

THE CRAZE FOR STUDENTS' NUMBERS IN KENYA'S PUBLIC AND PRIVATE UNIVERSITIES AND THE OPTIMAL OPERATION OF MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY: TOWARDS A COST RECOVERY STRATEGY

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The Research Issue

From 2003 when the university came into being as a constituent college of Moi University up to 2013, Masinde Muliro University of Science and Technology (MMUST) had experienced unprecedented growth. Student population had grown tremendously. As of 2012/2013 academic year, student enrolment stood at 10,100 majority of who were enrolled in the Privately Sponsored programme (PSSP). The University had also witnessed growth in new programmes, departments, schools and faculties. Quite a reasonable number of infrastructural facilities had also been developed such as the library, science complex building and hostels (CHE,2011). The university had also expanded its wings in study centers and campuses. These included, Bungoma Campus, Sangalo campus, Webuye, Kaimosi, Kobujoi, Eburngwe, Nambale, Budalangi, Busia, and Nairobi campuses among others. Despite these expansions, the University had faced myriad challenges. More serious challenges were reported between 2010/2011 to 2013/2014 FYs. The major challenges were:

- i) Fluid financial situation leading to inability of the university to meet its pecuniary obligations to staff and other service providers to pay salaries on time, inability to pay service providers for the PSSP programmes, inability to send SACCO capitation on time and delayed remittance of statutory deductions to banks, KRA and other stakeholders.
- ii) Inadequate staff support facilities and equipment.
- iii) Inadequate health care support facilities and equipment
- iv) Inadequate provision of tuition facilities and infrastructure
- v) Inadequate student accommodation and welfare services
- vi) Inadequate infrastructure to support research and innovation

Several attempts were made to remedy the situation through change of guard by University Council (UC) and Top University Management (TUM) including numerous austerity measures in 2012/2013 FY. However, it was believed that such changes alone would not steer the University to financial stability without proper identification of the problem from an empirical perspective. It is against this background that this study was proposed with a view of establishing the optimum level of operation of the University. The rationale behind this was to provide a foundation on which job rationalization, resource allocation, and University's target outputs can be measured through efficient utilization of the minimum resources available. Thus the purpose of this study was to establish the optimal level of operation of Masinde Muliro University of Science and Technology. This included identification of change in long-run average cost based on the concept of economies of scale and diseconomies of scale. The study argues that the university would enjoy economies of scale in a situation where average cost was equal to the marginal cost. By contrast, the university suffers from diseconomies of scale in a situation where marginal cost would be higher than the average cost of operation. The extent of diseconomies of scale can affect efficient operation of the University.

Objectives of the study

The following specific objectives guided this study.

- i) To determine the optimal level of operation of Masinde Muliro University of Science and Technology
- ii) To analyse the unit costs, the total costs and the marginal costs of operation of the university

Central Research Question

The study was guided by the following main question.

1. What is the optimal level of operation of Masinde Muliro University of Science and Technology?

Subsidiary Research Question

In order to address the main question, the study developed the following subsidiary research question stated as follows:

2. What are the unit costs, the total costs and the marginal costs of operation of the university?

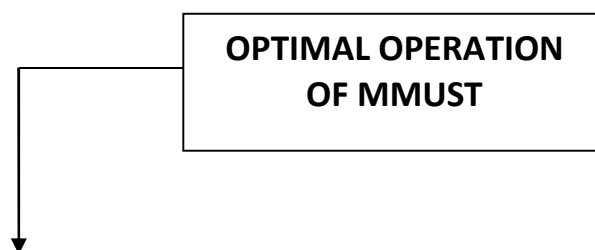
Significance of the study

Prudent financial and physical management of any institution is of prime significance. In the recent past many higher education institutions in Kenya have been accused of inefficiency in human capital and resources management. The significance of this study lies in the fact that it will:

- i) Aid the university's top management organs such as the Chief Executive officer and the Vice Chancellor, University Council, the deputy Vice Chancellors including Registrars, Heads of Departments, Deans and Directors, to identify areas of inefficiency in financial and human resource management of the University.
- ii) It is also hoped that this study might form the basis for future policy decisions in the University that will enhance prudent financial management, accountability among staff and cost recovery mechanism

1.5 Concepts

According to Gerring (1999), concept formation lies at the heart of all social science research. The significance of concept formation lies in its ability to aid proper conceptualization of the topic of study since every author makes lexical and semantic choices as they write. In this study, the terrain of concepts was developed in an organogram as shown in Figure 1 below.



