was 68.8% while 31.2% of the respondents denied to be influenced by network coverage.

TABLE I
Respondent's Subscription to Existing Mobile Network Operators

Operator	Number of Respondent
Vodacom	32
Tigo	16
Airtel	7
TTCL	2
Vodacom and Tigo	9
Vodacom and Airtel	1
Vodacom and TTCL	2
Airtel and Tigo	4

As mentioned earlier, different mobile networks have different coverage within the country. Although a mobile operator can have several other attractive incentives and/or several other attractive features, coverage may be limited to urban areas or some major cities only. Some respondents were found to own more than one line from different operators. The study wanted to know whether their decision to subscribe into

several mobile networks was made in order to get assured of connectivity wherever they go. The responses are as shown in Table II, where 35 respondents, (45.5%) agreed in principle that they subscribed into several mobile networks so as get connectivity assurance, while 18 respondents, which is (23.4%) disagreed to be driven by connectivity assurance.

TABLE II
REASONS FOR SUBSCRIPTION INTO SEVERAL MOBILE NETWORKS

Wanted Connectivity Assurance	Frequency	Percent
Strongly Agree	19	24.7
Agree	16	20.8
Neutral	12	15.6
Disagree	13	16.9
Strongly disagree	5	6.5
None	12	15.6
Total	77	100

From the respondents at least 12 (15.6%) did not care about connectivity assurance and hence they neither agreed nor disagreed. A total of 12 respondents did not respond to this question. Statistical analysis of the responses on the relationship between selection of mobile operator and network coverage are as summarized on Table III. The regression analysis showed that the results were not statistically significant since the value of Sig. = 0.181, which is greater than 0.05, the level of significance selected for this study. This being the case, we cannot reject the null hypothesis. We therefore accept the null hypothesis that, "There is no relationship between network coverage and selection of mobile network operator".

TABLE III
RELATIONSHIP BETWEEN SELECTION OF MOBILE NETWORK OPERATOR: NETWORK COVERAGE

Independent Variable	Standardized Coefficients Beta	Significance
Constant		0.00
Influenced by Network Coverage	0.154	0.181

These results are in line with the findings by Birke and Swann [18] and Goolsbee and Klenow [11] who said that the network size of mobile operator has lesser effects in mobile consumer's selection of a mobile operator, but individual's social network. It is not the size of the operator's data base that matters to new mobile customers, but how many of his or her companions are connected to the particular network.

Looking into what was observed during this research, the current study contradicts with research conducted in Slovenia by Hrovan et al. [15], which found out that small operator have a disadvantage in the telecommunication market where a battle for new customers and market share are highly concentrated. Such a case was proved after looking into the current operators who have the smallest network coverage like TTCL [6] and Zantel [5] on how they cannot increase their customers as fast without much effort. Other researchers who had the same findings are Matej and Hrovatin [17] who found out that, the entire network coverage of a particular operator leads into more competition in the market, and that, the number of connected subscribers and the total market share of the particular operator have a positive impact on the probability of choosing a mobile operator. The current study also contradicts a survey conducted by Ericsson Company in Malaysia which concluded that, the more the network coverage and capacity of a particular mobile operator the more likely the operator was to win more customers [14].

B. Relationship between Selection of Mobile Network Operator and Quality of Service

According to Belch and Belch [30] consumer's purchasing decision is driven by their knowledge and experience about the product or service to be purchased. Quality of service is thought to be one of the major attribute whose knowledge can lead into making a purchase or re-purchase of a commodity or service. To establish whether there is a relationship between selection of a mobile network operator and quality of service, this study asked the respondents whether quality of service was one of their influencing factors in selection of mobile operator. Out of 77 respondents, 53 respondents (68.9 %) agreed that they were influenced by quality of service in selecting their mobile operator, while 11 respondents (14.3%) totally disagreed to be influenced by quality of service. Nevertheless, 13 of the respondents (16.9%) were just neutral about this question. The results are summarized in Table IV. The collected data on the influence of quality of service and selection of mobile operator were regressed and the results are as shown in Table V.

