Influence of Quality Management Systems on the Relationship Between Infrastructure Systems and Performance of Kenyan Public Universities

Joyce Mokamba, Margaret Oloko, and Nicholas Letting
In recent years there have been attempts to import business models from the private sector into higher education systems and institutions in an attempt to improve their performance. This has led to the emergence of a debate on the applicability of Quality Management Systems (QMS) principles, methodologies and tools to the higher education sector and their relationship with performance of those institutions. There exists a lot of research on the importance of Quality Management Systems and how it impacts on performance of organizations in general. However, there is little research that specifically focuses on the influence of QMS on the relationship between internal factors and performance of Public Universities in Kenya. This study sought to establish the influence of QMS on the relationships between administrative systems and the performance of Kenyan public universities. The study adopted a survey design which allowed for easy sampling and analysis of data. Seven certified public sponsored Universities published by the Commission for Higher Education in Kenya were sampled. Structured questionnaires were used in the collection of data. A pilot study was conducted to check for the reliability and validity of the questionnaire instruments. SPSS software was used in analyzing and interpreting data that was collected. The findings of this study demonstrated that QMS played a huge influential role between administrative systems and the performance of Kenyan public universities. This meant that administrative systems, with the influence of QMS as a moderating factor had a positive contribution to the change in the performance of Kenyan public universities. The results obtained from study will be beneficial to a range of beneficiaries, among them; scholars in the subject of management; researchers who will use the results as a contribution towards the advancement of knowledge in the subject area; Government officials and university management will in particular, benefit from the knowledge on the linkages between QMS and its influence on internal factors and the performance of public universities in Kenya. The study recommended that for Kenyan universities to realize the dreams of a majority of Kenyans envisioned in Vision 2030 and the 2010 Kenyan constitution, they all should proactively adopt QMS in their operations across all internal factors in order to improve their performances.

**Key words:** Quality management systems, administrative systems, internal factors and organizational performance.

**INTRODUCTION**

**Background of the study**

In the last decades, several factors have contributed to raising public concern over higher education institutions' quality. This has led to the emergence of quality measurement and improvement devices such as performance indicators, accreditation, programme and institutional assessment and quality audits. According to Redmond, Curtis, Noon and Keenane (2008), a Quality Management System in its basic concept seeks to: Recognize the external quality related requirements specified in Licenses to Trade, guidelines, specified customer requirements, and the chosen management
system standard(s). The authors argue that for the system to be effective, the following have to be in place: Ensure that all requirements have been documented within the management system in the appropriate location in terms of defined specific system requirements and also confirm that employees receive applicable training in the quality system requirements. Redmond et al. (2008) continue to affirm that performance processes should be outline, where applicable, to the quality system requirements; at the same time produce records or evidence that system requirements have been met. The authors say that measuring, monitoring and reporting of the extent of compliance with those performance procedures, continually monitoring and analyzing changes to the requirements and conformance that all changes are reflected in changes to the specific requirements when necessary.

In recent years, there have been attempts to import models from the private sector into higher education systems and institutions in the attempt to improve the performance (Sarrico, Rosa, Teixeira and Cardoso, 2010). This move has led to the emergence of a debate on the applicability of quality management principles, methodologies and tools to the higher education sector. As reported in the literature on higher education, several voices have been heard about the non-applicability of those management models, especially because they are derived from industry and had nothing to do with the higher education ethos (Harvey, 1995; Kells, 1995; Birnbaum, 2000; Massy, 2003; Pratasavitskaya and Stensaker, 2010). Other authors gave a more nuanced view on the subject, claiming that although higher education institutions were not private business enterprises, some of the basic principles and tools could be applied as long as they were instruments at the service of institutions and their governance and management boards, subject to the institutions' academic mission, goals and strategies (Williams, 1993; Harvey, 1995; Dill, 1995).

