Mohamed K Mwanga
Department of General Studies,
Institute of Accountancy Arusha
(IAA), P.O.Box 2798, Arusha,
Tanzania

Lucas Salati
Department of General Studies,
Institute of Accountancy Arusha
(IAA), P.O.Box 2798, Arusha,
Tanzania

Dickson Luambano
Department of General Studies,
Institute of Accountancy Arusha
(IAA), P.O.Box 2798, Arusha,
Tanzania

Demographic factors lead to mobile phone ownership in Tanzania mainland: A binary logistic regression approach

Mohamed K Mwanga, Lucas Salati and Dickson Luambano

Abstract
The purpose of this study was to determine the demographic factors that influence mobile phone ownership in Tanzania Mainland. Secondary data from the 2017-2018 Household Budget Survey (HBS), which was conducted by the Tanzania National Bureau of Statistics (NBS), were used in this study. In order to determine which demographic factors influence Tanzanian mobile phone ownership, the Binary logistic regression method was utilized. According to the findings, a person's age, marital status, sex, residence area, and household size are all demographic factors that influence mobile phone ownership. Out of 9463 households, approximately 77.3 percent (7311) have at least one mobile phone, while only 22.7 percent (2152) do not. More than just a means of communication, the mobile phone has changed how people live and keep in touch with one another.

Keywords: Mobile phone, demographical factor and logistic regression

1. Introduction

Mobile phone ownership and usage are rising worldwide, but adoption rates vary by country and region. According to Yoon (2015) [14], numerous nations in Western Europe and North America were the first to begin using mobile phones at the end of the 1990s. Mobile phones are very important for development in developing countries due to their ability to sidestep the communications barriers in Africa. The mobile phone has become an adaptable device for bridging digital technology thanks to technological advancements and falling prices (Onyango *et al.*, 2014) [9]. For instance, entrepreneurs in Tanzania use their own mobile phones to call various markets to inquire about prices and communicate with customers.

Countries in Sub-Saharan Africa have lower rates of mobile access. According to Rashid & Elder (2009) [10], mobile phone distribution is more concentrated in urban areas compared to rural areas in the majority of African nations. The mobile phone has evolved from merely a means of voice communication to a device that provides financial services, news, information sharing, and health tracking to its users. Tanzania's mobile phone sales industry is expanding rapidly.

According to Addo (2013) [1], the use of mobile phones has evolved from a luxury item to a necessary everyday item for many individuals. Mobile phone ownership is rising among household members due to its significance. The widespread use of mobile phones has negative consequences, including the promotion of criminal activity, the diversion of attention, and an increase in social anxiety. Customers in Tanzania can choose from a variety of services provided by mobile phone providers. Voice calls and SMS are examples of the services that are provided. Other services include connecting clients to an optic-fiber network, data, Internet services, and mobile money transfer. In addition, the businesses collaborated with banks to provide mobile banking services. Additionally, they provide services to other businesses to make it easier to pay for goods and services. The number of individuals who own mobile phones is rising daily as a result of these services. Consequently, the purpose of this study is to use a binary logistic regression model to investigate the demographic factors that influence mobile phone ownership in Tanzania mainland.

Corresponding Author:
Mohamed K Mwanga
Department of General Studies,
Institute of Accountancy Arusha
(IAA), P.O.Box 2798, Arusha,
Tanzania

2. Materials and Methods
The study used secondary data from the 2017-18 Household Budget Survey (HBS) under the Tanzania National Bureau of Statistics (NBS). The Binary logistic regression was used on exploring demographic factors lead to mobile phone ownership in Tanzania Mainland.

2.1 Variables
The ownership of a mobile phone is the dependent variable. Age, marital status, sex, area of residence, and household size are the independent (explanatory) variables for the head of the household. The variables are described in Table 1 below.

Table 1: Description of variables

S. No	Variables	Description and values of variables
1	Mobile phone ownership	1 own mobile phone 0 not own mobile phone
2	Sex of household head	1 male 0 female
3	Age of household head	Age in years
4	Marital status of household head	1 married 0 not married
5	Area of residence	1 rural 0 urban
6	Household size	Number of members in the household

2.2 Model Specification
Binary Logistic regression is the suitable to be conducted when the dependent variable is dichotomous. The binary logistic regression is a predictive analysis. Binary logistic regression is used to explain the relationship between one dependent dichotomous variable and one or more ordinal, interval, nominal or ratio-level independent variables. Binary logistic regression should meet the several assumptions such as the dependent variable to be dichotomous. The data should have no outliers. Also, there should be no multicollinearity among the predictors.
Algebraic equation of the logistic model that describes the odds of being in the current interest category is written as:

$$\frac{\pi_i}{1-\pi_i} = exp(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_m x_m) \qquad (1)$$

Where; $Pi = \pi = \Pr(Y = 1 | X1 = x1, \dots, Xm = xm) is$ Probability of even

t$\frac{\pi_i}{1-\pi_i}$ is odds of success

The (natural) logarithm of the odds is a linear function of the Independent variables (and is often referred to as the log odds). This is also known as the log it transformation of the probability of success is written as:

$$log\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_m x_m \qquad (2)$$

From equation [1] we define probability by;

$$\pi = \frac{e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_m x_m}}{1 + e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_m x_m}} \qquad (3)$$

The equation [3] also can be written as;

$$\pi = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_m x_m)}}$$

We use the Wald test to test the statistical significance for individual regression coefficients in logistic regression. The standard normal curve is used to determine the p-value of the test.

