ICT PENETRATION AND UTILIZATION IN LOCAL AUTHORITIES IN KENYA: THE STATUS AND IMPLICATIONS

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Abstract

Effective penetration and utilisation of ICT in the public service for high-end value-adding operations in local government is crucial to enhance effective and efficient services that satisfy the citizens and other stakeholders. ICT penetration and utilization in the local government has not reached the levels necessary to reap the benefits of ICT in service delivery. This study sought to find out the status of ICT penetration and utilization and what the observed status implies. Three councils were purposively selected for this study. Stratified random sampling was employed to obtain respondents within the councils. Eighty respondents were obtained with a ratio of proportional allocation being used to allocate proportionate samples to the councils and their departments based on the respective staff populations. An ICT penetration and utilization index was developed based on a custom-made weighting. Pearson Moment of Correlation Coefficient and test of statistical significance were used to compare the strength of linear relationship between the index and ICT resources with descriptive statistics being used to analyze the results. ICT penetration and utilization was found to have a significant linear relationship with ICT resources, the level of education, age, length of service and the job scale of staff. Great investment in ICT resources and better educated staff was recommended towards improved ICT penetration and utilization in local authorities.

Key words: ICT-penetration, ICT-utilisation, ICT-infrastructure

1.0   Introduction and Literature Review

As a result of the limited resources allocated to most of the local authorities (2006 Kenya ICT Strategy) and their inability to generate sufficient revenue flows, most perform at the minimum even though the responsibility vested upon them in terms of public service delivery is enormous. It is noted that ICT infrastructure is essential to develop and implement e-government projects (Reilly *et al.,* 2003) of which local authorities form an indispensible part.

The Kenya Vision 2030 considers infrastructure development as a key enabler of economic, social and political development of the nation (GOK, 2007) while admitting that the country lacks adequate ICT infrastructure (GOK, 2006). The country therefore set out to develop a robust infrastructure. This momentum in infrastructural development includes power, road, rail, air and water transport, Internet backbone across all towns and telecommunications installations among others. The availability of ICT infrastructure is key to accelerated run towards the achievement of an information society status (ITU-WTD, 2003).

It is noted that any additional dollar invested into the purchases of ICT capital per individual in Latin America, developing Asian or African countries increases efficiency (and consequently service delivery) by almost ten times (Repkine, 2008).

This picture is replicated in the developed countries with every one dollar of broadband investment in the US yielding up to ten times while faster deployment of broadband in Europe is expected to create over one million jobs in Europe by 2015 (WEF, 2009). Thus, improving ICT infrastructure in Kenya would be expected to improve economic development and service delivery tremendously.

ICT plays a critical role in the success of e-government projects. It is argued that Arab countries must take actions to increase the penetration of e-government projects to reach the objectives of the Arab world (Ibraheem, 2008).

However, the acquisition of information systems, including computers and related hardware and software systems may not offer sufficient service delivery results. People are as important as technology and listening to workers' views about how ICT could improve the quality of public services delivery would help public services use of ICT more efficiently and effectively (Alexandra & Laura, 2005). It is thus critical that workers are involved in making decisions in the process of acquiring ICT infrastructure; be it software, hardware or human resources.

It is noteworthy that prior to the Kenya E-Government Strategy most local authorities outsourced computer generated accounts, budgets and reports and as of 2004 there were plans to acquire own personnel and computer systems (Wafula and Wanjohi, 2004).

The KLGRP was thus formed with the aim of improving local authorities' financial management and revenue mobilization by spearheading the development of an Integrated Financial Management System (IFMS).

2.0   Methodology
2.1   Sample and Sampling Design

Three councils were purposively selected for the study out of the 175 councils in Kenya. A sample of eighty respondents was drawn for the entire study. To ensure a fair representation for the three councils and the respective departments proportional allocation was used (Kothari, 2004) as shown below.

Ratio of proportional allocation used: $n_i = n \frac{y}{x}$ Where n_i is the strata sample size, n is the overall sample size, y is the strata size and x is the total population. Stratified random sampling was used for the study given the heterogeneity of the target population (Kothari, 2004). Samples were drawn randomly from the respective departments in each of the three councils.

Using this ratio the eighty respondents were allocated to the councils as shown in Table 1 below.

Table 1: Sample Size by Council

Council	Total Population	Sample Size
Municipal Council of Thika	503	50
County Council of Thika	187	19
Municipal Council of Murang'a	113	11
Total	**803**	**80**

Similarly, the respective departments within each council were allocated a number of respondents the same ratio of proportional allocation.