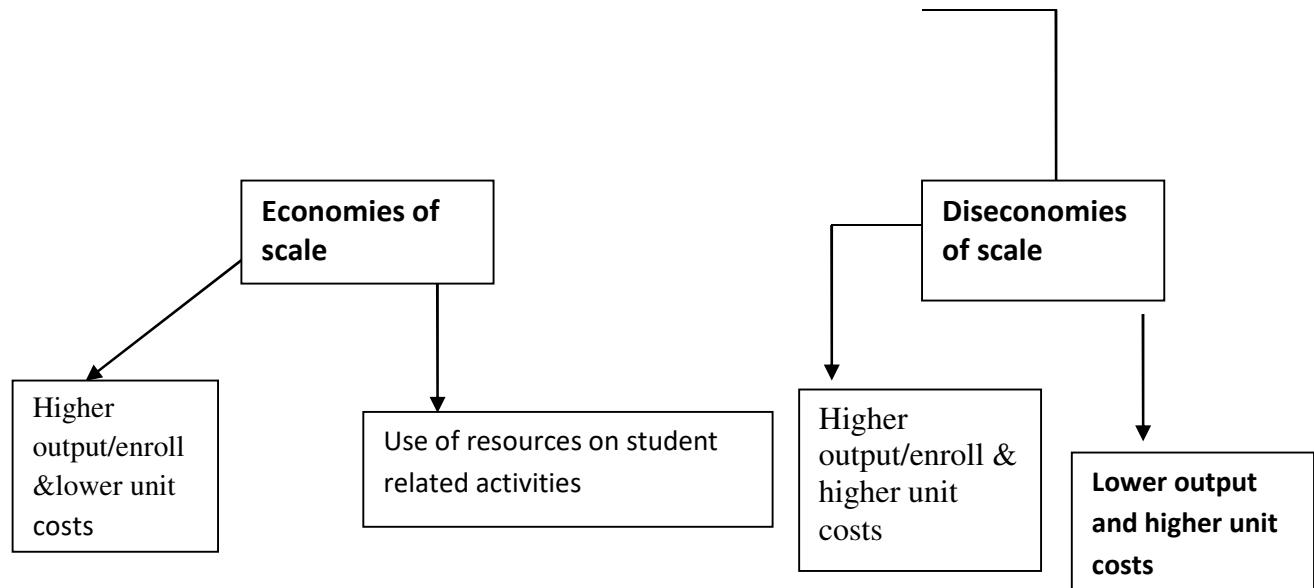


Figure 1: Organogram of the Main Concepts of the Study

Source: Own Conception.

Subsequently, the main concepts of the study were operationslised as follows:

Optimal operation of MMUST: As used in this study, this refers to a situation where average/unit costs equals to marginal costs

Marginal costs: This is the extra costs that an institution will incur by admitting one additional student. It is $\frac{\text{Change in total costs}}{\text{Change in number of students}}$

They are cost that change with number of students being admitted in the university for example the more the number of students being admitted in the university, the more the costs of food, water, electricity, hired lecture space, hired accommodation space, stationary and chairs. The University must get interested in marginal costs and average costs in its operation. This is because, when the marginal costs are increasing by a big margin, you cannot keep on admitting more students. However, when the marginal cost is equal to average cost, the institution is operating optimally. The University should aim at maintaining this.

Unit cost: It is the total costs divided by the number of students in the university. At the moment, the university should be concerned with lowering unit cost in its operation. The aim is to ensure the university operate optimally and therefore avoid wastage of scarce resources. Unit costs are also referred to as average costs or operating costs. All these terms will be used interchangeably.

Total costs: It is the additional fixed costs and variables costs. It includes all the costs that the university will incur in order to function or operate.

The Causal Path

Causality has been defined as a theoretical concept independent of the data used to learn about it. (King, Keohane and Verba, n.d:76). In this study the outcome variable denoted by Y (dependent variable) is the optimal operation of the university that encompasses low unit cost. At this point, the marginal cost is equal to the unit cost. However, the causal variable denoted by X (independent variable) is efficiency in financial expenditure. This explained by proper utilization of HC in the, teaching and non teaching staff. This will be shown by planned growth rates in staff employment and student numbers. The causal path assumes that funds will be utilized on student related activities. However, there could be intervening variables such as corruption, political pressure, court action, etc. Such factors are denoted by Z. This is shown in Figure 2.