Most African states have maintained tight control over their public universities. African presidents have traditionally been the chancellors and appointing officers of all the university chief officers. Government representatives have dominated the university councils and heavily dictated their budgets. These arrangements have infringed on the academic freedom and autonomy of the universities thus compromising the quality of the performance. In 2012, Kenya developed and adopted higher education reforms aimed at streamlining and improving the management of university affairs. The Universities Act of 2012, finally signed into law by the then President, Mwai Kibaki introduced far-reaching changes. Public universities were subjected to quality assurance overseen by the commission a role previously prevented by university acts. In an effort to introduce professionalism in the recruitment of university chancellors in Kenya, such officers are now, constitutionally, picked by the university community and alumni. This brings to an end an era in which university leaders were appointed by the president of Kenya. This change has been welcomed by a number of scholars who are of the view that change programs in organizations such as institutions of higher learning largely depend on an organization’s human resources (Jackson and Schuler, 2000; Weigl, Hartmann, Jahns, and Darkow 2008). They have indeed postulated Organizational Development and change programs as part of an organization’s internal systems, including quality management systems. Thus, the internal factors utilize the theories of change and their relationship to an organization because change affects individuals, groups and organizations. Internal systems have been positioned as a strategic partner in many organizations for facilitating organizational change (Jackson and Schuler, 2000; Dessler, 2003; Joy-Matthews, Megginson, and Surtees, 2004). These internal systems for managing change in organizations embraces a multi-disciplinary approach (Nafukho, Hairston and Brooks 2004) and a “levels of analysis” perspective in organizations.

From the multi-disciplinary approach, Bates and Chen (2005) noted that internal factor functions within work systems are based on three distinct paradigms. The first one is the learning paradigm which focuses on the change through learning which is expected to produce development of the individual and therefore postulates learning as a critical part of an institutional culture. On this basis, internal factors serve the basic need of facilitating learning and adaptation to a changing work environment (Torraccio, 2005) and are thus concerned with fostering improved performance which is aimed at enhancing quality of the outcome. The second paradigm is the performance paradigm which presents internal factors as an area focused on advancing the performance of systems that sponsor the internal factors by improving the capabilities of individuals working in the system and improving the system. The third one is the meaning of work paradigm which takes a holistic approach to human development and the development of organizations and focuses on the development of the whole person so as to realize their full potential meaningfully and enhancing institutional health through programs that have a human appeal (Hucynski and Buchanan, 2001, 2007) and transcend institutional boundaries to improve Quality of life in the organization, the society and the world as a whole.

According to Torraccio (2005), learning has for long been acknowledged as a major determinant of organizational success. From the behavioral sciences, learning has been studied at the individual level and connected with change in behavior. Organization theorists have studied the concept from an organizational perspective. In both perspectives the aspect of change is
a not an ingredient in the learning process. Scholars in internal factors borrow from this change perspective to advance the development of the learning orientation in order to respond to environmental dynamics (Bates and Chen, 2005). Human Resource Development scholars have cited learning in organizations as a source of competitive advantage in the context of change. Learning in an environment of change positions people as a source of distinctive competence and makes them become the only source of differentiation and sustainable competitive advantage (Kontogiorghes et al., 2005; Storberg-Walker and Gubbins, 2007; Collin, 2007). The resource based view to competitive advantage based on human resources identifies the critical conditions that bring about this distinctiveness as employees who add value, are rare and cannot be copied (Jackson and Schuler, 2000; Golding, 2007). Lopez et al. (2005) indicate that organizational learning constitutes a source of competitive advantage, and identify particular Human Resource activities that promote learning such as recruitment and selection activities, training programs and design of compensation systems that reward knowledge acquisition and learning. Prevailing change demands new ways of working which can only be supported through not only extensive training in new skills but also completely new ways of thinking about work and relating with one another.

Research objective
The objective of this research was to determine how QMS influence the relationship between infrastructure systems and the performance of Kenyan public universities.

Quality management
Paris (2003) argues that Process Based QMS enables the organizations to identify measure, control and improve the various core business processes that will ultimately lead to improved business performance. QMS is a systemic set of management procedures used to monitor, check and improve the organization operative and financial performances, aiming to offer the best product/service at lower costs. Paris (2003), further states that institutions may have a more plain organizational structure, run a lower number of processes liable to QMS and can manage with more simple communication tools. This might lead to a significant reduction of system documentation. On the other hand, the number of employees and the level of complexity of the enterprise usually result (different than in micro and small enterprises) in an - at least partly - documented system of conducting business, so that there is a certain base to build on when working out the quality documentation.