2.2 Data Collection Instruments and Data Collection

2.2.1 Data Collection Instruments

Primary data was collected as per the sample design. Two instruments were used as follows:

i. Structured Questionnaire

The researcher used a structured questionnaire which was researcher-administered (administered face to face with the respondent) to cushion the inability of the respondents to easily interpret some specialized questions (Mugenda and Mugenda, 2003). The questionnaires consisted of mainly closed and a few open-ended questions.

ii. Interviews for Specific ICT Resources

Interviews were used to obtain information on specific ICT resources including bandwidth, number of computers and printers and ICT budgetary allocations to complement the questionnaires in the research. The interviews were conducted during the same time period with the administration of the questionnaires.

2.2.2 Data Collection

The questionnaires were administered within each department (stratum) in the respective councils based on simple random sampling of respondents as per the sample and sampling design. These questionnaires were administered directly by the researcher to ensure clarity of technical ICT terms to the respondents and maximum return of the questionnaires. The overall response rate for the three councils was 75 questionnaires against an expectation of 80, representing an overall response rate of 93.75%.

3.0 Data Analysis

3.1 Weighting of ICT Penetration and Utilization Indicators

OECD provides guidelines on organizational ICT indicators and comparable statistics on access and use of ICT but it does not give recommendations on the use of a particular type of sample frame, sampling methodology, processing of collected information, imputation and weighting of data (Robert, 2005).

However, weighting is important noting that the various elements of ICT do not have equal contributions to ICT penetration and utilisation (such as the high prevalence of telephone extensions which would give a false high level of ICT penetration).

For the purpose of this study an ICT penetration and utilization index was developed based on the perceived contribution by each element to ICT penetration and utilization.

Access weights of range 1 to 10 were allocated to the elements as shown in Table 11 below.

Table 2: Access weighting

Element	Weight Allocated
Direct Telephone Line	2
Telephone Extension	1
Computer	10
Mobile Phone	4
Personal E-Mail Address	3
Institutional E-Mail Address	10

Under this weighting the possession and use of an institutional e-mail address (@mct.go.ke, @mcm.go.ke or @cct.go.ke) carries greater weight than personal e-mail address (@yahoo.com, @hotmail.com...) because the presence of an institutional e-mail has an implied message that the institution has a mail server, website, local area network and, perhaps, ICT staff to maintain these facilities.

Usage weights were allocated on a scale of 1 to 5 based on the perceived level of sophistication of the user on the given ICT tool and the level of investment (skill effort and finance) to reach that level of usage as shown in Table 3.

Table 3: Usage weights

Use	Telephone	Computer	Mobile
Calls	1	5	1
E-Mail	3	4	2
Internet	3	4	2
SMS	4	5	1
Word Processing	2	3	5
Data Processing	2	3	5

The usage of mobile phones for word and data processing is considered a higher level of usage sophistication than the use on calls and SMS. Similarly, the use of the computer for calls and SMS represents a usage which finds the deeper value of computer utilization than the traditional aspects of word and data processing.

Using the weights earlier allocated, an ICT penetration and utilization index is developed using the formula shown below:

$$\overline{xi} = \frac{\sum wixi}{\sum wi} * 100$$

Formula for the computation of weighted ict penetration and utilization index

Where w_i is the weight allocated to item i, x_i is the value of item i, while Σw_i is the sum of weights.

3.2   Correlation

The ICT penetration and utilization index obtained was correlated with the independent variables outlined in the literature review to reveal the strength of linear relationships using the Pearson Moment Correlation Coefficient (McClave & Dietrich, 1994) value, r, and statistical significance value, p, with the assumption of linear relationship between the independent and dependent variables and the presence of a large number of independent causes operating in both variables to cause normal distribution (Kothari, 2004).

Positive values of r, with r ranging between -1 and +1, indicate positive linear relationship between the variables under consideration while negative values indicate negative linear relationship. Values close to or equal to 0 are construed to mean weak linear relationship while values close -1 or +1 were construed to mean strong linear relationship. A test of statistical significance value, p, is used with the level of significance set at 5%.

Therefore, correlations with p values below 0.05 and r values close to ±1 are accepted as denoting a significant linear relationship.

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4.0 Findings and Discussion
4.1 General
4.1.1 Gender Representation

The findings indicate that the councils have a fair gender representation in employment with male and female employees representing 60 and 40 percent respectively as per Figure 2.
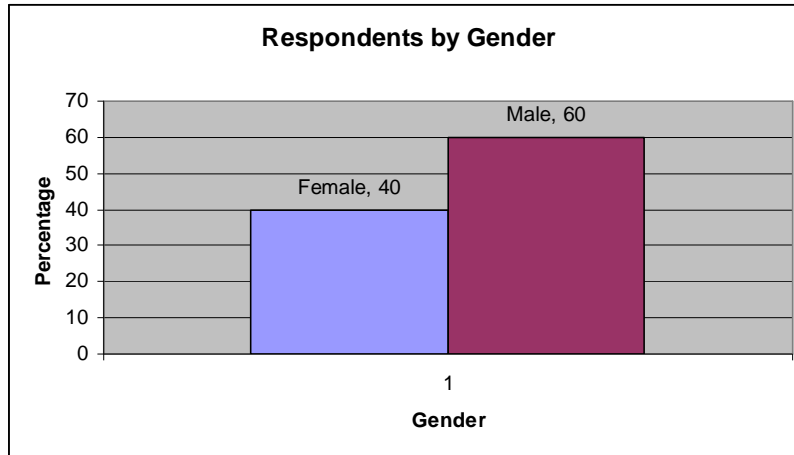

n = 75

Figure 1: Gender representation in the survey

This corresponds well with the commitment to mainstream gender and the effort to make fundamental changes in opportunity and empowerment as well as the attainment of at least 30 percent representation in recruitment, promotion and appointment of women towards the Kenya Vision 2030 (GOK, 2007).