TABLE IV
RESPONDENTS INFLUENCED BY QUALITY OF SERVICE

Wanted Connectivity Assurance	Frequency	Percent
Strongly Agree	21	27.3
Agree	32	41.6
Neutral	13	16.9
Disagree	6	7.8
Strongly disagree	5	6.5
Total	77	100

TABLE V
RELATIONSHIP BETWEEN SELECTION OF MOBILE NETWORK OPERATOR: QUALITY OF SERVICE

Independent Variable	Standardized Coefficients Beta	Significance
Constant		0.029
Influenced by Network Coverage	0.240	0.035

From Table V, the test results are seen to be statistically significant since Sig. =0.035, which is less than the selected level of significance, 0.05. We therefore reject the null hypothesis and accept the alternative that, "There is a relationship between selection of mobile operator and quality of service". The coefficient of Beta as seen from Table V is 0.24, implying that quality of service can predict selection of mobile operator by 24 percent. These results concur with the theories on Consumer Buying behavior according to Belch and Belch [30] and Kotler et al. [31] and which say that, the quality of a product or service has a great contribution in customer's purchasing decision. The reasonably high

percentage of respondents who agreed that quality of service was an influencing factor into their selection of a mobile operator is a confirmation. These results are in line with findings by another researcher, Dr Walid, whose study revealed that quality of service was the top reason for his population in Ukraine, India, Russia and Indonesia in selection of mobile operator [22]. The research by Walid showed that quality of service ranked first while low tariff ranked second in predicting selection of a mobile operator.

On contrary, these results differ with Fluss [24] findings which deduced that quality of service could be compromised by some other attributes without affecting the magnitude of acquisition of new customers. This means that, even at a compromised quality, the mobile operator can still acquire new customers by improving other influencing factors such as low off-net calling tariffs, free SMS, or free on-net calls.

VII. Conclusion

The current study was seeking if the network effects and QoS are determining factors that influence mobile customers in selection of their mobile network operators. A number of 80 students who were mobile customers were contacted and requested to respond according to the close-ended questionnaires. Out of them, 77 students responded and returned the questionnaires. The main aim was to verify whether the theory of consumer buying behaviour in making purchasing decisions also holds true in selection of mobile network operators. According to Kotler and others, consumer's buying behaviour is influenced by: price, groups (such as family and/or friends), age, and quality of the product or service, gender and consumer's social class. Other researchers conducted similar studies in different countries on mobile subscription behaviours and came up with opinions that network coverage and the quality of service were also among the influencing factors in selection of mobile network operator for their study population.

The current study was conducted on students in higher learning institutions and it was revealed through descriptive analysis that, the influence of the independent variables in selection of mobile operators was as follows: Network coverage had the highest influence which is 68.8%, followed by quality of service which is 64.9%. These results can be explained in that, the wider the network coverage, the higher is the possibility of reaching many people and also an assurance of connectivity wherever the customers move around the country. Network coverage also increases the possibility of having many people within an individual's social network connected into that network, even without there being prior coordination of the mobile operator. The advantage of subscribing to such a mobile operator was found to be that, the mobile customers take advantage of the cheap rates of making on-net calls and sending SMS within the same mobile networks. Also customers in the same network enjoy some bonus and promotional packages offered by operators from time to time for free or discounted calls and SMS within their networks.

It was revealed that there was a significant relationship between quality of service and selection of mobile network operator. Nevertheless statistical analysis had different results for the other independent variables in that, there was no enough evidence to reject the null hypotheses for there being no relationship between selection of a mobile operator and network coverage. Statistical analysis was based on a decision rule that, the null hypothesis would be accepted or rejected with reference to p-value, the significance level of the particular test statistics. Where the p-value was less than the selected significance level (0.05), the null hypothesis was rejected. Otherwise, the null hypothesis was accepted.

According to Stat Trek, failure to reject or accept a null hypothesis basing on the p-value decision does not always conclusively indicate that an alternative hypothesis is correct or vice versa, since there are additional tests which if performed may make a more definitive statement about the validity of the null hypothesis, such as "goodness of fit" test [28]. This being the case, failure to reject the null hypothesis although the descriptive analysis has different results does not indicate that the null hypotheses for all independent variables except for quality of service are true. Different analytical methods or different approach into data collection might lead to a different conclusion. This test does not therefore completely remove the possibility of there being a statistical relationship between selection of a mobile operator and these independent variables. The current study results are contradicting the existing theories on consumer behaviour, and since the particular test conducted is not enough to rule out the possibility of there being a relationship between the independent variables and the dependent variables. This observations call for further research on the same environment using different approaches in data collection and analysis to confirm or reject the existing theories.

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