ISO 9001 is an international standard that specifies the basic requirements for a Quality Management System. It further affirms that Quality management system is a powerful tool, which enables every organization to increase quality of products and/or services offered through continuous improvement of processes. It further affirms that QMS is that part of the organization's management system that focuses on the achievements of results, in relation to the quality objectives, to satisfy the needs, expectations and requirements of interested parties, as appropriate. According to Amyx (2005), when an institution has a working QMS, it is able to demonstrate its ability to meet customer and regulatory requirements and to enhance customer satisfaction. The standard outlines the five major elements in conjunction with the internal factors would lead to quality of the performance. This requires the organizational structure, the procedures, the management responsibility, the resource management, and the process which leads to product realization, measurement, analysis, and improvement of the same.

QMS development and implementation
A Quality Management System in its basic concept it seeks to: Recognize the external quality related requirements specified in Licenses to Trade, guidelines, specified customer requirements, and the chosen management system standard(s). ISO 9001:2008 states that for the system to be effective and efficient in functioning the following must be in place: Ensure that all requirements have been documented within the management system in the appropriate location in terms of defined specific system requirements and confirm that employees receive applicable training in the quality system requirements. Outlining of performance processes, where applicable to the quality system requirements and produce records or evidence that system requirements have been met. The standard further states that measure, monitor and report the extent of compliance with these performance procedures be maintained continually monitor and analyze changes to the requirements and confirm that all changes are reflected in changes to the specific requirements when necessary.

QMS and ISO standards
QMS is a formalized system that documents the structure, responsibilities, and procedures required to achieve effective results, in the area of quality. According to the requirements of ISO 9001, an organization must develop six quality documented procedures namely control of documents, control of quality records, internal audits, control of non-conformities, corrective action, and preventative action. The development of other procedures, work instructions, and other documents is largely at the discretion of the organization. Karipidis et al. (2008) contend that from the very beginning of the process, it is essential that organizations establish a
balanced view between a short-term focus (marketing/sales) and a long-term focus (achieving company-wide quality awareness through TOM). They further argue that ISO documentation should be considered as an enabler along that way and organizations must guard against the creation of unnecessary documentation. According to Mert and Cory (2011), a successful QMS must be fully functional and appropriately documented. They state that the institution's QMS system should be complete death, informally alive, formally death and informally death.

**Complete Death: No documentation, no functioning**
This is the state in which there is no indication of the existence and functionality of the QMS. No documentation exists and no processes are in place to help ensure the quality of the product. This is the state in which most institutions are. In such institutions there are no procedures to guide the performance of the work to realize their objectives.

**Informally Alive: No documentation, some level of functioning**
Many institutions exhibit an organic structure characterized by an absence of standardization and the prevalence of loose and informal working relationships. Institutions operating in this state are more likely to rely on people rather than a system. In such situations, key personnel may resist documentation for two key reasons arguing that documentation is considered a waste of time and that documentation of processes and procedures makes the individual less dependable. Institutions in this state perform some or all of the processes required by ISO 9001 and the QMS may function fairly well. These institutions are not willing and ready to document those processes unless there is a cultural change led by top management.

**Formally Death: Some level of documentation, no functioning**
Institutions categorized in this state have documented processes and procedures at some degree, however, the documents are generally not followed and do not necessarily reflect the actual manner in which the organization undertakes its operations and management. This situation highlights the fact that the mere existence of documentation does not necessarily lead to a functional QMS. Moreover, such a situation may help perpetuate the view that ISO 9001 is a way for institutions to market their products and services but that implementation of the standard requires stacks of documents that offer no value.

**Formally Alive: Some level of documentation, some level of functioning**
Sousa et al argues that institutions considered in this state, achieves a unique combination of the existence and functionality of processes and procedures that may or may not be required by ISO 9001. They agree that institutions in this state have documented the procedures, established and at the same time are implementing them including reviewing and continually improving on the same.

**Infrastructure systems and performance**
Menger (2001) states that to sustain innovation, firms must develop and implement Human Resource practices that encourage innovation and entrepreneurial behaviour. Institution's leadership must develop and implement an infrastructure that actively encourages and supports innovation. Gillay (2002) identify six factors that positively influence the organizational success rate and therefore incorporated as elements into numerous change models: ability to coach, reward, communicate, motivate, involve and support others and promote teamwork. Fey and Furu (2008) advocate the development of incentive structures that promote knowledge sharing and creation at the organizational and sub-organizational level. They content that knowledge is the most important source of competitive advantage and sustained superior performance.