4.1.2 Education

A simple majority of employees in the councils have diploma as the highest level of education followed by secondary school education with degree and higher national diploma a distant third and fourth in that order as shown in Figure 3.
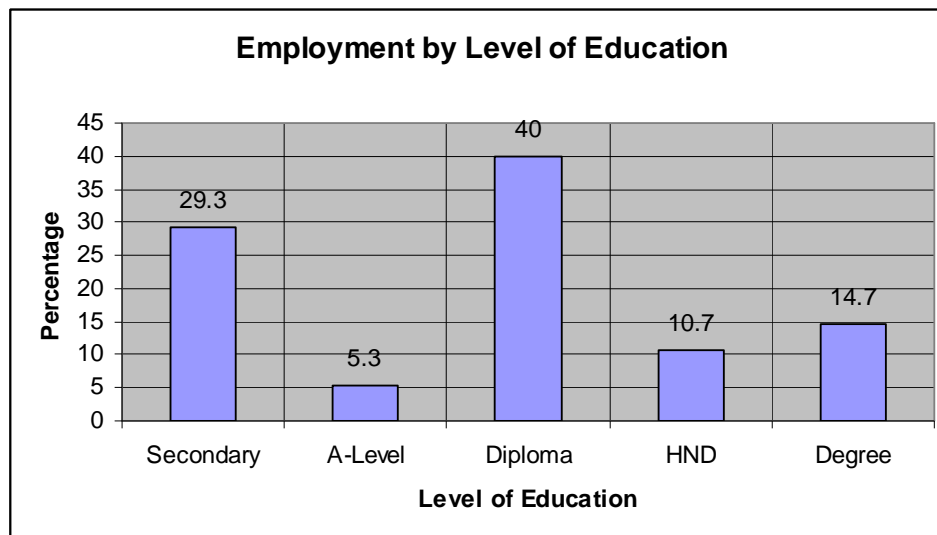
n = 75

Figure 2: Level of education of respondents

This status with respect to the level of education implies that while the local authorities are charged with key public services most of the staff lack advanced education with 29.3% being secondary school leavers and over 70% having a diploma or below. Degree holders account for a meager 14.7% of the staff.

4.2   Level of ICT Penetration and Utilization

Using the data obtained in the survey in percentages the level of ICT penetration and utilization obtained was a mean of 43.58% with a standard deviation of 14.96%. However, for the purpose of this study an ICT penetration and utilization index was computed based on custom-made weighting as explained in Section 3.8.1. The analysis herein was based on the computed value of ICT penetration and utilization index.

The councils in the survey recorded mean ICT penetration and utilization levels of 30.12%, 33.13% and 28.66% for MCT, MCM and CCT respectively while the overall mean ICT penetration and utilization for the three councils was 30.15% as shown in Table 4.

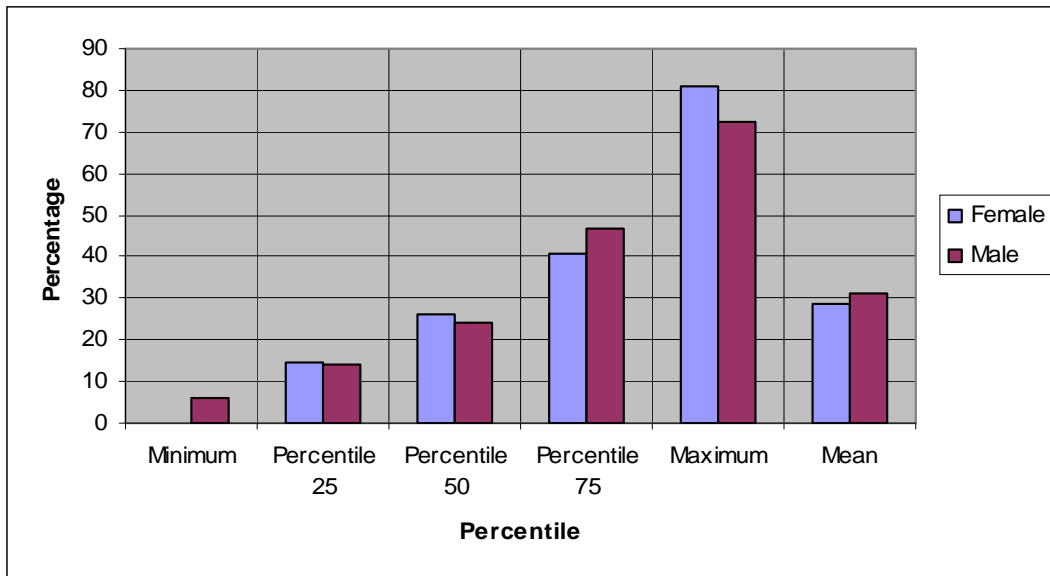*Table 4: Overall ICT Penetration and utilization in the survey*