Xcausal MechanismY

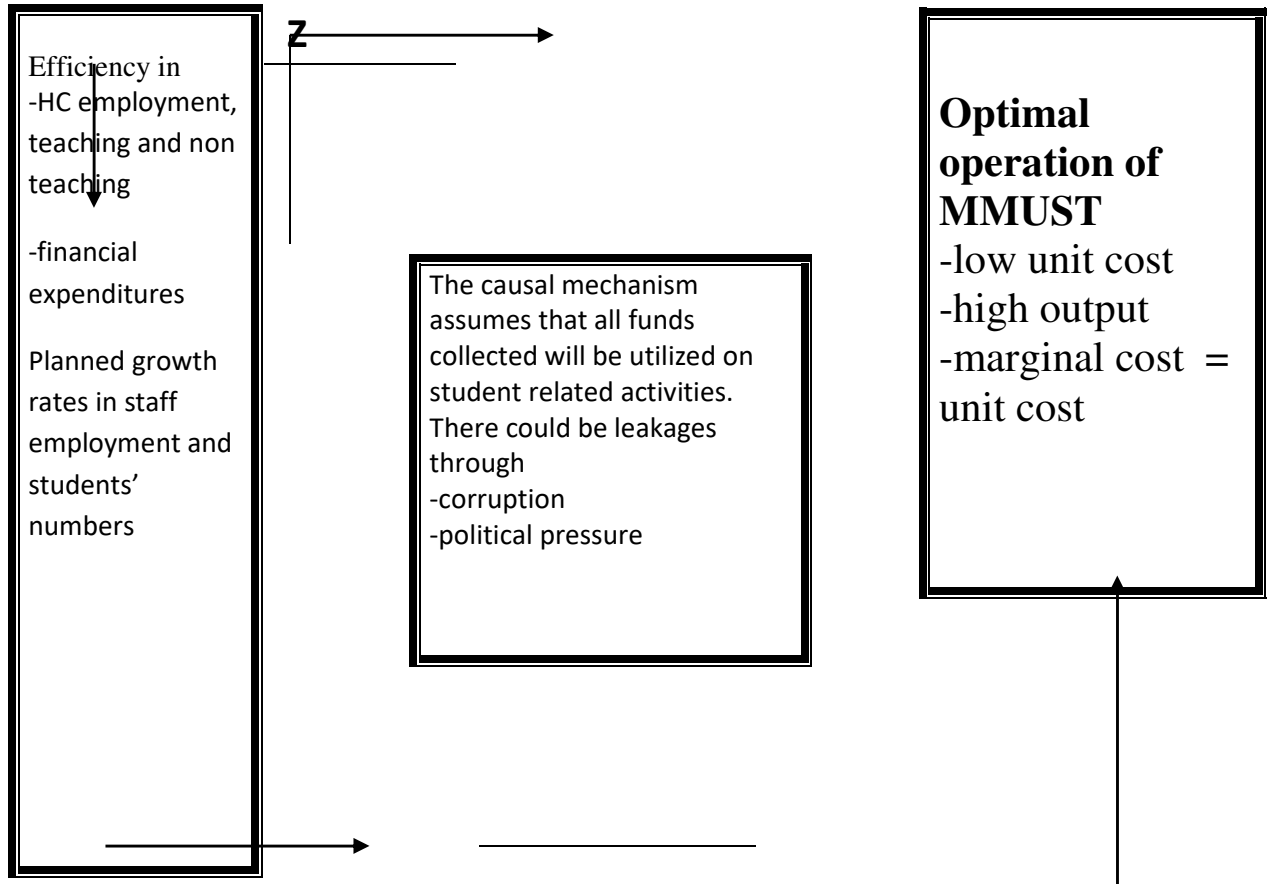


Figure 2: the causal path

Source: adopted from Odebero, 2012

Theoretical framework

Educational Cost Function Analysis

The survey was based on the theory of Cost function analysis of educational investment. Cost function analysis models the relationship between firm costs, firm output, and input prices (Very and Layard, 1975; Grogberge, Jansen, Taylor and Booker, 2005). As such, an educational cost function uses statistical techniques to measure the systematic relationship between actual

expenditures and educational output and outcomes given input prices and technological factors (Grogberge, Jansen, Taylor and Booker, 2005).

Economically, output (Q) has a direct relationship with the total cost since an increase in the output leads to a rise in the total cost and vice versa. Be that as it may, an improvement in the state of technology usually provides the producer with cost saving techniques of producing the output. Technology therefore has an indirect relationship with the total cost. Rises in the prices of the factors of production directly lead to increases in the total cost of production, hence, a direct relationship.

Graphically, the other factors of the total cost function apart from the output (Q), act as shift factors as changes in any or all of them shift the cost curve outwards or inwards, depending on the direction of change. The relationship between total cost and output can be plotted on a two-dimensional diagram allowing for movements along the cost curve, holding all other factors constant. This implies that the cost function may be written as

$$C = f(Q)$$

The short-run total cost function is given as

$$C = f(Q, T, P_f, K)$$

and the long-run function is

$$C = f(Q, T, P_f)$$

where C = total cost

Q = output

T = technology

P_f = prices of factors of production

K = fixed factors of production

In the area of higher education, any analysis of costs must acknowledge and explicitly take into account in the estimation technique the multi-product nature of production. Universities by their very nature are engaged in production and dissemination of knowledge (Cohn and Cooper, 2004). As such,

the final outcomes are in the form of the knowledge generated through research and its subsequent dissemination by way of teaching.

Application of Cost Function Approach to the Optimal Operation of MMUST

The cost function approach has a number of desirable technical properties. It is reasonable to expect that education systems will be evaluated with respect to multiple outcomes, and the cost function framework accommodates this requirement handily. Some other statistical approaches, such as estimation of an education production function, are not as readily adapted to a multiple outcome situation. Second, the cost function approach is applicable as long as firms are minimizing costs. Public education systems may attempt to provide education services at minimum cost, but they are certainly not profit maximizing as must be presumed in some other methodologies. Hence a cost function approach has often been employed in studies of nonprofit institutions, both in the public sector and in the private sector.