Juran in his theory believed there were ten steps that could lead to quality and great improvement. These steps are: An awareness of the opportunities and needs for improvement must be created; Improvement goals must be determined; Organization is required for reaching the goals; Training needs to be provided; Initialize projects; Monitor progress; Recognize performance; Report on results; Track achievement of improvements and the repeat the cycle. Deming's theory concurs with Juran that Total Quality Management rests upon fourteen points of management he identified, the system of profound knowledge, and the Shewhart Cycle (Plan-Do-Check-Act). He is known for his ratio - Quality is equal to the result of work efforts over the total costs. If a company is to focus on costs, the problem is that costs rise while quality deteriorates. The standard thus concludes that for the institution be effective and enjoy high performance, it should determine the necessary competence for personnel performing work affecting conformity to product requirements, where applicable, provide training or take other actions to achieve the necessary competence, evaluate the effectiveness of the actions taken, ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and finally maintain appropriate records of education, training, skills and experience. The cycle after completion as Deming said is reviewed and then the repeat is done until the set objective is met.

Figure 1 identifies the PDCA model as a strong agent that could facilitate successful and effective way to
achieving quality and improved performance. By aligning the Plan, Do, Check and Act, victories in performance is possible. Summary highlights within each area are provided as follows: Plan - Establish the objectives and processes necessary to deliver results in accordance with the expected output (the target or goals).

Achieve this goal by reviewing and studying the current work process and available data. This stage really involves examining the current method or the problem area. Do- Implement the improvement or problem-solving plan by actually doing it. This is the implementation stage during which the plan is actually tried out in the operation. The people responsible need to be trained and equipped with the resources necessary to complete the task. Check - The new implemented solution is evaluated to see whether it has resulted in the expected performance improvement. Analyze the new data available and measure the results to see if the implementation of the plan is giving the results that it should. Act - If the implementation was successful standardize and document the work and new processes. If the change were not successful, learn from the trial, adjust where necessary to overcome problems, and formalize the new knowledge before starting the PDCA cycle over again.

The ‘Deming cycle’ benefits what is change management considerably because of its intended nature, which is continually reviewing and changing to do better. This change model implies the never ending process or repeatedly questioning the details of our work in the dynamic world of higher learning (figure 1).

Figure 1: Deming Cycle - PDCA Cycle - Shewhart Cycle Diagram

Table 1: Reliability test on the moderating variable

<table>
<thead>
<tr>
<th>Reliability Statistics</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cronbach’s Alpha</td>
<td>7</td>
</tr>
<tr>
<td>.886</td>
<td></td>
</tr>
</tbody>
</table>

Based on knowledge gained from “positive” verification of observable experience rather than introspection or intuition. As cited in Keraro (2014), May (1997), stated that the positivist philosophy pre-supposes that there is an objective reality that people can know reality and that symbols can accurately describe and explain this objective reality. A study by Schiffman and Kanuk (1997) observed that principal positivist methods often involve statistical analysis in order to generate findings and to test hypotheses. The study used a descriptive and correctional research designs as the basic designs which are of cross sectional survey in nature.

The study population comprised of all the public universities in their first cycle of QMS certification of three years. A multi stage sampling technique was applied in this research to select the respondents from whom primary data will be collected. A sample size of 221 respondents was used in the study. Data was collected using questionnaires, interview guide and document analysis.

DISCUSSION OF STUDY RESULTS AND FINDINGS

Reliability test on the moderating variable, QMS

Cronbach’s Alpha Coefficient was used to test for internal consistency of the data collected on the moderating variable (Quality Management System). The closer Cronbach’s alpha is to 1, the higher the internal consistency (Sekaran, 2006). Sekaran further argued that reliability of a measure indicates the extent to which it is without bias and hence ensures consistent measurement across time and across the various items in the instrument. If the Cronbach’s alpha is above 0.7 the instrument is reliable. Table 1 show that Cronbach’s Alpha is 0.886 and since it is above 0.7, the data therefore, can be termed as reliable.