Council	Min.	Percentile 25	Percentile 50	Percentile 75	Max.	Mean	Std Dev.
MCT	6.02	14.46	11.44	18.08	80.72	30.12	17.74
MCM	8.43	11.75	25.6	13.55	61.45	33.13	18.8
CCT	0	10.84	12.05	20.48	72.29	28.66	20.53
Overall	0	14.46	10.84	18.07	80.72	30.15	18.4

n = 75

Table 4 above shows the level of ICT penetration and utilization along the percentiles for the three councils surveyed and the overall level for three councils combined. The uppermost row indicates the level attained at each percentile while the leftmost column indicates the three councils and the overall penetration and utilization level. In the first percentile (1-25%) we have 14.46% level of overall ICT penetration and utilization. In the second (26-50%) and third (51-75%) percentiles we have 10.84% and18.07% respectively.

Considering the cumulative (sum of current percentile and the previous percentiles) figures across the percentiles, the overall ICT penetration and utilization the indication is that 25% of the respondents are at 14.46% level of ICT penetration and utilization, 50% respondents at 25.3%, and 75% respondents at 43.37%. Assuming that there were no errors in the sampling and sample design then the level of ICT penetration and utilization is quite low in all the councils involved.

There is no indication that the level of ICT penetration and utilization varies with gender. Both male and female staff was found to be at par across the percentiles with respect to the ICT penetration and utilization index as indicated in Figure 4.
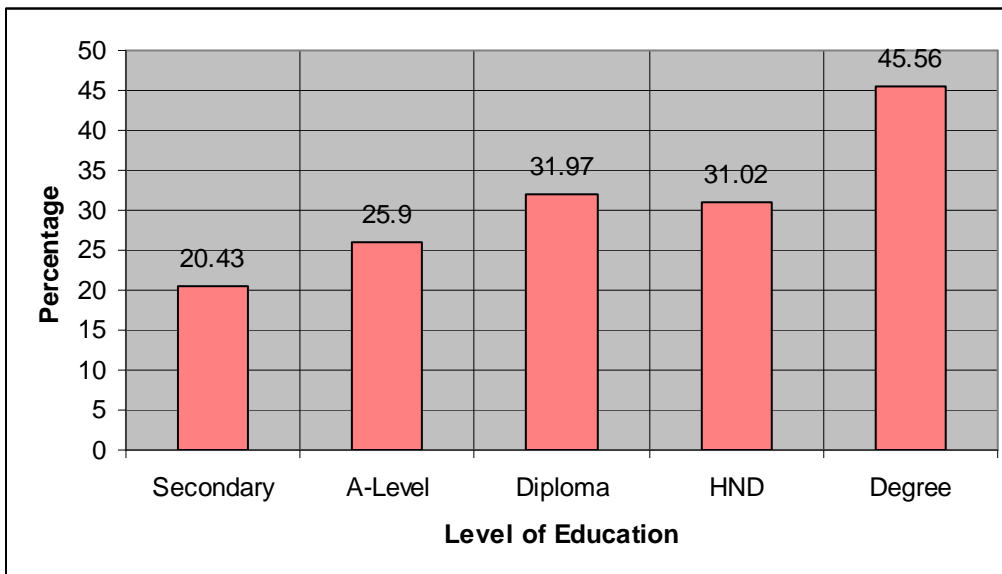
n = 75

Figure 3: ICT Penetration and utilization by gender

The level of education, on the other hand, has a strong linear relationship with ICT penetration and utilization. The ICT penetration and utilization is seen to gradually increase with an increase on the level of education from secondary school leavers at 20.43% to degree holders at 45.56% as indicated in Figure 5.

An investment in more educated staff is thus pertinent to improved ICT penetration and utilization.


n = 75

Figure 4: ICT penetration by level of education

The above is further confirmed by the Pearson Moment of Correlation Coefficient value, r, of 0.416 and $p < 0.01$ meaning that there is a significant linear correlation between the level of education and the ICT penetration and utilization. This means that a greater investment in better educated staff would be an incentive towards an increased ICT penetration and utilization.