Finally, a cost function-based approach encourages or even forces researchers and policy analysts to be explicit about what outcomes are being studied and what inputs are being considered, as well as what assumptions are being made regarding behavior of decision makers at the school or any other level under analysis.

Criticisms of the Cost Function Analysis in Education

The cost function approach has been criticized because its technical complexity makes it difficult to communicate to the policy-making community. A number of judgments and assumptions must be made by a researcher attempting to estimate an education cost model. The basis for and importance of these choices may, indeed, be less than transparent to the policy audience (Psacharopoulos and Woodhall, 1985). In our view, a singular focus upon transparency is a poor policy lens. The primary objective should be to use the approach which can provide the most accurate policy information.

Simplicity, bought at a price of significant inaccuracy, is a poor bargain. Another related criticism of the cost function approach is that the cost function does not directly inform how education systems should spend their money. This is a relevant observation about the cost approach, but we don't see it as a fatal criticism. The cost function approach provides a predicted available technology, and given a target level of efficiency.

Cost Behaviour in Public Universities

Cost behavior is the general term describing how a cost will change when the level of output changes. Normally as the level of activity rises or falls, a particular cost may rise, fall or even remain constant. It is therefore against this background that a manager should be in a position to predict how a certain cost will behave in response to a change in an activity. Understanding these dynamics is critical for the purpose of planning and decision making. As such, hypothetical set of data can be used to illustrate this relationship as presented in Table 1 and Figure 3.

Table 1: Variation in educational costs against enrollment/output

Enrollment	Total Cost	Average Cost	Marginal Cost
0	5		
1	9	9	4
2	12	6	3
3	15	5	3
4	20	5	5
5	30	6	10
6	42	7	12

Table 1 uses hypothetical data to demonstrate how average costs and marginal costs vary with changes in the level of output or enrollment. Accordingly, the average cost is initially higher than the marginal costs. However, as the student enrollment continues to increase, the marginal costs start increasing until they surpass the average costs. The point where average costs are equal to marginal costs signifies the stage of optimal enrollment. This information is further expressed graphically as shown in Figure 3.