Descriptive statistics on QMS, the moderating variable

Under this predictor variable, responses were sought from seven different questions on the influence of the moderating variable on the internal factors and the performance of public universities in Kenya. Table 2 presents the detailed descriptive statistics on the moderating variable of this study. A question posed on whether the management review meetings are held by the universities at least twice a year received the following responses: a majority of 56.3% (32.5% and 23.8%) of the respondents agreed that this was the case to a large and very large extents, 33.1% were moderate, 9.9% were to a little extent and 0.7% said not at all.
the question of whether the internal QMS audits are done twice a year by the universities, 72.9% (37.1% plus 35.8%) said this was the case to a large and very large extent, 21.9% were moderate, 4.6% and 0.7% were to a little extent and no extent at all respectively. On whether there is a budget allocation by the universities for QMS, 66.9% (36.4% plus 30.5%) said this was the case to a large and very large extent, 25.2% were moderate while 7.3% and 0.7% were to a little extent and to no extent at all respectively. On whether there are follow ups done on the audits are implemented by the universities, 69.5% (43.7% and 25.8%) said this was the case to a large and very large extent, 25.2% were moderate while 4% and 1.3% were to a little and no extent at all respectively. A question on whether effective infrastructure was established by the universities 60.2 (41.7% and 18.5%) responded that this was the case to a large and very large extent, 33.8% were moderate while 3.3% and 2.6% were to a little and no extent at all respectively. A question asked on whether various university departments had well established procedures elicited the following responses; 61.5% (37.7 plus 23.8%) responded that this was the case to a large and very large extent, 31.8% were moderate while 4.6% and 2% were to a little and no extent at all respectively. A final question on the moderating variable was asked regarding whether all staff in the universities was aware of QMS, 63.6% (35.8% plus 27.8%) responded that this was the case to a large and very large extent, 30.5% were moderate while 4% and 2% were to a little and no extent at all respectively.

The results obtained from this study concur with ISO 9001 which affirms that Quality management system is a powerful tool, which enables every organization to increase quality of products and/or services offered through continuous improvement of processes. The standard affirms that QMS is that part of the organization’s management system that focuses on the achievements of results, in relation to the quality objectives, to satisfy the needs, expectations and requirements of interested parties, as appropriate. Paris (2003) observed that process based QMS enables organizations to identify measure, control and improve the various core business processes that will ultimately lead to improved business performance which tallies well with the results of this study. A study by Amyx (2005) concluded that when an institution has a working QMS, it is able to demonstrate its ability to meet customer and regulatory requirements and to enhance customer satisfaction. This position taken by Amyx resonates well with the findings obtained from this study on QMS as a moderating variable. Further, the results obtained from this study are congruent to the arguments advanced by Karipidis et al. (2008) who contended that from the very beginning of the process, it is essential that organizations establish a balanced view between a short-term focus and a long-term focus of QMS. They emphasized that QMS documentation should be considered as an enabler along the way and organizations must guard against the creation of unnecessary documentation. A successful QMS Mert and Cory (2011) must be fully functional and appropriately documented.

In each of the questions relating to the QMS as a moderating variable, over 50% responded in the affirmative with a clear indication that they either agreed or strongly agreed with the statement that QMS was an integral part of the performance of public universities in Kenya. Diverse streams of scholarship support the position of a strong link between QMS and institutional performance. Bosse, Robert and Harrison (2009) identified performance as a dependent variable in organizational studies. As noted by Sousa et al (2011), a successful QMS must be fully functional and appropriately documented. It could, therefore, be strongly argued that QMS is an influential moderating factor between internal factors and the performance levels achieved by public universities in Kenya.

**Correlation of performance of the public universities and funding mobilization**

Pearson’s correlation was done on performance of the public universities against funding mobilization. The findings were presented in Table 3 and 4. The Pearson correlation coefficient was 0.29, which implied that performance of the public universities and funding mobilization were weakly correlated.