In addition, the Pearson Moment of Correlation Coefficient value, r, is -0.528 and $p < 0.01$ meaning that there is also a significant linear relationship between the ICT penetration and utilization and the job scale. As we go up the

ranks the ICT penetration and utilization increases. In the local authorities the job scale or grades start with 1 the senior-most and end with 20 the lowest hence the negative value of r.

In the data obtained, the senior-most respondent was at scale 4. It is noteworthy that the ICT penetration and utilization index was significantly higher in job scale 4 to 10 than in job scale 11 to 16 as shown in Figure 6.
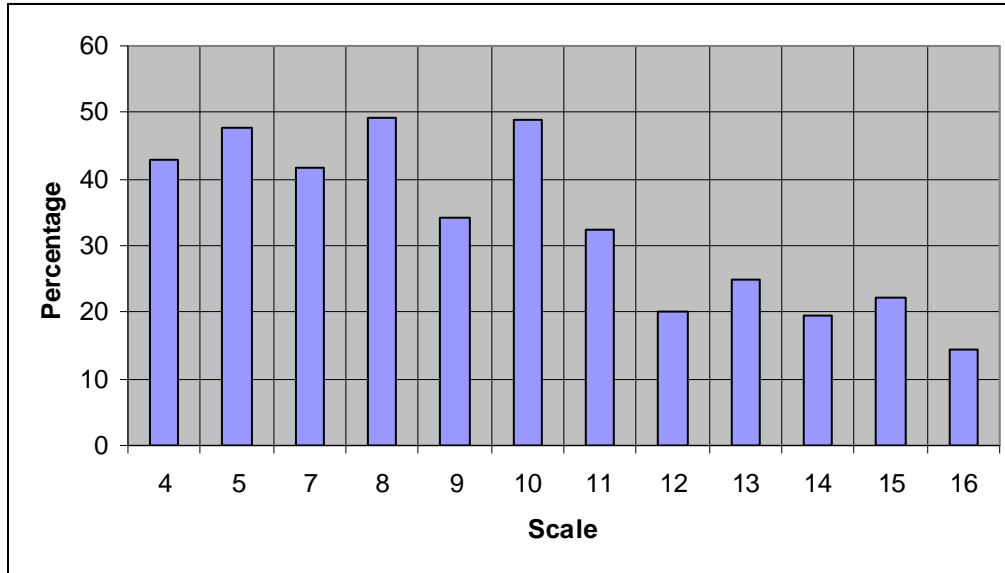

n = 75

Figure 5: ICT penetration and utilization by job scale

4.3   Sophistication of usage of ICT Tools

Technology has evolved over the time especially in the era of convergence leading to the development of "intelligent multi-functional machines … capable of performing a whole range of ancillary tasks" (Cleary, 1998, p. 3). The telephone line as was in the history of telecommunications can now serve as a data line with a modem and thus be used to access e-mail and Internet. Similarly, the basic modern computer can support video conferencing with a web-camera, television, radio and telephone among others.

The mobile phone too has evolved in modern times to support banking services, radio and television, data processing and storage, camera as well as support telecommuting through remote access to institutional servers (Ndukwe, 2005). However, it is noteworthy that in this study the use of telephone, computer and the mobile phone is confined to the traditional functions and purposes only.

Figure 7 indicates that an overwhelming majority use the telephone only for calls.
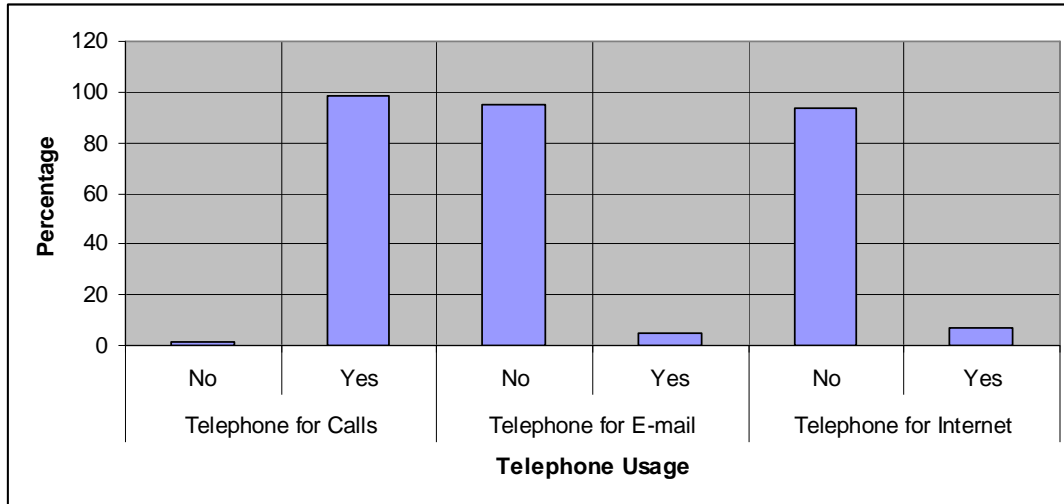

