Influence of End User Demographic Characteristics on Adoption of New Technologies At Kenya Power And Lighting Company, Kenya

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Abstract: *In order to execute its mandate efficiently, the company has embraced new technologies such as a modern robust and integrated Distribution Management System (DMS) as well as different types of sensors on feeders, transformers and distribution substations. Other measures include smart metering of transformers and feeders to enable energy balancing amongst a host of diverse new technologies in its operations. Adoption of technology expected to reduce power losses, operational cost savings, lowered peak demand, new or increased revenue streams, improved long-term growth prospects and improved customer satisfaction. Despite, the potential benefits of new technologies usage within KPLC, there is evidence showing low adoption levels of diverse introduced technologies at KPLC. Examples in this context include poor adoption levels of live line handling technology, as well as cable joining and termination technology amongst others. This study therefore seeks to examine influence of end user demographic characteristics on adoption of new technologies at Kenya Power and Lighting Company in Nakuru. The theoretical framework of the study was based on the Unified Theory of Acceptance and Use of Technology (UTAUT). The descriptive research design was used for the study. The target population is the 274 Kenya Power and Lighting Company staff in Nakuru. The sample size of 73 for the study was calculated using the Nassiuma's formula. Respondents on average tended to agree in relations to the influence of age (mean of 3.57), education (mean of 4.23), job role (mean of 3.86) and experience in years (mean of 3.59)on the adoption of new technologies. The study therefore found that age, education, job role and experience in years had a positive influence on the adoption of new technologies at KPLC. However, respondents were not certain (mean of 2.97) on the influence that gender had on the adoption of new technologies at KPLC. The study also found that comparative to other end user demographic characteristics, gender had the least consensus amongst respondents in relations to its influence on the adoption of new technologies. Comparatively education had the highest consensus amongst the respondents in relations to its influence on the adoption of new technologies at KPLC. The aggregate standard deviation of end user demographic characteristics was 1.06 meaning that on average responses were widely distributed around the mean showing no consensus in general. The p value for one way ANOVA for end user demographic characteristics was above 0.05 (p=0.367>0.05) which led to acceptance of the null hypothesis that demographic characteristics of end users has no significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya. Thus, the alternate hypothesis that demographics characteristics of end users has significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya was rejected.The regression model indicated that a unit increase in end user demographic characteristics would result in a 0.047 decrease in adoption levels of new technology with the other variables kept constant. This indicates that end user demographic characteristics cannot positively influence the adoption levels of new technology individually. The study concluded that there was no significant influence of end user demographic characteristics in relations to the adoption of the new technologies.*

Keywords: *End user Demographic Characteristics, Adoption of New Technologies,*

I. Introduction

The Kenya Power and Lighting Company (KPLC) plays a critical role in the economic development of the country through supply of electricity for both domestic and corporate customers (Kenya Power and Lighting Company., 2017). In this context, the energy sector is listed as one of the ten pillars of the country's Vision 2030 pillars in which more electricity connection, and efficiency in electricity consumption amongst other aspects need be achieved (Vision 2030 Secretariat, 2017). The country is also facing an increasing electricity demand at the moment from a peak demand of 899 MW in 2004/2015 to 1,585 MW in 2015/2016 year with an

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increase of customer base from 735, 144 to 4, 890, 373 in the same period. In its operations, KPLC faces challenges such as challenges in reliability of power supply to diverse customer base and other network changes.

The company therefore targets in its 2016/17-2020/21 network strategic plan to adapt diverse new technology in its supply of electricity (Kenya Power and Lighting Company., 2015b). These measures include Installation of a modern robust and integrated Distribution Management System (DMS) as well as different types of sensors on feeders, transformers and distribution substations. Other measures include smart metering of transformers and feeders to enable energy balancing amongst a host of diverse new technologies in its operations (Kenya Power and Lighting Company., 2015b).