Further, partial correlation of performance of public universities and funding mobilization was done while

<table>
<thead>
<tr>
<th>Statements</th>
<th>Not at all</th>
<th>Little extent</th>
<th>Moderate extent</th>
<th>To a large extent</th>
<th>A very large extent</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review Meetings</td>
<td>1</td>
<td>.7</td>
<td>15</td>
<td>9.9</td>
<td>50</td>
<td>33.1</td>
</tr>
<tr>
<td>Internal Audits</td>
<td>1</td>
<td>.7</td>
<td>7</td>
<td>4.6</td>
<td>33</td>
<td>21.9</td>
</tr>
<tr>
<td>QMS Budget</td>
<td>1</td>
<td>.7</td>
<td>11</td>
<td>7.3</td>
<td>38</td>
<td>25.2</td>
</tr>
<tr>
<td>Audit Follow Ups</td>
<td>2</td>
<td>1.3</td>
<td>6</td>
<td>4</td>
<td>38</td>
<td>25.2</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>4</td>
<td>2.6</td>
<td>5</td>
<td>3.3</td>
<td>51</td>
<td>33.8</td>
</tr>
<tr>
<td>Procedures</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>4.6</td>
<td>48</td>
<td>31.8</td>
</tr>
<tr>
<td>QMS Awareness</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>46</td>
<td>30.5</td>
</tr>
</tbody>
</table>
controlling for Quality Management System. The Pearson Correlation Coefficient reduced from 0.297 to 0.290, a difference of 0.007, as shown in table 4. This was attributed to the effect of Quality Management System on the relationship between performance of public universities and funding mobilization.

**INFRASTRUCUTRE SYSTEMS**

The study sought to find out the influence quality management systems had on the relationship between performance of public universities and infrastructure systems. The findings were presented and discussed in this section.

**Reliability test on infrastructure systems**

Cronbach’s Alpha was used to determine the internal consistency of the independent variable (infrastructure systems) so as to ascertain its reliability. The findings were presented in table 5. From the table, Cronbach’s Alpha value was 0.836 which was higher than the threshold of 0.7. From the results, it can be concluded that infrastructure systems was considered as highly reliable for data analysis.

**Descriptive statistics of infrastructure systems**

On this predictor variable, responses were sought from six different questions in relation to the performance of public universities in Kenya. Table 6 presents the detailed descriptive statistical findings on this variable is presented. On the first question on whether there were well established and equipped laboratories in the universities, 65.6% (sum of 49.7% and 15.9%) of the respondents agreed that this was the case to a large and very large extents, 27.2% of the respondents were moderate while 6.6% and 0.7% said to a little extent and not at all respectively. On whether the universities had developed and equipped laboratories and workshop centres for carrying out innovative experiments, 60.2% (48.3% plus 11.9%) said this was the case to a large and very large extents, 32.5% were moderate, 6.6% and 0.7% were to a little extent and no extent at all respectively. On whether the universities have adequate and well furnished lecture halls to meet the needs of all the students, 49.7% (30.5% plus 19.2%) said this was the case to a large and very large extents, 29.8% were moderate while 14.6% and 6% were to a little extent and to no extent at all respectively. The other question addressed was whether the universities had adequate accommodation facilities to cater for all the students, 43.1% (30.5% and 12.6%) said this was the case to a large and very large extents, 28.5% were moderate while 15.2% and 13.2% were to a little and no extent at all respectively. On whether there was clear communication guidelines between students, leadership, lecturers and support staff, 50.3% (39.7% and 10.6%) said this was the case to a large and very large extents, 37.1% were moderate while 9.3% and 3.3% were to a little and no extent at all respectively. On whether QMS was adopted in order to improve infrastructure systems of the universities, 55% (40.4%...
Table 6: Descriptive statistics of infrastructure systems

<table>
<thead>
<tr>
<th>Statements</th>
<th>Not at all F</th>
<th>%</th>
<th>Little extent F</th>
<th>%</th>
<th>Moderate extent F</th>
<th>%</th>
<th>To a large extent F</th>
<th>%</th>
<th>A very large extent F</th>
<th>%</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Resources</td>
<td>1</td>
<td>.7</td>
<td>10</td>
<td>6.6</td>
<td>41</td>
<td>27.2</td>
<td>75</td>
<td>49.7</td>
<td>24</td>
<td>15.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Lecture Halls</td>
<td>1</td>
<td>.7</td>
<td>10</td>
<td>6.6</td>
<td>49</td>
<td>32.5</td>
<td>73</td>
<td>48.3</td>
<td>18</td>
<td>11.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Labs and W/shop</td>
<td>9</td>
<td>6</td>
<td>22</td>
<td>14.6</td>
<td>45</td>
<td>29.8</td>
<td>46</td>
<td>30.5</td>
<td>29</td>
<td>19.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Accommodation</td>
<td>20</td>
<td>13.2</td>
<td>23</td>
<td>15.2</td>
<td>43</td>
<td>28.5</td>
<td>46</td>
<td>30.5</td>
<td>19</td>
<td>12.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Internal Commun.</td>
<td>5</td>
<td>3.3</td>
<td>14</td>
<td>9.3</td>
<td>56</td>
<td>37.1</td>
<td>60</td>
<td>39.7</td>
<td>16</td>
<td>10.6</td>
<td>100.0</td>
</tr>
<tr>
<td>QMS and Infrastructure</td>
<td>2</td>
<td>1.3</td>
<td>12</td>
<td>7.9</td>
<td>54</td>
<td>35.8</td>
<td>61</td>
<td>40.4</td>
<td>22</td>
<td>14.6</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 2: Scatter diagram of performance and infrastructure