N= 67
Figure 6: Diversity of telephone utilization

This situation is also replicated in the use of the computer for word and data processing as indicated in Figure 8. Given the rise of portals offering SMS services on the Internet it is quite surprising that the use of the computer for SMS is only an insignificant 8.9%. The percentage of staff utilizing computers for e-mail and Internet and those not using computers for the same is near equal.
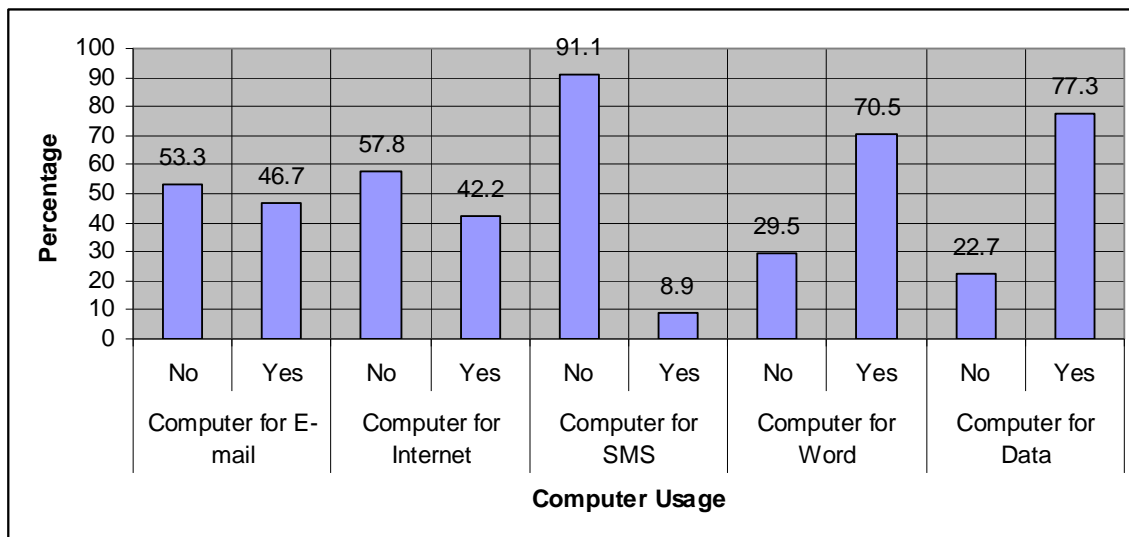
n = 60
Figure 7: Diversity of computer utilization

It is clearly noticeable that the mobile phone is basically used only for calls and SMS from the Figure 9 below with an insignificant 12.5% and 14.1% using it for e-mail and internet respectively. The low use of mobile phone for advanced purposes may change as more capable mobile handsets set into the Kenyan market and costs go down.
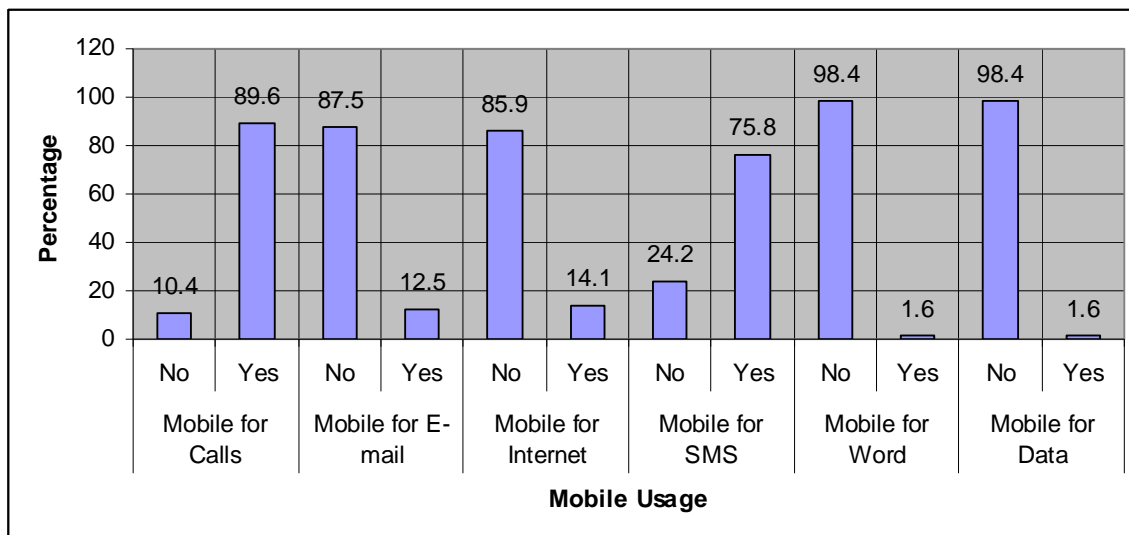
n = 71

Figure 8: Diversity of mobile phone utilization

It is thus clear that the utilization of telephone, computer and the mobile phone is highly confined to the traditional uses and therefore the benefits of convergence are yet to be reaped in the councils.