$$Z = \frac{\hat{\beta}_i}{se(\hat{\beta}_i)} \qquad (4)$$

3. Results and Discussion
3.1 Mobile Phone ownership Status
Table 2 shows the status of mobile phone ownership in Tanzania Mainland. The table depicts that about 77.3% (7311) out of 9463 households there is at least one member own mobile phone while only 22.7% (2152) out of 9463 households doesn't own mobile phone. Mobile phone helps to expand social and business network. According to Srivastava, (2005) [11] mobile phone transformed from a technology device to a social and economic means of communication. This makes to become the main reason for buying a mobile phone among the individuals. Moyi, (2019) [5] discuss that mobile phone increasing information circulation and also increasing access to and usage of such information.

Table 2: Mobile phone ownership

Status	Frequency	Percent
Not own mobile phone	2152	22.7
Own mobile phone	7311	77.3
Total	9463	100

3.2 Binary Logistic regression
The outcomes for Nagelkerke R Square and Cox & Snell R Square are presented in Table 3.2. Cox and Snell's R square is calculated by comparing the model's log likelihood to that of a baseline model. It has a theoretical maximum value of less than 1 for categorical results. Table 3 shows that incentive for Cox and Snell R square is 0.085. The adjusted version of the Cox & Snell R-square known as Nagelkerke's R square changes the statistic's scale to cover the entire range of 0 to 1. According to Table 3, the Nagelkerke R square value is 0.13, and the Cox and Snell R square value is 0.085. This indicates that the variable (Own mobile phone) is explained by factors such as the age, marital status, sex, area of residence, and household size of the head of the household.

Table 3: Model Summary

Cox & Snell R Square	Nagelkerke R Square
0.085	0.130

Binary logistic regression results are shown in Table 3.3. It shows that all the explanatory variables included in the model shows statistical significance. Area of a residence shows a positive statistical significance which means households live in rural areas are more likely to own mobile phone than their counterpart in urban areas. Household live in rural areas are 3 times more likely to own mobile phone than those in urban areas. This study contradicts with that from Forenbacher *et al.*, (2019) [4] who found that area of residence is not significantly contributed to mobile phone ownership. Olaitan (2018) [8] discuss that the access of mobile technologies in rural areas is increasing due to the fact that it has become a part of the culture in the world as it the coordination of social and business activities.

Table 4: Binary logistic regression

Variable	B	S.E.	Wald	DF	Sig.	Exp(B)
Area of residence	1.098	.066	275.356	1	.000*	2.999
Household size	.159	.011	202.622	1	.000*	1.173
Household head sex	-.317	.070	20.346	1	.000*	.729
Household head age	-.017	.002	112.842	1	.000*	.983
Household head marital status	.251	.073	11.869	1	.001*	1.286
Constant	.189	.178	1.137	1	.286	1.208
*shows variable is statistical significance						

The results show that household size is positive statistical significance. This means as the member of household increasing, the chance of any household member to own mobile phone increased by 1.17. This result is in line with that done by Mwalukasa et al., (2018) [6] and Amir et al. (2016) [3]. If household size is large, many of its members generate income and lead them to own mobile phones.

Household head age shows negatively significant. When the age of household head is increasing, the chance of its members to own a mobile phone is decreasing by 0.98. Households with the younger household head are more likely to own mobile phones. Gupta and Jain (2015) [15] using least-squares regression found age as significant determinants of mobile phone ownership. This study is consistence with that from Forenbacher et al., (2019) [4] and Nishijima et al., (2017) [7] who found that age have a negative effect on mobile phone ownership with older persons less likely to own mobile phone. Age is important factor in the use of technology in which younger people tending to show higher use. Therefore, younger people tend to use and own mobile phones more than older users.

The results also show that sex of household head is negatively significant as a factor lead to mobile phone ownership. Household head being a male is decreasing a chance of its members to own mobile phone by 0.73. This means household head being a female increasing a chance of household to own mobile phone. Nishijima et al., (2017) [7] using a logit model recognized sex as significant factor of mobile ownership among Brazilians. Furthermore Forenbacher et al., Forenbacher et al., (2019) [4] revealed that female associated with lower probability of owning a mobile phone than male which is inconsistent with this study. Household head marital status shows positive significant. This means household head being married increasing a chance of its members to own mobile phone by 1.29. Studies by Yaseen et al. (2016) [13] and Ali and Kumar (2010) [2] found marital status to have a significant on mobile phone usage and ownership. Due to mobile ownership between male and female, male's decision to use technology is more strongly controlled by their perception of usefulness while female decisions are based more on controlled of the technology's easiness of use (Venkatesh & Morris, 2000) [12].

4. Conclusion and Recommendations
In general, the study found that demographic factors lead to mobile phone ownership in Tanzania Mainland are such as age of household head, marital status of household head, sex of household head, area of residence and household size. Mobile phone has become a worth important in the society with various people using mobile phones in their own way to acquire their needs. The ownership of mobile phone has increasing due to communication and business networking. Although there are poor people in Tanzania but they strive and save in order to buy mobile phones.

Based on the findings of this study, it is recommended that Tanzania government, telecommunication companies and policy makers ensure easy access of mobile networks so as to increase mobile phone ownership. Also, the government of Tanzania and policy makers must bring the program which educate the entire community the benefits of using mobile phones.

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