II.   Literature Review
Demographic Characteristics of End Users and Adoption of New Technologies

The demographic characteristics play a critical role in the adoption of new technologies. In this context, the early adopters of technological innovations are typically younger in age, having higher incomes, better educated, and having higher social status and occupation(Baariu, 2015). Age is a key demographic characteristic that influences the adoption of new technologies across diverse firms. The younger people in an organization are likely to have a higher perceived ease of use that leads to their increased adoption of new technologies. Abdelbary (2011) in a study on factors affecting adoption of biometric technology by five-star Egyptian hotel employees found significant differences in ease of use by age (F (3, 718)= 2.676, p < .05). The users in within the 18-28 age bracket had a higher mean score compared to those relatively older (Abdelbary, 2011)

The education levels in a firm have a significant impact on the adoption of new technologies. This is because the education levels is often correlated with a higher exposure rate to computer usage leading to development of internet skills and computer trouble shooting skills which are critical in the adoption of new technologies. The education levels are associated with high cognitive skills that aids in adoption of new technologies. Abdelbary (2011) in a study on factors affecting adoption of biometric technology by five-star Egyptian hotel employees found significant influence of education perceived ease of use. The study used a Likert scale of strongly disagree (1), disagree (2), uncertain (3), agree (4), and strongly agree (5) to evaluate education levels impact on perceived ease of use. The study found that Egyptian hotel employees with some high school, some college, and college and post graduate education levels had means of 3.4733, 3.8470, 4.0208, and 4.0488 respectively in relations to ease of use of new biometric technology. The study concluded that there was significant differences in ease of use by education level F (3, 718) = 14.428, p < .05). Mulwa (2015) in a study on factors influencing adoption of ICT in service delivery by Kitui County Governments found that education levels had an impact on the adoption levels of ICT. In this context, 10%, 10%, and 80% of the respondents indicated that level of education assisted in adoption of new technology to a moderate extent, great extent and very great extent respectively.

The gender of the end user has an impact on the adoption of new technologies. This is because men tend to be more technically oriented and may have an easier time adopting to new technologies due to better attitudes towards the new technologies. For example, Gachukia (2012) in a study on influence of demographics on adoption of social media noted gender differences in the adoption of new technologies. The study noted that men's adoption of new technology was strongly influenced by their perception of usefulness while women were strongly influenced by their perceptions of ease of use. Additionally the study notes that more males than females are likely to adopt to new technologies faster. Amongst the major issue that led to the slower adoption of new technologies was that females displayed more negative attitude towards computer based technology.

The job role of the end user is a critical component in the determination of whether the end user of the new technologies easily adopts the technology. Certain job roles such as those in the technical fields often give these job holders an advantage over their peers in non-technical oriented roles when it comes to adoption of new technologies(Gachukia, 2012).

The experience levels of the users of new technology have a significant influence on the adoption of new technologies. Users who have been exposed to similar technologies in the past have a higher chance of having a positive attitude towards adoption of new technologies(Qatawneh, 2015). On the other hand, Alzighaibi, Mohammadian, & Talukder (2016) indicates that experience in Information Technology (IT) often influence the adoption of new technologies as most technologies are IT based.

III.   Objective of the Study
To examine the influence of end user demographic characteristics on adoption of new technologies at Kenya Power and Lighting Company, Kenya.

IV.   Research Hypothesis
H$_0$: Demographics characteristics of end users have significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya

H$_A$: The demographic characteristics of end users have no significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya

V. Methodology

The descriptive survey research design was used for the study. The descriptive survey research describes the characteristics of the research phenomenon as it is on the ground without any manipulation of the variables. The descriptive survey research design was most suitable for this study in the context that the research is interested in the examination of the factors affecting the end user adoption of new technologies at KPLC. The study described the factors as they are on the ground without any manipulation of variables. The target population for this study was 274 employees of Kenya Power and Lighting Company staff in Nakuru across various departments, that is, regional management, design and construction, finance, supply chain, transport, technical services, security, information and communications technology, customer service, and human resources and administration. A sample size of 73 respondents was utilized for the study which was calculated using Nassiuma's (2009) formula, therefore 73 questionnaires were issued to the potential respondents with distribution per department shown in Table 1. Out of the questionnaires distributed, 70 questionnaires were returned with 3 questionnaires not being returned. One respondent who whose questionnaire was not returned opted not to participate in the study despite assurance that the responses will be kept strictly confidential and that the purpose of the study was academic only. The other 2 questionnaires that were not returned was because they had not been filled due to lack of time on the part of the respondents despite the questionnaires having been left with the respondents to be collected at a pre agreed time. During data cleaning 1 questionnaire was rejected because it was incomplete which left 69 questionnaires whose data was entered into SPSS and analyzed. The study results and findings were therefore based on 69 questionnaires. The return rate was 94.5% which was deemed sufficient for the studies as it was above the 80% that is recommended by Mugenda &Mugenda (1999).