4.4 ICT Resources

The local authorities have managed to acquire the basic ICT equipment, allocate funds for ICT utilities and some ICT human resource. In all the three councils the ICT services are not a distinct department but are integrated in the treasury departments.

MCT in the 2008/2009 financial year, for instance, allocated KSh. 1,000,000 for computer and office equipment, KSh. 800,000 for postage and communication (including telephone, internet and postage), KSh. 240,000 for ICT staff skills development and KSh. 1,500,000 for ICT staff salaries and emoluments. In addition, MCT has 40 computers and 21 printers with Internet bandwidth of 256 Kbps. MCT has 7 ICT staff that provides user support, implementation and maintenance services.

CCT, on the other hand, has 20 computers, 1 server and 7 shared printers. It also has a bandwidth of 256 Kbps. It has an ICT staff budget of KSh. 452,000 for the 2008/2009 financial year. In the 2007/2008 financial year it had a budget of KSh. 1,800,000 for ICT equipment. CCT has a specialist systems administrator under the job title of computer programmer and one computer operator.

MCM also has 12 computers and 5 printers. It had an allocation of KSh. 2,000,000 for the 2008/2009 financial year although not broken down to specific ICT elements. MCM does not have specialist ICT staff while access to the Internet is restricted to the top management based on a portable wireless broadband modem.

Correlating the ICT resources and its level of its ICT penetration and utilization it is noted that there is a strong linear relationship between the two. Using the Pearson Moment of Correlation Coefficient value, r, is 0.667 with $p<0.01$. There is a significant linear relationship between ICT penetration and utilization and ICT resources. ICT penetration and utilization index increases with increased investment in ICT resources in the councils.

Looking at the percentages of staff that have access to basic ICT equipment it is clear that access to a mobile telephone and telephone extension is exceptionally high as shown in Figure 10 below:

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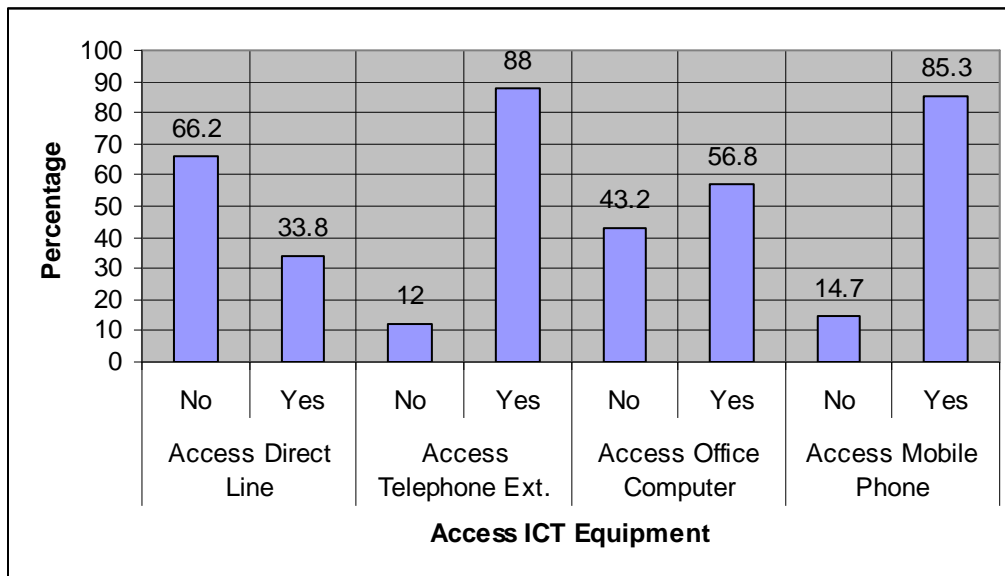
n = 75

Figure 9: Level of access to ICT equipment at the work place

It is noteworthy that MCT has 40 computers and 21 printers against a staff population of 503 employees; CCT has 20 printers and 7 printers against a staff population of 187 employees while MCM has 12 computers and 5 printers against a staff population of 113 employees. This translates to 7.95 computers per 100 employees in MCT, 10.7 computers per 100 employees in CCT and 10.62 computers per 100 employees in MCM.

Clearly, sharing the meager computer resource against the high number of employees is a gargantuan task to achieve a 56.8% computer access rate for the people surveyed. However, the understanding of how these employees share the little computer resources at their disposal and the level of effectiveness achieved under the circumstances is beyond the scope of this study and may be subject to further research.

It is also important to note that the Pearson Moment of Correlation Coefficient value, r, between the ICT penetration and utilization index and the number of supervised staff with computers is 0.471 with $p < 0.01$ indicating a significant linear relationship. This means that as the number of people with computers being supervised by an officer increases the ICT penetration and utilization also increases (see Roberts, 2005). This confirms the fact that more ICT resources consequently mean more ICT penetration and utilization.