and 14.6%) responded that this was the case to a large and very large extents, 35.8% were moderate while 7.9% and 1.3% were to a little and no extent at all respectively.

The findings above resonate with Menger (2001) and Gillay (2002) who states that Institution's leadership must develop and implement an infrastructure that actively encourages and supports innovation and thus performance. Fey and Furu (2008) argued that the development of incentive structures that promote knowledge sharing and creation at the organizational and sub-organizational level promotes good performance. They contended that knowledge is the most important source of competitive advantage and sustained superior performance. These findings also concur with conclusions by QMS gurus such as Juran, Demming, Crosby and others who believed that QMS had a role in coordinating infrastructure of an institution and that once this coordination is done effectively, the institution's performance is guaranteed to improve.

The findings obtained from this study corroborate quite well with the literature reviewed in chapter in infrastructure. The findings provide strong evidence that 55% of the respondents were convinced that QMS plays a vital role in the enhancement of infrastructure of public universities in Kenya.

Scatter plot of performance and infrastructure systems
Scatter diagram of performance of the universities and infrastructure systems was generated to establish whether there was any relationship between performance and infrastructure. The findings were presented in figure 2. The Figure shows that there is positive linear relationship between performance of the universities and infrastructure systems.

Regression and correlation analysis of performance and infrastructure systems
The study employed regression and correlation analysis to find out the influence Quality Management System had on the relationship between performance of the universities and infrastructure systems. The findings were
Figure 3: Line of best fit for performance and infrastructure systems

Table 7: Model summary of performance and infrastructure systems

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R²</th>
<th>Adjusted R²</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.704*</td>
<td>.496</td>
<td>.492</td>
<td>4.27961</td>
</tr>
<tr>
<td>2</td>
<td>.735*</td>
<td>.541</td>
<td>.535</td>
<td>4.09693</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Infrastructure Systems
b. Predictors: (Constant), Infrastructure Systems, Quality Management System

presented and discussed in the sections that follow:

**Line of best fit for performance against infrastructure systems**

Regression line of best for performance of the public universities against the infrastructure systems showed that a positive linear relationship was present as can be observed in figure 3. This implies that, as infrastructure systems improve, performance of the public universities is also bound to improve.

**Linear regression analysis for performance and infrastructure**

Stepwise linear regression analysis of the performance of the Kenyan public universities and infrastructure was carried out to establish the influence Quality Management System had on the relationship between performance and infrastructure systems. The findings were presented and discussed in this section.

**Model summary of performance and infrastructure systems**

From the model summary table 7, it is noted that infrastructure systems on their own explain 49.6% (R²) of performance of Kenyan public universities (Model 1 of table 4). However, with the introduction of the moderating variable Quality Management Systems, the resultant is R² improved from 49.6% to 54.1%. This means that with the influence of the moderating variable, Infrastructure systems explain 54.1% (Model 2 of table 7) of performance of Kenyan public universities.

The findings concur with Fey and Furu (2008) who advocates that development of incentive structures that promote knowledge sharing and creation at the organizational and sub-organizational. They content that knowledge is the most important source of competitive advantage and sustained superior performance. Menger (2001) agrees with them that institution’s leadership must develop and implement an infrastructure that actively encourages and supports innovation. These findings explain the higher response 49.6% (Table 7) that Infrastructure alone contributes to performance of Kenyan public universities.