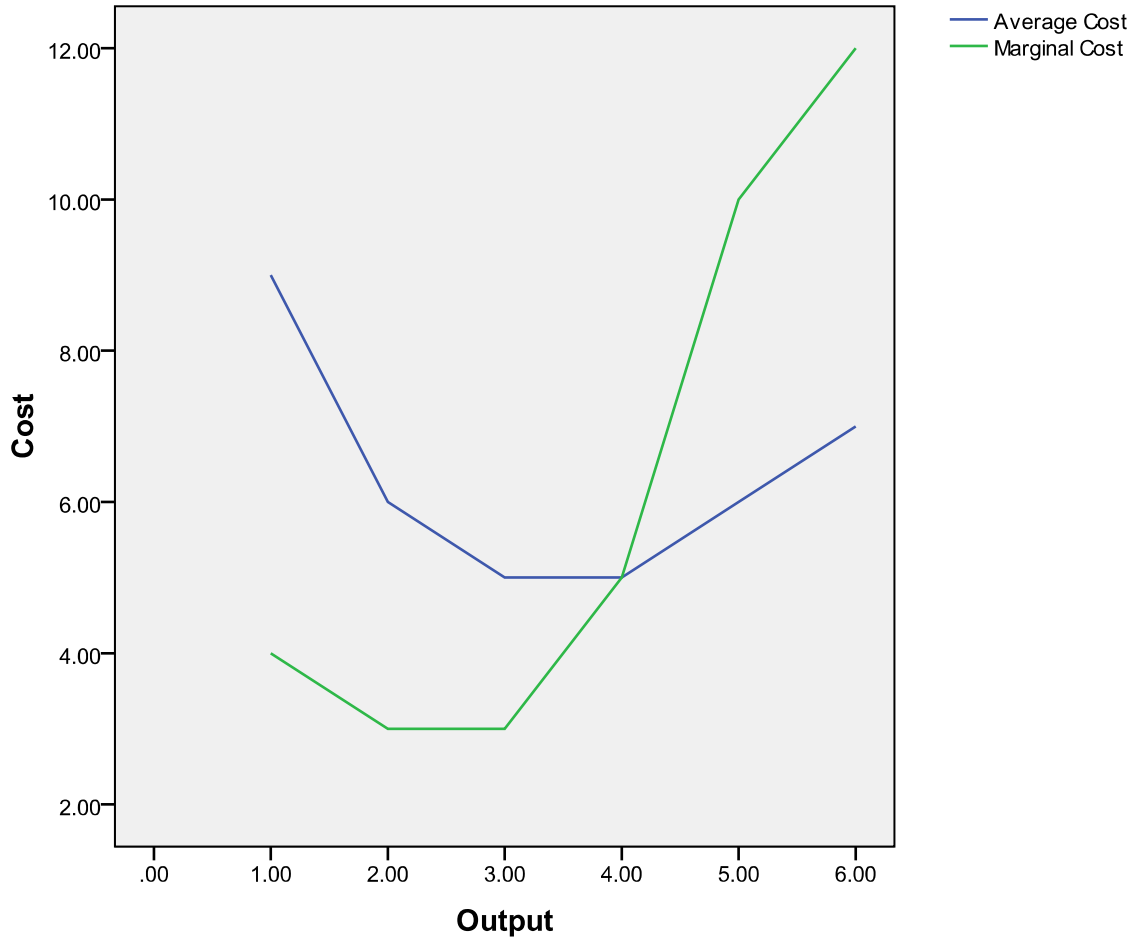


Figure 3: Cost against Output

From Figure3, three relationships between average costs and marginal costs can be deduced.

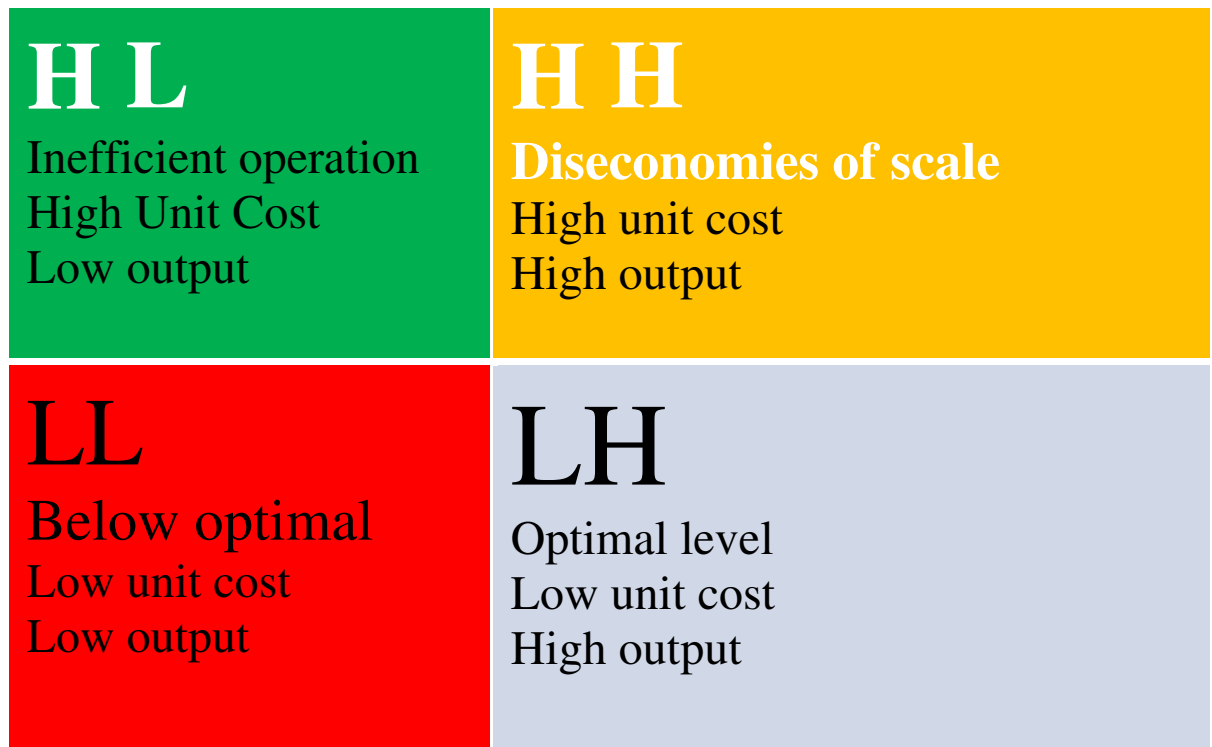
- i) When the average cost is falling, the marginal cost is less than the average cost.
- ii) When the average cost is at the minimum, marginal cost is equal to average cost. This is a point of optimal operation/ optimal enrollment
- iii) When the average is rising, marginal cost is greater than average cost

In addition to the above relationships, it is important to note that the stage, at which the marginal cost is lower than the average cost, represents the economies of scale. When the economies of scale are in existence, it is possible to increase production or enrollment without incurring substantial expenditure. In educational institutions, unit costs decline as the student/pupil enrollment increases, until the point where economies of scale are exhausted.

Once economies of scale have been exhausted diseconomies of size set in. For example, if there is spare capacity in a university, it is possible to increase enrollments without incurring substantial expenditure. However, once this capacity is exhausted, diseconomies of scale will set in and the marginal cost will exceed the average cost. This is because continuing to enroll students in the university where facilities are exhausted will necessitate the construction of new buildings, purchase of more books and equipment among others. It is the acquisition of these new facilities/items that causes the marginal cost to exceed the average cost, thus ushering in the diseconomies of scale.