A close look at Figure 21 overleaf reveals an important aspect. It is noteworthy that a simple majority of council employees have access to a local area network (64.7%), uninterrupted power supply system (65.2%), printer (56.5%), and anti-virus protection (60%). However, similar simple majorities have no access to the Internet (62.3%) and automated value-adding systems (51.4%) for their core duties (see Khamula, 2004).
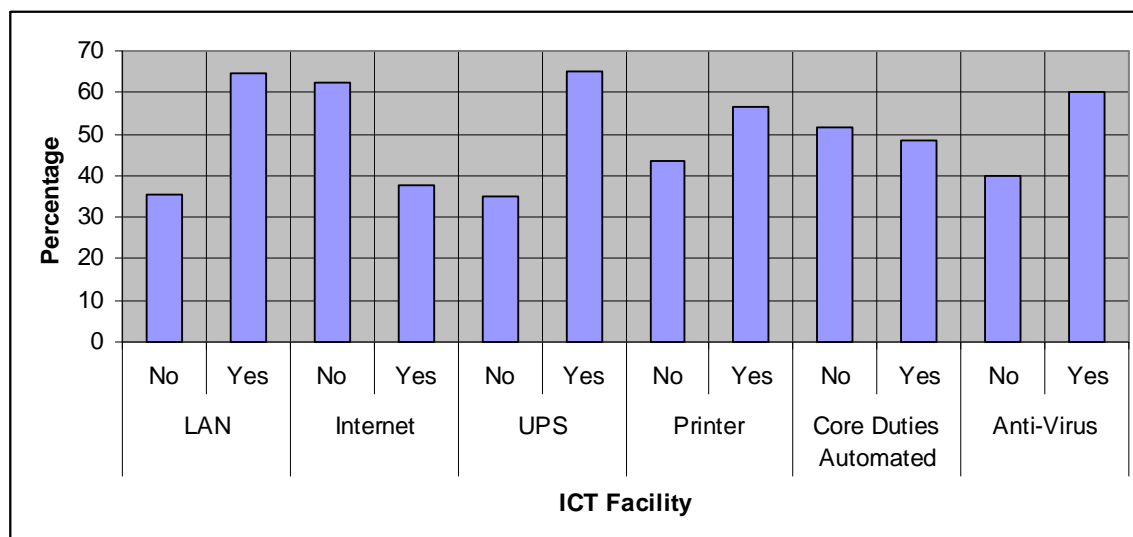
n = 69

Figure 10: Strategic ICT facilities

The investment in the local area networks, computers, printers, reliable power systems and anti-virus protection may not be able to leverage the local authorities public service delivery advantage if access to information, e-government services and e-business is not availed over the Internet while on the other hand the core duties cannot be performed on the systems because they are not automated. It is thus important that, as noted earlier, the local authorities align ICT with their strategic plans to maximize on the investment in ICT.

5.0 Summary of Factors Affecting ICT Penetration and Utilization

Generally, the state of ICT resources was noted to exert the greatest influence on the level of ICT penetration and utilization. As the number of staff with access to a computer in a section increased the level of ICT penetration and utilization increased. Greater investments in ICT resources would thus be expected to improve the level of ICT penetration and utilization.

The level of ICT penetration and utilization was found to have a significant linear correlation with the awareness, attitude and skill of the staff. It also emerged that as the level of education improved and the job scale ranking increased to seniority the penetration and utilization index improved. In addition, it was noted that the ICT trainings for staff significantly improved their awareness, attitude and skill.

It was noted that the there was no significant linear correlation between the institutions management and its level of ICT penetration and utilization. It was, however, clear that the LAIFOMS information management system in the councils was driven by a strong championship of the government under the KLGRP and the will to ensure that the system was implemented successfully. LAIFOMS have consequently managed to streamline financial, operational and revenue management processes in the councils.

There was no significant linear relationship between the ICT penetration and utilization and the ICT policy, regulatory and strategy. However, a significant majority of 83.4% of the respondents indicated that they agreed/strongly agreed that an ICT policy needed to be part of the strategic plan of the organization underpinning the importance of embedding ICT in the core business of the councils. The role of government was highlighted with the performance contracting policies being considered a key influence to the penetration and utilization of ICT in the councils meaning that when the government reinforced the need to deliver effective services, the respective councils would consequently embed all technology tools possible to improve the operations. The government was identified by a simple majority as being a driving force towards the use of ICT in the councils.

The job scale, the level of education, the length of time in public service and the age of the council staff were also found to have a significant linear relationship with ICT penetration and utilization. The job scale, length of service and age of council staff had negative values for the Pearson Moment Correlation Coefficient because as they increase the ICT penetration and utilization decreased.

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