Table 1: Return Rate by Department

Departments	Questionnaires Issued	Questionnaire Analysed	Response Rate
Regional Management	1	1	100%
Design and Construction	10	9	90%
Finance	11	10	91%
Supply Chain	6	5	83%
Transport	3	2	67%
Technical Services	9	9	100%
Security	1	1	100%
ICT	4	4	100%
Customer Service	24	24	100%
Human Resources and Administration	4	4	100%
Total	**73**	**69**	**94.5%**

VI. Findings And Discussions

The study sought to know which end user demographic characteristics have been instrumental in adoption of new technologies. Age, education, gender, job role, and experience in years were the metrics used to measure the end user demographic characteristics. In the context of age, most of the respondents (42.0%) gave an agree response which affirmed that age had been instrumental in adoption of new technologies. This was further supported by 8.7% of the respondents who gave a strongly agree response, with 15.9% unsure. The respondents who chose disagree and strongly disagree prompts were 11.6% and 8.7% respectively. The high percentage of respondents who were affirmative (50.7%) that age was critical in the adoption of new technologies is attributable to the fact that the young employees are flexible and more willing to learn and adopt new technologies.

Most of the respondents affirm that job role at KPLC Nakuru, Kenya has been instrumental in adoption of new technologies with 52.2% and 23.2% responding with agree and strongly agree. Only 2.9% and 7.2% of the respondents strongly disagreed and disagreed that job role has been instrumental in adoption of new technologies. The employees who are undertaking technical oriented roles are likely to have an easier time in relations to the adoption of technically inclined new technologies. In the context of experience in years, 37.7% and 23.2% were of the opinion that it has been instrumental in adoption of new technologies, while 14.5% 7.2% and 2.9% chose the uncertain, disagreed and strongly disagreed prompts.

Education has been very instrumental in adoption of new technologies as supported by 39.1% and 49.3% of the respondents who chose the strongly agree and agree prompts. None of the respondents chose the strongly disagreed prompt with only 4.3% disagreed with the metric that education has been instrumental in adoption of new technologies. The education level is critical in the adoption of new technologies due to the ability to comprehend instructions on the operations of new technologies as well as comprehend self-help instructional materials.

In the context of whether gender been instrumental in adoption of new technologies, the responses were fairly distributed between those who affirmed and those who were of a contrary opinion with an equal number of respondents (11.6%) choosing the strongly agreed and strongly disagreed prompts. The agree and disagree prompts also received an almost equal number of responses, that is, 24.6% and 29.0% respectively, while those who were unsure were 23.2%. The gender is of importance to the adoption of new technologies due to the fact that different genders display different attitudes towards technology which has an impact on their adoption levels. The female gender are often less receptive towards new technologies.

Table 2; Frequency Distribution of End User Demographic Characteristics

	SA Freq. (%)	A Freq. (%)	U Freq. (%)	D Freq. (%)	SD Freq. (%)
Age	6 8.7%	29 42.0%	11 15.9%	8 11.6%	6 8.7%
Education	27 39.1%	34 49.3%	5 7.2%	3 4.3%	0 0.0%
Gender	8 11.6%	17 24.6%	16 23.2%	20 29.0%	8 11.6%
Job Role	16 23.2%	36 52.2%	10 14.5%	5 7.2%	2 2.9%
Experience in years	16 23.2%	26 37.7%	12 17.4%	13 18.8%	2 2.9%

The means of the respondents' responses on the influence of end user demographic characteristics were examined. In this context, the means for influence of age, education, gender, job role and experience in years on adoption of new technologies were 3.57, 4.23, 2.97, 3.86, and 3.59 respectively. These responses indicated that the respondents tended to agree in relations to the influence of age, education, job role and experience in years having an influence on the adoption of new technologies at KPLC. This was due to means of between 3.5 and 4.5. On the other hand, the respondents tended to be uncertain as to whether gender had an influence on the adoption of new technologies due to a mean between 2.5 and 3.5.