Typology of optimal operation at MMUST

Unit cost



Output

Figure 4: source: *derived from Odebero, 2012*

The typology explains that low unit cost and low output would lead to an undesirable type of operation called *below optimal*. This means that the institution would still require to enroll more students to maximize the use of existing facilities and resources. The reverse of it is when the institution has low unit cost but high output. This would result in a desirable type of operation called *optimal operation*. Any institution would want to maintain this level of enrolment to keep the costs low and manageable.

In the event of the institution increasing enrollment, this would result in even higher unit cost and the result would be a *diseconomies of scale*.

Methodology

The study was done as a descriptive survey to carry out a survey of the existing status with regard to optimal operation of the university. This involved personal interview with senior managers of the university who were purposively sampled in order to establish the status of the phenomenon.

In addition, questionnaires were administered to a random sample of students, teaching staff, non-teaching staff, and University community members such as suppliers, the business community and parents. The main object of this was to establish the level of efficiency in institutional operation. The information got from questionnaire was cross validated by in-depth interviews from key informants such as senior officers in university management.

Process tracing of employment policies for staff, financing policies from exchequer, and policies governing income generating units was done. Specifically, document analysis was used to establish trends in university financing through government capitation and PSSP collections and students enrolment. The major documents used included but were not limited to, audited annual reports and accounts, budget proposals and senate reports.

Sample and sampling techniques

Table 2: Target Population, sample population and Response rate

Item	Target	Sample	Response rate
Teaching staff	285	30	17
Non-teaching staff	700	80	84
Students	9000	100	88
Community		40	22

coordinators	10	05	03
Deans	5	1	1
Finance Officer	1	1	1
Registrars	3	1	1
DVCs	3	3	1
Grand Total			218

Findings

Optimal Level of Operation of Masinde Muliro University of Science and Technology

The main objective of this study sought to establish unit costs, total costs, marginal costs and optimal level of operation of the university. The findings are discussed as follows.

STUDENTS COSTS

Students' costs were divided into two components: average (or unit) costs and marginal costs. The calculation of these costs makes two underlying assumptions: first, that all expenditures in the university are incurred to further the objectives for which a student is enrolled, and that there are no disparities in students fees payments that may arise from differentiated program costs or inability to pay. Thus students pay equal amounts of money to get a carefully packaged set of services from the university.

Average (or unit) costs were determined by the following formula:

$$C_{av} = \frac{C_j}{E_j} \quad \text{where } C_{av} \text{ is the average cost, } C_j \text{ is the total expenditure in the given year, and } E_j \text{ is the total student enrolment in the given year.}$$

Average cost therefore is the amount of money required to keep one students in the university for the given year.

Marginal costs were determined using the formula:

$$C_m = \frac{C_j - C_i}{E_j - E_i} \quad \text{where } C_m \text{ is the marginal cost, } C_{av} \text{ is the average cost; } C_j \text{ is the total expenditure in the given year; } C_i \text{ is the total expenditure for the previous year; } E_j \text{ is the total enrolment in the given year, and } E_i \text{ is the total enrolment in the previous year.}$$

Marginal cost is the expenditure that the university incurs to enroll an extra student. When marginal costs equal average costs, the institution is said to be operating at its optimal level. *When average*

costs are higher than marginal costs, it means the institution is operating below capacity and there is need to enroll more fees paying students. *When marginal cost is above average costs, the institution is said to be over established and diseconomies of scale set in.* Difficulties associated with maintaining optimal levels of operation include the challenge of keeping strict fiscal discipline and managing incidental expenditure drivers such as unforeseen emergencies. Table 6 gives statistical data of the total costs, unit cost, unit cost growth rate and the corresponding marginal costs.

Table 7: Operational Costs at MMUST

Year	Total Cost Ksh.(Millions)	Unit Cost Ksh. (Thousands)	Marginal Cost Ksh. (Thousands)
2006/07	597.796	294.917	
2007/08	747.159	217.324	105.856
2008/09	967.822	181.240	116.016
2009/10	1214.953	181.255	181.314
2010/11	1519.713	184.252	197.256
2011/12	1802.003	192.316	251.595
2012/13	2154.731	213.340	483.189

The table shows that total costs have been rising steadily over the years as students enrolment grow. Starting with Ksh. 597.796 million in 2006/7 academic year, total costs reached Ksh. 2.14 billion in 2012/13 academic year. An examination of unit costs however shows an initial decline from Ksh. 294,917 to reach the lowest level of Ksh. 184, 252 in the year 2010/2011 before rising again to reach the highest level of Ksh. 213,340 in the 2012/2013 academic year. Marginal costs on the other hand started off at the lowest level of Ksh. 105,856 to reach the highest level recorded at Ksh. 483,189.

Cost curve analysis was employed to help pin point the optimal operating point for the university, as illustrated in Figure. 4.