It is evident from these findings that, similar to that discussed in the literature by Juran’s Theory, that with awareness of opportunities, improved goals, provided
training needs, monitoring progress, reporting on results and tracking achievements led to the improvement of performance from 49.6% to 54.1% increment of 4.5%(Table 4.31).

ANOVA of Performance and Infrastructure Systems
The ANOVA table 8 shows that p-value of model 2 is less than 0.05. Therefore, the null hypothesis; Quality Management Systems have no influence on performance of Kenyan Public Universities and infrastructure systems, is rejected and the alternative hypothesis; Quality Management Systems have an influence on performance of Kenyan Public Universities and infrastructure systems, is accepted. Since the P-value equal to .000, it means that the model is statistically significant in explaining the influence infrastructure systems have on performance considering that the P-value is less than .05 at the 95% level of confidence.

Coefficients of Performance and Infrastructure Systems
Coefficients table 9 shows that for every unit change in performance of Kenyan public universities, infrastructure systems alone contribute .973. When Quality Management is included in the model, infrastructure systems and quality management systems contribute .824 and .283 respectively and their p-value is .000. Since the p-value is less than .05 for both, this means that their contributions are statistically proven to be significant as their p-value is less .05.

Correlation analysis of performance and infrastructure systems
Pearson’s correlation coefficient was generated when performance of Kenyan public universities was correlated against infrastructure systems. The findings were presented in table 4. The findings revealed that performance of Kenyan public universities was highly correlated to infrastructure systems, with a Pearson Correlation Coefficient of .704 and this correlation was statistically significant as p-value was less .05.

Summary of study findings
The study established that when controlling for QMS as a moderating variable, the coefficient of determination, R² of infrastructure systems on the performance of Kenyan public universities was 49.6%. This meant that infrastructure systems alone as a predictor variable contributed up to 49.6% of the change in the performance of Kenyan public universities. When QMS was uncontrolled, the coefficient of determination, R² of infrastructure systems on the performance of Kenyan public universities improved to 54.1%, meaning that with the influence of QMS, the contribution to the performance of Kenyan public universities improved to 54.1% (a change of 4.5%). It was also established that there was a high positive correlation, R, of 70.4% between infrastructure systems and the performance of Kenyan public universities when QMS was controlled. This correlation improved to 73.5% with the introduction of QMS. In all these cases, the p-value between the
independent variable and the dependent value was less that .05 at 95% level of confidence. This meant that infrastructure systems were statistically significant in the change in the performance of Kenyan public universities.

The study further established that: there was a positive linear relationship between infrastructure systems and the performance of Kenyan public universities; over 65.6% of the universities had well established and equipped libraries; over 60.2% of the universities had developed and equipped laboratories and workshop centers for carrying out innovative experiments; only 49.7% of the universities had adequate and well furnished lecture halls to meet the needs of all the students; a mere 43.1% of the universities had adequate accommodation facilities to cater for all the students; 50.3% of the respondents said their universities had developed clear communication guidelines between students, leadership, lecturers and support staff; and a majority of 55% that their universities had adopted QMS in order to improve their infrastructure systems as a way of enhancing performance. These findings, thus; led to rejection of the null hypothesis that QMS had no influence on infrastructure systems and performance of Kenyan public universities.

**CONCLUSIONS**

Based on the findings presented in chapter four and the summaries contained in section 5.2 of QMS has a significant moderating influence on infrastructure systems and that this has a direct positive impact on the performance of the Kenyan public universities. This means that all public universities require to embrace the culture of sound QMS processes in developing; well established and equipped libraries for information and knowledge; laboratories and workshop centers for carrying out innovative experiments; adequate and well furnished lecture halls to meet the needs of all the students; adequate accommodation facilities to cater for all the students and thus motivate them to concentrate of their studies; clear communication guidelines between students, leadership, lecturers and support staff to enhance cohesion and a common approach to critical university matters.

**Recommendations**

QMS has a significant moderating influence on infrastructure systems. Thus, all public universities should embrace the culture of sound QMS processes in developing; well established and equipped libraries for information and knowledge; laboratories and workshop centers for carrying out innovative experiments; adequate and well furnished lecture halls to meet the needs of all the students; adequate accommodation facilities to cater for all the students and thus motivate them to concentrate...
Published). Jomo Kenyatta University of Agriculture and Technology. Nairobi.
Williams, G. (1993). Total quality management in higher education: panacea or placebo?