The results that respondents tended to agree in relations to the influence of age (mean of 3.57), education (mean of 4.23), job role (mean of 3.86) and experience in years (mean of 3.59) having an influence on the adoption of new technologies at KPLC was consistent with other scholars. The results on the influence of age on new technologies was consistent with Baariu (2015) and Abdelbary (2011) findings. In this context, Baariu (2015) argued that younger demographics are usually early adopters of technological innovations due to a higher perceived ease of use. The result on the education levels being a critical factor in the adoption of new technologies was consistent with Abdelbary (2011) findings. This was attributed to the fact that high education levels was associated with high cognitive skills that aid in adoption of new technologies.

In the context of the job role being influential on the adoption of new technologies. The results that the respondents' job roles had an influence on the adoption of new technologies (mean of 3.86) were consistent with Gachukia (2012) findings. Gachukia (2012) study found that employees in technically oriented jobs had an advantage over their peers in non-technical oriented roles when it comes to adoption of new technologies. Similarly, in terms of the role of experience in years in adoption of new technologies Qatawneh (2015) indicated that users who have been exposed to similar technologies in the past have a higher chance of having a positive attitude towards adoption of new technologies (Qatawneh, 2015). On the other hand, Alzighaibi, Mohammadian, &Talukder (2016) indicates that experience in Information Technology (IT) often influence the adoption of new technologies as most technologies are IT based.

The results of this study indicated that the respondents on average were uncertain in respect to whether the gender had an influence on adoption of new technologies. This was due to a mean of 2.97 which was between 2.5 and 3.5. This could be attributed to the fact that the women employed at KPLC are often technically oriented and have undertaken science oriented courses such as engineering and surveying amongst other such courses. Therefore, the differences that would be there between male and female in terms of perceived ease of use and usefulness would be reduced at KPLC compared to general population. The finding of this study is different from other studies examining gender aspects and adoption of new technologies. For example, Gachukia (2012) in a study on influence of demographics on adoption of social media noted gender differences in the adoption of new technologies. The study noted that men's adoption of new technology was strongly influenced by their perception of usefulness while women were strongly influenced by their perceptions of ease of use. Additionally the study notes that more males than females are likely to adopt to new technologies faster. Amongst the major issue that led to the slower adoption of new technologies was that females displayed more negative attitude towards computer based technology.

These means of the end user demographic characteristics were ranked from the highest to the lowest based on their mean scores. In the context of the mean scores of the end user demographics, education was the

highest rank (mean of 4.23), job role was second (mean of 3.86), experience in years was third (mean of 3.59), age was four (mean of 3.57), and finally gender with a mean of 2.97. This implied that education level was the highest ranked item at KPLC that had an influence on the adoption of new technologies. The aggregate mean was 3.64 implying that in respect to the end user demographic characteristics the respondents tended to agree that they impacted on adoption of new technologies.

Table 3: Means of End User Demographic Characteristics

	N	Min.	Max.	Mean	Respondents on average tended to;	Rank
Age	69	1	5	3.57	Agree	4
Education	69	2	5	4.23	Agree	1
Gender	69	1	5	2.97	Uncertain	5
Job Role	69	1	5	3.86	Agree	2
Experience in years	69	1	5	3.59	Agree	3
Aggregate mean				**3.64**		

Standard Deviations of End User Demographic Characteristics

The standard deviations of the various metrics on end user demographic characteristics were generated. These metrics were age, education, gender, job role, and experience in years. The standard deviation for age was 1.21, standard deviation for education was 0.77, and standard deviation for gender was1.22. Job role and experience in years had standard deviations of 0.96 and 1.13 respectively. Education and job role had standard deviations in the interval $0.5 < \sigma_X < 1$, that is, 0.77 and 0.96 respectively which meant that the responses were moderately distributed around the mean .This implied that there was moderate consensus among the respondents that education and job role have been instrumental in adoption of new technologies. On the other hand, there was no consensus ($\sigma_X \geq 1$) among the respondents whether age, gender and experience in years have been instrumental in adoption of new technologies since the responses were widely distributed around the mean.