Figure. 4: Average costs, Marginal Costs and optimal operation of MMUST

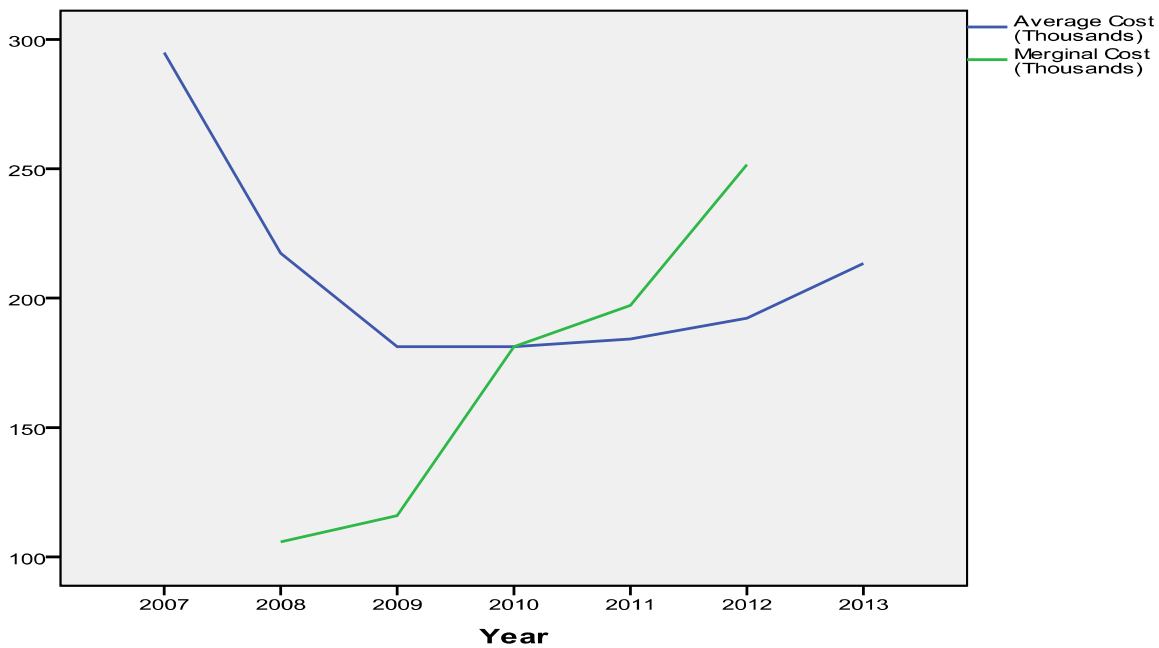


Figure. 4 shows a comparative diagrammatic representation of students' average costs and marginal costs and optimal level of operation.

As seen earlier, marginal cost is the expenditure that the university incurs to enroll an extra student. While average cost is equivalent to unit cost. Between 2007 and 2009 the university experiences higher *average costs than marginal costs and this implies that the institution is operating below capacity. At that point it was advisable for the university to enroll* more fees paying students. This is because there were more facilities that were underutilized. More students would ensure that university facilities are exhaustively utilized to meet the set objectives. From the figure, the average costs were dropping from around kshs.300, 000 in 2007 to kshs.181,000 in 2009. The marginal costs on the other hand rose from kshs.116, 000 in 2007 to kshs.116,000 in 2008.

However, the university experienced optimal operation in the year 2010. This is the point of intersection or the point when marginal costs equaled average costs. Specifically, the average cost and the marginal cost were equal at kshs 181,000. It is advisable that the university should have tried to maintain this point because this was the cheapest it could get in its operation. At this point, the university would make surplus cash, the salaries would be paid on time and statutory

deductions would be paid on time. However, it is important to note that the fees charges were lower than the average cost at the optimal level of kshs. 181,000. It is recommended that fees be raised to match the costs at the optimal level of operation.

From the year 2011, the marginal costs surpassed the average cost at kshs 251,500 for MC and ksh 192,000 for average cost respectively. This means that the university was spending more to maintain an extra new student than to maintain the already admitted old student. Because the *marginal cost is above average costs, we conclude that MMUST has been over established from 2011 to date. By implication, the university is operating at diseconomies of scale. At the moment, the university spends a whopping ksh 483,000 to admit an extra student as opposed to ksh 213,000 in maintaining an old student.*

Some of the glaring indicators of over establishment include congested lecture halls where students to attend lesson outside classrooms. Numerous incidents of students catching voices of their lecturers through windows without visual contact with the lecturers have been observed. Indeed the possibility of a lecturer covering the entire course without coming in physical contact with some students is not farfetched possibility. The study discovered that there was one public address system in the University. This could partly explain the apathy lecturers have in enforcing the quality requirement of 80% lesson attendance for a student to sit examinations. Would such a lecturer therefore deploy the most appropriate teaching methodology to effectively deliver the content to student? And if the University is unable to provide sitting space for students, is it possible that it is facilitating effective teaching through provision of teaching aids that expose students to what the knowledge economy demands of them after school? The university has responded to this by hiring lecture halls, Office space and teaching spaces outside the university. This has only helped to increase costs of operation.

In the interest of education quality and institutional competitiveness, management should lay out a clear time bound activity plan to ensure students do not learn in noisy environments, lecturers have office and preparation rooms from where students can consult on academic issues, administrative staff have adequate office space to attend to those seeking assistance of confidential nature. Such measure may help improve employee and student moral and promote responsible behavior. The

exponential growth in academic units that are often unstructured has exacerbated the already sorry situation of infrastructure such as lecture space, staff offices, access to reliable internet and other ICT facilities, students' hostels and recreational facilities. Hiring of facilities that are spread out wide exhaust students as they run about to catch up with lectures while at the same time denying the university the required revenue for its critical operation. In addition, hiring lecture halls and students accommodation may be a conduit through which corruption related schemes are incubated and hatched.

It is advisable that the university must quickly stop further admission of new students since it's uneconomical. It is further advised that the university expands existing facilities such as lecture halls, office space, students' hostels, recreational facilities, etc before any new admissions can be done as opposed to hiring of lecture halls, teaching spaces and office spaces outside the university as this only leads to increased costs. The university could also start new campuses outside the main campus where the new students can be housed. In such a case careful planning and spontaneous investment in one campus to optimality could be more efficient than hurried but haphazard expansion. Increment in fees to mitigate the average costs may not be an option because other institutions charge much less especially private universities.

Difficulties associated with maintaining optimal levels of operation include the challenge of keeping strict fiscal discipline and managing incidental expenditure drivers such as unforeseen emergencies.

Table 6 gives statistical data of the total costs, unit cost, unit cost growth rate and the corresponding marginal costs.

Conclusions and recommendations

The main objective of this study sought to establish unit costs, total costs, marginal costs and optimal level of operation of the university.

Students' costs were divided into two components: average (or unit) costs and marginal costs.

Average cost was defined as the amount of money required to keep one students in the university for the given year.

Marginal cost was defined as the expenditure that the university incurs to enroll an extra student.

The institution was said to be operating at its optimal level when marginal costs equaled average costs. However, when average costs were higher than marginal costs, the institution was said to be operating below capacity. At this point there was need to enroll more fees paying students. On the other hand when marginal cost was above average costs, the institution was said to be over established and diseconomies of scale were seen to have set in.

The study shows that total costs had been rising steadily over the years as students enrolment grew. Starting with Ksh. 597.796 million in 2006/7 academic year, total costs reached Ksh. 2.14 billion in 2012/13 academic year.

The study also shows unit costs declining initially from Ksh. 294,917 to reach the lowest level of Ksh. 184, 252 in the year 2010/2011 before rising again to reach the highest level of Ksh. 213,340 in the 2012/2013 academic year.

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According to the study, the average costs were dropping from around kshs.300, 000 in 2007 to kshs.181,000 in 2009. The marginal costs on the other hand rose from kshs.116, 000 in 2007 to kshs.116,000 in 2008.

The study reveals that the university experienced **optimal operation** in the year 2010 ie the point of intersection or **the point when marginal costs equaled average costs**. Specifically, the average cost and the marginal cost were equal at kshs 181,000. It is recommended that the university should have tried to maintain this point because this was the cheapest it could get in its operation.

At this point, the university would most likely make surplus cash because it was cheap to run its operations.

It is however noted that the fees charges were lower than the average cost at the optimal level of kshs. 181,000. This implies that the tuition fees charges were not based on any empirical study and can therefore not be relied upon to finance the university operations. It is recommended that fees be raised to match the costs at the optimal level of operation.

From the year 2011, the marginal costs surpassed the average cost at kshs 251,500 for MC and ksh 192,000 for average cost respectively. This means that the university was spending more to enroll and maintain an extra student than to maintain the already admitted old student. Because the marginal cost is above average costs, we conclude that MMUST has been over established from 2011 to date. By implication, the university is operating at diseconomies of scale. At the moment, the university spends a whopping ksh 483,000 to admit an extra student as opposed to ksh 213,000 in maintaining an old student.

It is advisable that the university must quickly stop further admission of new students since it's uneconomical. Our recommendations is that the university must cease further admissions and gradually lower the students numbers to the optimal level so as to be able to maximize its operations. However, in the interest of growth, it is advised that the university expands existing facilities such as lecture halls, office space, students' hostels, chairs, library facilities, recreational facilities and related facilities before surpassing the optimal numbers in admissions.

The study also observes that hiring of lecture halls, teaching spaces and office spaces outside the university only leads to increased costs. The university could also start new campuses outside the main campus where the new students can be housed. In such a case careful planning and spontaneous investment in one campus to optimality could be more efficient than hurried but haphazard expansion. Increment in fees to mitigate the average costs may not be an option because other institutions charge much less especially private universities and this could only serve to make the university unpopular.

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