The standard deviations for the end user demographic characteristics were ranked on a scale of 1 to 5 with the indicator ranked 1 having the highest standard deviation. The ranking saw gender ranked as number 1 with a standard deviation of 1.22. This implied that comparative to other end user demographic characteristics, gender had the least consensus amongst respondents in relations to its influence on the adoption of new technologies. Age ranked second, experience in years ranked third, job role ranked fourth, and education ranked fifth. This implied that comparatively education had the highest consensus amongst the respondents in relations to its influence on the adoption of new technologies at KPLC. The aggregate standard deviation of end user demographic characteristics was 1.06 which was generated by getting the average of the individual standard deviations of the metrics on end user demographic characteristics meaning that on average responses were widely distributed around the mean showing no consensus ($\sigma_X \geq 1$) in general.

Table 4: Standard Deviations of End User Demographic Characteristics

	N	Std. Deviation	Responses distribution around the mean;	Rank
Age	69	1.21	Widely	2
Education	69	0.77	Moderately	5
Gender	69	1.22	Widely	1
Job Role	69	0.96	Moderately	4
Experience in years	69	1.13	Widely	3
Aggregate Standard Deviation		**1.06**		

Hypothesis Testing

For the purposes of hypothesis testing, this study used the hypothesis testing steps that were enumerated by Kothari in the book *Research Methodology; Methods and Techniques*. According to Kothari (2004), a research hypothesis is a predictive statement that relates an independent variable to a dependent variable. The research hypothesis was also defined as a proposition or a set of proposition set forth as an explanation for the occurrence of some specified group of phenomena either asserted merely as a provisional conjecture to guide some investigation or accepted as highly probable in the light of established facts. According to Kothari (2004), there are six steps that should be used in hypothesis testing; (i) making a formal statement, (ii) Selecting a significance level, (iii) Deciding on the distribution to use, (iv) selecting a random sample and computing an appropriate value, (v) Calculation of the variable, and (vi) comparing the probability.

In respect to the first step of making a formal statement, this step relates to formally stating the null hypothesis (*H*0) and also of the alternative hypothesis (*Ha*).The second step of hypothesis testing involves the selection of the significance levels. The significance level (usually stated as a percentage) refers to the percentage of risk that the researcher is willing to take of rejecting the null hypothesis when the null hypothesis is in fact true(Kothari, 2004). The significance level is therefore the maximum value of rejecting null hypothesis

when it is true. This is also referred as the probability of making Type I error that is the probability of rejecting H_0 when H_0 is true. The level of significance of this study was set at 5% (Kothari, 2004).

The third and fourth and step that is selection of a random sample and computation of its appropriate value was undertaken through the use of SPSS software. In this context, the individual metrics of the independent variables were regressed against a composite variable of the independent variable for the purposes of getting the p-value. The p-value statistic was then examined for the viability of the regression model. The indicators for the variable were five indicators for end user demographic characteristics. The last step of the hypothesis testing involved the comparison of the calculated p value with the set significance level.

In order to test the hypothesis in respect to work flow management influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya, the following null (**H_0**) and alternate hypothesis (**H_a**) were used;

H_0: The end user demographic characteristics have no significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya

H_a: The end user demographic characteristics have significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya

The p value for one way ANOVA for end user attitude was 0.367 which led to acceptance of the null hypothesis. Therefore, the null hypothesis (H_0) that end user characteristics have no significant influence on adoption of new technologies at Kenya Power and Lighting Company, Kenya was accepted since p=0.367>0.05.

VII.   Conclusion Of The Study

The study found that age (mean of 3.57), education (mean of 4.23), job role (mean of 3.86) and experience in years (mean of 3.59) had on average the respondents agreeing that those metrics had a positive influence on the adoption of new technologies. Additionally, the study concluded that the end user demographic characteristics do not have any significant influence on the adoption of new technologies at KPLC. In this context, the study concluded that education has greater influence on the adoption of new technologies at KPLC due to its high mean and low standard deviation

VIII.   Recommendations

An examination of the end user demographic characteristics indicators gave education as the indicator with the highest mean and lowest standard deviation. Therefore, the study recommends that KPLC should review their basic education requirements for people joining the organization so as to get well educated employees who will be able to adopt new technology faster.

IX.   Suggestions for Further Studies

The study recommended for further studies an examination of the an examination of the influence of end user demographics including age, gender, and employee's experience on the adoption of new technologies amongst utility firms' employees.

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